SEPW Architecture Inc.

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PROJECT

Interior Fit Up
Regina, Saskatchewan

PROJECT No.	SET No.
13/2015	
DATE	
2016-03-11	

Pages

LIST OF DRAWINGS

ARCHITECTURAL

STRUCTURAL

MECHANICAL

ELECTRICAL

END OF SECTION

Part 1 General

1.1 WORK COVERED BY CONTRACT DOCUMENTS

.1 Work of this Contract comprises of renovating approximately 970 m² of floor space on two floors of an occupied building. The project site is located in Regina, Saskatchewan and further identified as “Interior Fit Up, Regina, SK”.

1.2 WORK SEQUENCE

.1 The General Contractor will be responsible for the coordination of all work.

1.3 CONTRACTOR USE OF PREMISES

.1 Coordinate use of premises under direction of Departmental Representative.

.2 Obtain and pay for use of additional storage or work areas needed for operations under this Contract.

.3 Cooperate with other contractors employed by the Departmental Representative for other work within the building.

1.4 EXISTING SERVICES

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

.2 Where Work involves breaking into or connecting to existing services, give Departmental Representative 48 hours of notice for necessary interruption of mechanical or electrical service throughout course of work. Minimize duration of interruptions. Carry out work at times as directed by governing authorities with minimum disturbance to pedestrian, vehicular traffic and tenant operations.

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

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

.5 Provide temporary services when directed by Departmental Representative to maintain critical building and tenant systems.

.6 Provide adequate bridging over trenches which cross sidewalks or roads to permit normal traffic.

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

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

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

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

END OF SECTION

Part 1 General

1.1 USE OF SITE AND FACILITIES

.1 Execute work with least possible interference or disturbance to normal use of premises.

.2 Normal hours of operation are between 08:00 – 16:30, Monday to Friday.

.3 Noise generating activities and access to the occupied spaces are to be conducted outside of normal hours of operation.

1.2 EXISTING SERVICES AND BUILDING SYSTEMS

.1 Notify, Departmental Representative of intended interruption of services or building mechanical or electrical systems, and obtain required permission.

.2 Where Work involves breaking into or connecting to existing services or disruption to electrical or mechanical systems, give Departmental Representative 48 hours of notice for necessary interruption of mechanical or electrical service throughout course of work. Keep duration of interruptions minimal.

.3 Carry out interruptions after normal working hours of occupants, preferably on weekends.

1.3 SPECIAL REQUIREMENTS

.1 Submit schedule in accordance with Section 01 32 16 - Construction Progress Schedules - Bar (GANTT) Chart.

.2 Ensure that Contractor 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.

1.4 SECURITY CLEARANCES

.1 Contractor personnel must submit to local law enforcement verification by RCMP, prior to admittance to the facility site. The Client reserves the right to deny access to any facility / site or part thereof to any Contractor personnel, at any time.

.2 All access to the building is to be through a designated entrance. Personnel will be signed in daily at start of work shift and provided with pass, which must be worn at all times. Pass must be returned at end of work shift and personnel checked out.

.3 Security documents are attached at the end of the Section.

1.5 SECURITY ESCORT

.1 Personnel employed on this project must be escorted when executing work in non-public areas during normal working hours. Personnel must be escorted in all areas after normal working hours.

1.6 BUILDING SMOKING ENVIRONMENT

.1 Comply with smoking restrictions. No smoking will be allowed in or around the building. Smoking is allowed only in areas indicated by Departmental Representative.

.2 Turn off vehicles when they are parked next to building.

1.7 OCCUPIED SPACES

.1 Spaces designated for renovations for the interior fit up will be vacant when the Contractor takes possession to undertake this Work.

.2 Common spaces within the building must remain clear for pedestrian access within building by occupants. Common corridors must remain unencumbered so that access to exits are maintained throughout the construction period.

.3 Spaces adjacent to the renovated areas may be occupied and full demising partitions must be in place prior to Work on the interior fit up commencing.

.4 Coordinate the work with the occupancy schedule of the building, which will be provided by the Departmental Representative. Schedule work outside of the occupancy schedule within the occupied spaces identified by the Departmental Representative.

END OF SECTION

RCMP F Division Office, Regina
Contractor/Consultant Information Sheet

PLEASE PRINT LEGIBLY / ALL INFORMATION MUST BE PROVIDED

General Contractor only: Upon completion of forms, please contact the RCMP – Cherylyn Shewchuk to make arrangements for submission of documents.

NOTE: SUB-CONTRACTORS ARE TO CONTACT THE GENERAL CONTRACTOR FOR INSTRUCTIONS AND/OR QUESTIONS REGARDING COMPLETION OF FORMS – NOT THE RCMP

CONTRACTORS/CONSULTANTS MUST PROVIDE THE FOLLOWING INFORMATION:	
1. Your Complete Legal Name: *(First/Middle or "no Middle Name"/ Last Name)*	
2. Name of Company That You Work For:	
3. Company Telephone Number:	
4. Project That You Are Working On: (*Name of Project/Building/City/Province*)	SRCL No.:
5. Access Period (Start & End Dates): (*If exact dates unknown, estimate start &end dates*)	

CONTRACTORS / CONSULTANTS - PLEASE NOTE THE FOLLOWING:

Should an RCMP Access tag/card be issued to you, please note the following;

1) You are the sole user of the access tag and it must be visibly worn while working on the site.
2) The access tag is non-transferrable / can not be used while working on projects other than the RCMP projects it was issued for.
3) The access tag must be returned to the RCMP issuing office or site foreman (if approved) at the end of each day.
4) No access to areas that you have not been cleared will be allowed and if found in these areas your clearance will be revoked and you will be removed from the site.

Employee Signature:	Signed on Date:

EMPLOYER TO REVIEW (not employee applicant of this form), COMPLETE AND SIGN:

In order to comply with Federal Government and RCMP policies and guidelines, in relation to the collection of personal information, the employer requesting the security checks must be satisfied that he/she can confirm the identity of the applicant.

The employer MUST ("employer" is your supervisor or a colleague of the company that you are employed by):

1) Request that their employees attend in person and provided two pieces of Identification.
2) Gov't issued ID MUST include full date of birth and name of the individual ie, Driver's Licence - Birth Certificate, Passport, Firearms Licence. (One piece of Gov't issued ID must include the photograph and if using the Drivers Licence copy both the photo portion as well as the signature portion.)
3) If the employee has changed his/her name, ID MUST be provided with both the current as well as past names.

Type of ID: 1)_____Number_____

2)_____Number_____

Employers Name: _____
(First Name and Last Name)

Employers Signature: _____

Date of signature: _____

…/2

Facilities Access Level 2 (FA2) clearance Applicants:

Documents noted in the box below must be provided with your FA2 clearance application (Facilities Access Level 2 Clearance Forms to be completed for FA2 clearances: 1. Contractor/ Consultant Information Sheet & 2. Form TBS 330-23E):

CONTRACTORS/CONSULTANTS MUST PROVIDE PHOTOCOPIES OF:

I HAVE ATTACHED THE FOLLOWING DOCUMENTS TO THE ABOVE NOTED FORMS:	**YES / NO**
1. Driver's License (a clear copy of both the front and back of the document on the same page, certified to be a true copy by their supervisor or colleague). ***Note:*** If you do not have a Driver's License, please provide other government issued photo identification (passport, treaty card). Note: the photo must be clear.	
2. Birth Certificate (a clear copy of both the front and back of the document on one page, certified to be a true copy by their supervisor or colleague). ***Note:*** If you do not have a Birth Certificate, please provide other government issued identification (ie. Health Card Card, passport, treaty card).	

RCMP Reliability Status (RRS) clearance Applicants:

Documents noted in the box below must be provided with your RRS clearance application (RRS Clearance Forms to be completed for RRS clearances: 1. Contractor/ Consultant Information Sheet, 2. Form TBS 330-23E, 3. Form TBS 330-60E & 4. Security/Reliability Pre-Interview Questionnaire):

CONTRACTORS/CONSULTANTS MUST PROVIDE PHOTOCOPIES OF:

I HAVE ATTACHED THE FOLLOWING DOCUMENTS TO THE ABOVE NOTED FORMS:	**YES / NO**
1. Driver's License (a clear copy of both the front and back of the document on the same page, certified to be a true copy by their supervisor or colleague). ***Note:*** If you do not have a Driver's License, please provide other government issued photo identification (passport, treaty card). Note: the photo must be clear.	
2. Birth Certificate (a clear copy of both the front and back of the document on one page, certified to be a true copy by their supervisor or colleague). **DOCUMENT MUST BE PROVIDED FOR RRS CLEARANCES – NO ALTERNATE DOCUMENTS.**	
3. Two sets of Fingerprints ("Roll and Ink" style) – must be obtained from a Corp of Commissionaires office.	

PLEASE CHECK WITH THE GENERAL CONTRACTOR IF YOU ARE UNSURE WHAT LEVEL OF SECURITY CLEARANCE YOU SHOULD BE APPLYING FOR.

Government of Canada / Gouvernement du Canada

PROTECTED (when completed)

PERSONNEL SCREENING, CONSENT AND AUTHORIZATION FORM

OFFICE USE ONLY		
Reference number	Department/Organization number	File number

NOTE: For *Privacy Act* Statement refer to Section C of this form and for completion instructions refer to attached instructions.
Please typewrite or print in block letters.

A ADMINISTRATIVE INFORMATION (To be completed by the Authorized Departmental/Agency/Organizational Official)

☐ **New** ☐ **Update** ☐ **Upgrade** ☐ **Transfer** ☐ **Supplemental** ☐ **Re-activation**

The requested level of reliability/security check(s)

☐ Reliability Status ☐ Level I (CONFIDENTIAL) ☐ Level II (SECRET) ☐ Level III (TOP SECRET)

☐ Other _____

PARTICULARS OF APPOINTMENT/ASSIGNMENT/CONTRACT

☐ Indeterminate ☐ Term ☐ Contract ☐ Industry ☐ Other (specify secondment, assignment, etc.) _____

Justification for security screening requirement

Position/Competition/Contract number	Title		Group/Level (Rank if applicable)
Employee ID number/PRI/Rank and Service number (if applicable)	If term or contract, indicate duration period ▶	From	To
Name and address of department / organization / agency	Name of official	Telephone number ( )	Facsimile number ( )

B BIOGRAPHICAL INFORMATION (To be completed by the applicant)

Surname (Last name)	Full given names (no initials) underline or circle usual name used	Family name at birth

All other names used (i.e. Nickname)	Sex ☐ Male ☐ Female	Date of birth Y M D	Country of birth	Date of entry into Canada if born outside Canada Y M D

RESIDENCE (provide addresses for the last five years, starting with the most current) Home address	Daytime telephone number ( )	E-mail address

	Apartment number	Street number	Street name	Civic number (if applicable)	From Y M	To present
1	City	Province or state	Postal code	Country	Telephone number ( )	

	Apartment number	Street number	Street name	Civic number (if applicable)	From Y M	To Y M
2	City	Province or state	Postal code	Country	Telephone number ( )	

Have you previously completed a Government of Canada security screening form? ☐ Yes ☐ No	If yes, give name of employer, level and year of screening. Y

CRIMINAL CONVICTIONS IN AND OUTSIDE OF CANADA (see instructions)

Have you ever been convicted of a criminal offence for which you have not been granted a pardon? ☐ Yes ☐ No	If yes, give details. (charge(s), name of police force, city, province/state, country and date of conviction) ▪	
Charge(s)	Name of police force	City
Province/State	Country	Date of conviction ▶ Y M D

Government of Canada / Gouvernement du Canada

PERSONNEL SCREENING, CONSENT AND AUTHORIZATION FORM

PROTECTED (when completed)

Surname and full given names	Date of birth Y M D

C CONSENT AND VERIFICATION (To be completed by the applicant and authorized Departmental/Agency/Organizational Official)

Checks Required (See Instructions)	Applicant's initials	Name of official (print)	Official's initials	Official's Telephone number
1. ☐ Date of birth, address, education, professional qualifications, employment history, personal character references				( )
2. ☐ Criminal record check				( )
3. ☐ Credit check (financial assessment, including credit records check)				( )
4. ☐ Loyalty (security assessment only)				
5. ☐ Other (Law Enforcement Records Checks)				( )

The Privacy Act Statement
The information on this form is required for the purpose of providing a security screening assessment. It is collected under the authority of subsection 7(1) of the *Financial Administration Act* and the Government Security Policy (GSP) of the Government of Canada, and is protected by the provisions of the *Privacy Act* in institutions that are covered by the *Privacy Act*. Its collection is mandatory. A refusal to provide information will lead to a review of whether the person is eligible to hold the position or perform the contract that is associated with this Personnel Screening Request. Depending on the level of security screening required, the information collected by the government institution may be disclosed to the Royal Canadian Mounted Police (RCMP) and the Canadian Security Intelligence Service (CSIS), which conduct the requisite checks and/or investigation in accordance with the GSP and to entities outside the federal government (e.g. credit bureaus). It is used to support decisions on individuals working or applying to work through appointment, assignment or contract, transfers or promotions. It may also be used in the context of updating, or reviewing for cause, the reliability status, security clearance or site access, all of which may lead to a re-assessment of the applicable type of security screening. Information collected by the government institution, and information gathered from the requisite checks and/or investigation, may be used to support decisions, which may lead to discipline and/or termination of employment or contractual agreements. The personal information collected is described in Standard PIB PSU 917 (Personnel Security Screening) which is used by all government agencies, except the Department of National Defence PIB DND/PPE 834 (Personnel Security Investigation File), RCMP PIB CMP PPU 065 (Security/Reliability Screening Records), CSIS PIB SIS PPE 815 (Employee Security), and PWGSC PIB PWGSC PPU 015 (Personnel Clearance and Reliability Records) used for Canadian Industry Personnel. Personal information related to security assessments is also described in the CSIS PIB SIS PPU 005 (Security Assessments/Advice).

I, the undersigned, do consent to the disclosure of the preceding information including my photograph for its subsequent verification and/or use in an investigation for the purpose of providing a security screening assessment. By consenting to the above, I acknowledge that the verification and/or use in an investigation of the preceding information may also occur when the reliability status, security clearance or site access are updated or otherwise reviewed for cause under the Government Security Policy. My consent will remain valid until I no longer require a reliability status, a security clearance or a site access clearance, my employment or contract is terminated, or until I otherwise revoke my consent, in writing, to the authorized security official.

Please have the applicant check and initial all 5 boxes, then sign and date the form.

Signature _____ Date (Y/M/D) _____

D REVIEW (To be completed by the authorized Departmental/Agency/Organizational Official responsible for ensuring the completion of sections A, B and C)

Name and title	Telephone number
Address	Facsimile number

E APPROVAL (To be completed by authorized Departmental/Agency/Organizational Security Official only)

I, the undersigned, as the authorized security official, do hereby approve the following level of screening.

Reliability Status

☐ Approved Reliability Status ☐ Not approved

Name and title _____

Signature _____ Date (Y/M/D) _____

Security Clearance (if applicable)

☐ Level I ☐ Level II ☐ Level III ☐ Not recommended

Name and title _____

Signature _____ Date (Y/M/D) _____

Comments

PHOTO (for Level III T.S., and/or upon request - see instructions)

Part 1 General

1.1 ADMINISTRATIVE

.1 Project meetings will be scheduled throughout the progress of the work and at the call of Departmental Representative.

.2 Provide physical space and make arrangements for meetings.

.3 The Consultant shall chair meetings.

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

1.2 PRECONSTRUCTION MEETING

.1 Within 10 days after award of Contract, request a meeting of parties in contract to discuss and resolve administrative procedures and responsibilities.

.2 Agenda to include:

- .1 Appointment of official representative of participants in the Work.
- .2 Schedule of Work: in accordance with Section 01 32 16 - 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, offices, storage sheds, utilities, fences in accordance with Section 01 52 00 - Construction Facilities.
- .5 Delivery schedule of specified equipment.
- .6 Site security in accordance with Section 01 56 00 - Temporary Barriers and Enclosures.
- .7 Proposed changes, change orders, procedures, approvals required, mark-up percentages permitted, time extensions, overtime, administrative requirements.
- .8 Owner provided products and work.
- .9 Record drawings in accordance with Section 01 33 00 - Submittal Procedures.
- .10 Maintenance manuals in accordance with Section 01 78 00 - Closeout Submittals.
- .11 Take-over procedures, acceptance, warranties in accordance with Section 01 78 00 - Closeout Submittals.
- .12 Monthly progress claims, administrative procedures, photographs, hold backs.
- .13 Appointment of inspection and testing agencies or firms.
- .14 Insurances, transcript of policies.

1.3 PROGRESS MEETINGS

.1 During course of Work, progress meetings will be held on a regular basis. Schedule to be determined.

.2 Contractor, major Subcontractors involved in Work, Departmental Representative, Consultant and Owner’s representatives are to be in attendance.

.3 Minutes of meetings will be recorded by the Consultant. Minutes will be distributed within 3 working days.

.4 Agenda for project meetings to include the following:

.1 Review, approval of minutes of previous meeting.

.2 Review of Work progress since previous meeting.

.3 Field observations, problems, conflicts.

.4 Problems which impede construction schedule.

.5 Review of off-site fabrication delivery schedules.

.6 Corrective measures and procedures to regain projected schedule.

.7 Revision to construction schedule.

.8 Progress schedule, during succeeding work period.

.9 Review submittal schedules: expedite as required.

.10 Maintenance of quality standards.

.11 Review proposed changes to determine how these will affect the 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 other project element. Usually expressed as workdays or workweeks.

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

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

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

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

1.2 REQUIREMENTS

.1 Ensure Project Schedule and Detail Schedules are practical and remain within specified Contract duration.

.2 Include scheduled activities for Commissioning in the project schedule.

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

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

.5 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 7 working days of Award of Contract Bar (GANTT) Chart as Master Plan for planning, monitoring and reporting of project progress.

.3 Provide schedule in PDF format in sized so that description of work can be clearly read when printed out.

1.4 PROJECT MILESTONES

.1 Project milestones form interim targets for Project Schedule.

.1 Project milestone will be identified through discussion with the Contractor and Departmental Representative at the outset of the project.

1.5 PROJECT SCHEDULE REPORTING

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

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

1.6 PROJECT MEETINGS

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

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

END OF SECTION

1.1 ADMINISTRATIVE

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

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

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

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

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

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

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

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

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

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

1.2 SHOP DRAWINGS AND PRODUCT DATA

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

.2 Submit where required in the specifications, shop drawings bearing stamp and signature of qualified professional engineer registered or licensed in Province of Saskatchewan, Canada.

.3 Indicate materials, methods of construction and attachment or anchorage, erection diagrams, connections, explanatory notes and other information necessary for completion of Work. Where articles or equipment attach or connect to other articles or equipment, indicate that such items have been co-ordinated, regardless of Section under which adjacent items will be supplied and installed. Indicate cross references to design drawings and specifications.

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

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

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

.7 Accompany submissions with transmittal letter, containing:

- .1 Date.
- .2 Project title and number.
- .3 Contractor's name and address.
- .4 Identification and quantity of each shop drawing, product data and sample.
- .5 Other pertinent data.

.8 Submissions include:

- .1 Date and revision dates.
- .2 Project title and number.
- .3 Name and address of:
  - .1 Subcontractor.
  - .2 Supplier.
  - .3 Manufacturer.
- .4 Contractor's stamp, signed by Contractor's authorized representative certifying approval of submissions, verification of field measurements and compliance with Contract Documents.
- .5 Details of appropriate portions of Work as applicable:
  - .1 Fabrication.
  - .2 Layout, showing dimensions, including identified field dimensions, and clearances.
  - .3 Setting or erection details.
  - .4 Capacities.
  - .5 Performance characteristics.
  - .6 Standards.
  - .7 Operating weight.
  - .8 Wiring diagrams.
  - .9 Single line and schematic diagrams.
  - .10 Relationship to adjacent work.

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

.10 Submit 6 copies of shop drawings for each requirement requested in specification Sections and as Departmental Representative may reasonably request.

.11 Submit 6 copies of product data sheets or brochures for requirements requested in specification Sections and as requested by Departmental Representative where shop drawings will not be prepared due to standardized manufacture of product.

.12 Submit 6 copies of test reports for requirements requested in specification Sections and as requested by Departmental Representative.

.1 Report signed by authorized official of testing laboratory that material, product or system identical to material, product or system to be provided has been tested in accord with specified requirements.

.2 Testing must have been within 3 years of date of contract award for project.

.13 Submit 6 copies of certificates for requirements requested in specification Sections and as requested by Departmental Representative.

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

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

.14 Submit 6 copies of manufacturer’s instructions for requirements requested in specification Sections and as requested by Departmental Representative.

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

.15 Submit 6 copies of manufacturer's Field Reports for requirements requested in specification Sections and as requested by Departmental Representative.

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

.16 Submit 6 copies of Operation and Maintenance Data for requirements requested in specification Sections and as requested by Departmental Representative.

.17 Delete information not applicable to project.

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

.19 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.

.20 The review of shop drawings by Departmental Representative is for sole purpose of ascertaining conformance with general concept.

.1 This review shall not mean that Departmental Represenetaive 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.

.21 Electronic submission of Shop Drawings

.1 Electronic Shop Drawings (PDF format) shall not exceed 11x17 actual size. Electronic transfer of shop drawings relies on Architect and Engineering Consultants to print a record copy for their files - this can be done providing shop drawings do not exceed 11x17. Larger shop drawings would require hard copies for review.

.2 General Contractor to review shop drawing and place their electronic stamp signifying review.

.3 General Contractor to email all shop drawings to Architect with copy to Engineering Consultant as applicable.

.4 Engineering Consultant to review and place their electronic stamp / marks up, then email to Architect only (Engineering Consultant will not copy anyone else).

.5 Architect to check for coordination and transmit reviewed shop drawings by email to General Contractor.

1.3 SAMPLES

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

.2 Deliver samples prepaid to 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 such in writing to Departmental Representative prior to proceeding with Work.

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

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

1.4 MOCK-UPS

.1 Erect mock-ups in accordance with 01 45 00 - Quality Control and as specified in each applicable Section.

END OF SECTION

Part 1 General

1.1 REFERENCES

.1 Canada Labour Code, Part 2, Canada Occupational Safety and Health Regulations

.2 Health Canada/Workplace Hazardous Materials Information System (WHMIS)

.1 Material Safety Data Sheets (MSDS).

.3 Province of Saskatchewan

.1 Occupational Health and Safety Act, 1993, S.S. 2005.

1.2 SUBMITTALS

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

.2 Submit site-specific Health and Safety Plan: Within 7 days after date of Notice to Proceed and prior to commencement of Work. Health and Safety Plan must include:

.1 Results of site specific safety hazard assessment.

.2 Results of safety and health risk or hazard analysis for site tasks and operation found in work plan.

.3 Submit 1 copy of Contractor's authorized representative's work site health and safety inspection reports to Departmental Representative, weekly.

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

.5 Submit copies of incident and accident reports.

.6 Submit WHMIS MSDS - Material Safety Data Sheets in accordance with Section 01 33 00 - Submittal Requirements and Section 02 81 01 - Hazardous Materials.

.7 Departmental Representative will review Contractor's site-specific Health and Safety Plan and provide comments to Contractor within 7 days after receipt of plan. Revise plan as appropriate and resubmit plan to Departmental Representative within 5 days after receipt of comments from Departmental Representative.

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

.9 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.

1.3 FILING OF NOTICE

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

1.4 SAFETY ASSESSMENT

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

1.5 MEETINGS

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

1.6 REGULATORY REQUIREMENTS

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

1.7 GENERAL REQUIREMENTS

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

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

1.8 RESPONSIBILITY

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

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

1.9 COMPLIANCE REQUIREMENTS

.1 Comply with Occupational Health and Safety Regulations, 1996.

.2 Comply with Canada Labour Code, Canada Occupational Safety and Health Regulations.

1.10 HAZARDOUS MATERIALS

.1 Where the contractor is in doubt or suspicious material is encountered, stop work and advise the Departmental Representative immediately.

1.11 UNFORSEEN HAZARDS

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

1.12 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 specific to activities associated with overhead work.

.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 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.

1.15 BLASTING

.1 Blasting or other use of explosives is not permitted.

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.

END OF SECTION

Part 1 General

1.1 REFERENCES AND CODES

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

.2 Meet or exceed requirements of:

.1 Contract documents.

.2 Specified standards, codes and referenced documents.

1.2 HAZARDOUS MATERIAL DISCOVERY

.1 Asbestos: 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.

1.3 BUILDING SMOKING ENVIRONMENT

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

.2 Smoking on site is restricted to within personal vehicles or designated smoking locations.

END OF SECTION

Part 1 General

1.1 INSPECTION

.1 Allow Departmental Representative and Consultant 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 or Consultant, 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 shall pay cost of examination and replacement.

1.2 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.

1.3 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.

1.4 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.

1.5 REPORTS

.1 Submit two (2) copies of inspection and test reports to Departmental Representative.

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

1.6 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.

1.7 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 and as specified in specific Section.

.3 Prepare mock-ups for Departmental Representative and Consultant's 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 Mock-ups may remain as part of Work.

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 make available a continuous supply of potable water for construction use.

1.4 TEMPORARY HEATING AND VENTILATION

.1 Maintain temperatures of minimum 10 degrees C in areas where construction is in progress.

.2 Ventilating:

.1 Disable air return ventilation from renovation areas or provide MERV 11 filtration at ducted returns.

.2 Provide dust screens at all air pathways above ceilings around renovated areas to prevent spread of dust through building.

.3 Prevent accumulations of dust, fumes, mists, vapours or gases in areas occupied during construction.

.4 Provide local exhaust ventilation to prevent harmful accumulation of hazardous substances into atmosphere of occupied areas.

.5 Dispose of exhaust materials in manner that will not result in harmful exposure to persons.

.6 Ventilate storage spaces containing hazardous or volatile materials.

.7 Continue operation of ventilation and exhaust system for time after cessation of work process to assure removal of harmful contaminants.

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

.4 On completion of Work for which permanent heating system is used, provide service maintenance to system at discretion of the Departmental Representative.

.5 Pay costs for maintaining temporary heat, when not using permanent heating system. Owner will pay utility charges when temporary heat source is existing building equipment.

.6 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.

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

1.5 TEMPORARY POWER AND LIGHT

.1 Provide and maintain temporary lighting throughout project. Existing lighting and power systems may be utilized.

1.6 TEMPORARY COMMUNICATION FACILITIES

.1 Provide and pay for temporary telephone, fax, data hook up, lines and equipment necessary for own use and use of Departmental Representative.

1.7 FIRE PROTECTION

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

END OF SECTION

Part 1 General

1.1 REFERENCES

.1 Canadian Standards Association (CSA International)

.1 CAN/CSA-S269.2-M1987(R2003), Access Scaffolding for Construction Purposes.

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 which have to be gravelled to prevent tracking of mud.

.3 Indicate use of supplemental or other staging area.

.4 Provide construction facilities in order to execute work expeditiously.

.5 Remove from site all such work after use.

1.4 SCAFFOLDING

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

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

1.5 HOISTING

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

.2 Hoists and cranes to be operated by qualified operator.

1.6 ELEVATORS

.1 Designated existing elevator to be used by construction personnel for transporting of materials only. Co-ordinate use with Departmental Representative.

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

1.7 SITE STORAGE/LOADING

.1 Confine work and operations of employees by Contract Documents. Do not unreasonably encumber premises with products.

.2 Do not load or permit to load any part of Work with weight or force that will endanger Work.

1.8 CONSTRUCTION PARKING

.1 Parking will be permitted on site but may be limited. Parking arrangements will be provided by the Departmental Representative at project start up.

.2 Provide and maintain adequate access to project site.

1.9 OFFICES

.1 Provide and maintain, during the entire progress of the Work, a suitable office on the site, for own use, with suitable tables or benches for the examination of drawings, specifications, etc., and where all notices and instructions from the Consultant may be received and acknowledged. Provide suitable meeting space for site meetings. Provide adequate heating, ventilating and lighting. Location of these offices to be coordinated with the Departmental Representative.

.2 Provide marked and fully stocked first-aid case in a readily available location.

1.10 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.

1.11 SANITARY FACILITIES

.1 One female washroom and one male washroom will be designated on site, for Contractor’s use during this project. Final location to be coordinated and confirmed with the Departmental Representative.

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

.3 Contractor shall be responsible for cleaning and maintenance or designated facilities. Failure to do so will result in loss of this privilege. In that case the Contractor will be responsible for providing portable toilet facilities outside of the building at an area to be designated by the Departmental Representative.

1.12 CONSTRUCTION SIGNAGE

.1 No signs or advertisements, other than warning signs, are permitted on site.

1.13 PROTECTION AND MAINTENANCE OF TRAFFIC AND PEDESTRIANS

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

.2 Provide measures for protection 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

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

.4 Do not block roads without obtaining approval to do so from the Departmental Representative.

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

.6 Provide necessary lighting, signs, barricades, and distinctive markings for safe movement of traffic.

1.14 CLEAN-UP

.1 Remove construction debris, waste materials, packaging material from work site daily.

.2 Clean dirt or mud tracked onto paved or surfaced roadways on an on-going basis.

.3 Store materials resulting from demolition activities that are salvageable.

.4 Stack stored new or salvaged material not in construction facilities.

END OF SECTION

Part 1 General

1.1 INSTALLATION AND REMOVAL

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

.2 Remove from site all such work after use.

1.2 GUARD RAILS, BARRICADES, AND SIGNAGE

.1 Provide secure, rigid guard rails and barricades around deep excavations, open shafts, open stair wells, open edges of floors and roofs.

.2 Provide Construction Zone warning and access control signage.

1.3 WEATHER ENCLOSURES

.1 Provide weather tight closures to unfinished door and window openings, tops of shafts and other openings in floors and roofs.

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

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

1.4 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. Dust tight screens must continue from floor slab to underside of structure and be installed tight to substrates and around interferences in order to block transmission of dust.

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

.3 Maintain negative pressure in area of dust generating work. Exhaust directly to the exterior.

1.5 HARD WALL SCREENS

.1 Provide floor to underside of structure partitions between renovated areas and occupied spaces in the building to prevent noise transmission.

.2 Partitions shall be minimum 12.7 gypsum board both sides metal studs with batt insulation in all stud cavities.

.3 Maintain in place until noise generating activities are complete in renovated area.

.4 Existing partitions may be left in place to provide hard wall screens.

1.6 ACCESS TO SITE

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

1.7 PUBLIC TRAFFIC FLOW

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

1.8 FIRE ROUTES

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

1.9 PROTECTION FOR OFF-SITE AND PUBLIC PROPERTY

.1 Protect surrounding private and public property from damage during performance of Work.

.2 Be responsible for damage incurred.

1.10 PROTECTION OF BUILDING FINISHES

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

.2 Provide necessary screens, covers, and hoardings.

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

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

1.11 WASTE MANAGEMENT AND DISPOSAL

.1 Separate waste materials for reuse and recycling in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.

END OF SECTION

Part 1 General

1.1 REFERENCES

.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 born by Owner 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 Procurement policy is to acquire, in cost effective manner, items containing highest percentage of recycled and recovered materials practicable consistent with maintaining satisfactory levels of competition. Make reasonable efforts to use recycled and recovered materials and in otherwise utilizing recycled and recovered materials in execution of work.

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

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

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

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

1.3 STORAGE, HANDLING AND PROTECTION

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

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

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

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

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

.6 Store sheet materials, lumber, steel members, doors and frames 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.

1.4 TRANSPORTATION

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

1.5 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.

1.6 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.

1.7 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.

1.8 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.

1.9 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.

1.10 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.

1.11 FASTENINGS

.1 Provide metal fastenings and accessories in same texture, colour and finish as adjacent materials, unless indicated otherwise.

.2 Prevent electrolytic action between dissimilar metals and materials.

.3 Use non-corrosive hot dip galvanized steel fasteners and anchors for securing exterior work, unless stainless steel or other material is specifically requested in affected specification Section.

.4 Space anchors within individual load limit or shear capacity and ensure they provide positive permanent anchorage. Wood, or any other organic material plugs are not acceptable.

.5 Keep exposed fastenings to a minimum, space evenly and install neatly.

.6 Fastenings which cause spalling or cracking of material to which anchorage is made are not acceptable.

1.12 FASTENINGS - EQUIPMENT

.1 Use fastenings of standard commercial sizes and patterns with material and finish suitable for service.

.2 Use heavy hexagon heads, semi-finished unless otherwise specified. Use No. 304 stainless steel for exterior areas.

.3 Bolts may not project more than one diameter beyond nuts.

.4 Use plain type washers on equipment, sheet metal and soft gasket lock type washers where vibrations occur. Use resilient washers with stainless steel.

1.13 PROTECTION OF WORK IN PROGRESS

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

1.14 EXISTING UTILITIES

.1 When breaking into or connecting to existing services or utilities, execute Work at times directed by local governing authorities, with minimum of disturbance to Work, and/or building occupants.

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

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 Owner or separate contractor.

.3 Include in request:

- .1 Identification of project.
- .2 Location and description of affected Work.
- .3 Statement on necessity for cutting or alteration.
- .4 Description of proposed Work, and products to be used.
- .5 Alternatives to cutting and patching.
- .6 Effect on Work of Owner or separate contractor.
- .7 Written permission of affected separate contractor.
- .8 Date and time work will be executed.

1.2 FORMS

.1 Special forms required during the course of this Work may include the following. Forms will be supplied by the Departmental Representative.

- .1 Hot work.
- .2 Confined space entry.
- .3 Site steam protocol.
- .4 Ground disturbance.

1.3 MATERIALS

.1 Required for original installation.

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

1.4 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.

1.5 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 original installer to perform cutting and patching for weather-exposed and moisture-resistant elements, and sight-exposed surfaces.

.8 Cut rigid materials using masonry saw or core drill. Pneumatic or impact tools not allowed on masonry work without prior approval.

.9 Restore work with new products in accordance with requirements of Contract Documents.

.10 Fit Work airtight to pipes, sleeves, ducts, conduit, and other penetrations through surfaces.

.11 At penetration of fire rated wall, ceiling, or floor construction, completely seal voids with firestopping or firestopping sealant material using UL or ULC rated assembly in accordance with manufacturer's instructions.

.12 Refinish surfaces to match adjacent finishes: Refinish continuous surfaces to nearest intersection. Refinish assemblies by refinishing entire unit.

.13 Conceal pipes, ducts and wiring in floor, wall and ceiling construction of finished areas except where indicated otherwise.

1.6 WASTE MANAGEMENT AND DISPOSAL

.1 Separate waste materials for reuse and recycling in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.

END OF SECTION

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 Provide “walk-off” mats where required to control dust from tracking out of areas being renovated to public areas or other areas of the building.

.3 Vacuum mats and surrounding area daily and as needed where dust has been tracked from renovated areas.

.4 Remove waste materials from site at daily regularly scheduled times. Do not burn waste materials on site.

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

.6 Provide on-site containers for collection of waste materials and debris.

.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. Remove debris and surplus materials from accessible concealed spaces.

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

.4 Vacuum carpet in renovated areas and where construction traffic occurs. If heavily soiled carpeting shall be commercially steam cleaned. This will be at the discretion of the Departmental Representative.

.5 Clean and wax areas of resilient sheet and tile flooring in renovated areas, where required by specification section.

.6 Dust all horizontal surfaces, clean all glass and wipe down walls in renovated areas.

END OF SECTION

Part 1 General

1.1 DEFINITIONS

.1 Materials Source Separation Program (MSSP): consists of series of ongoing activities to separate reusable and recyclable waste material into material categories from other types of waste at point of generation.

.2 Recyclable: ability of product or material to be recovered at end of its life cycle and re-manufactured into new product for reuse.

.3 Recycle: process by which waste and recyclable materials are transformed or collected for purpose of being transferred into new products.

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

.5 Reuse: repeated use of product in same form but not necessarily for same purpose. Reuse includes:

.1 Salvaging reusable materials from re-modelling projects, before demolition stage, for resale, reuse on current project or for storage for use on future projects.

.2 Returning reusable items including pallets or unused products to vendors.

.6 Salvage: removal of structural and non-structural materials from deconstruction/disassembly projects for purpose of reuse or recycling.

.7 Separate Condition: refers to waste sorted into individual types.

.8 Source Separation: acts of keeping different types of waste materials separate beginning from first time they became waste.

.9 Waste Audit (WA): detailed inventory of materials in building. Involves quantifying by volume/weight amounts of materials and wastes generated during construction, demolition, deconstruction, or renovation project. Indicates quantities of reuse, recycling and landfill. Refer to Schedule A.

.10 Waste Management Co-ordinator (WMC) : contractor representative responsible for supervising waste management activities as well as coordinating related, required submittal and reporting requirements.

.11 Waste Reduction Workplan (WRW): written report which addresses opportunities for reduction, reuse, or recycling of materials. Refer to Schedule B. WRW is based on information acquired from WA (Schedule A).

1.2 SUBMITTALS

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

1.3 WASTE REDUCTION WORKPLAN (WRW)

.1 Prepare WRW prior to project start-up.

.2 WRW should include but not limited to:

- .1 Destination of materials listed.
- .2 Deconstruction/disassembly techniques and sequencing.
- .3 Schedule for deconstruction/disassembly.
- .4 Location.
- .5 Security.
- .6 Protection.
- .7 Clear labelling of storage areas.
- .8 Details on materials handling and removal procedures.

.3 Structure WRW to prioritize actions and follow 3R's hierarchy, with Reduction as first priority, followed by Reuse, then Recycle.

.4 Describe management of waste.

.5 Identify opportunities for reduction, reuse, and recycling of materials.

.6 Post WRW or summary where workers at site are able to review content.

.7 Set realistic goals for waste reduction, recognize existing barriers and develop strategies to overcome these barriers.

.8 Monitor and report on waste reduction.

1.4 MATERIALS SOURCE SEPARATION PROGRAM (MSSP)

.1 Prepare MSSP and have ready for use prior to project start-up.

.2 Implement MSSP for waste generated on project in compliance with approved methods and as reviewed by Departmental Representative.

.3 Provide on-site facilities for collection, handling, and storage of anticipated quantities of reusable and recyclable materials.

.4 Provide containers to deposit reusable and recyclable materials.

.5 Locate containers in locations, to facilitate deposit of materials without hindering daily operations.

.6 Locate separated materials in areas which minimize material damage.

.7 Collect, handle, store on-site, and transport off-site, salvaged materials in separate condition.

- .1 Transport to users of material for recycling.

.8 Collect, handle, store on-site, and transport off-site, salvaged materials in combined condition.

.1 Ship materials to site operating under Certificate of Approval.

1.5 STORAGE, HANDLING AND PROTECTION

.1 Store, materials to be reused, recycled and salvaged in locations as directed by Departmental Representative.

.2 Protect surface drainage, mechanical and electrical from damage and blockage.

.3 Separate and store materials produced during dismantling of structures in designated areas.

.4 Prevent contamination of materials to be salvaged and recycled and handle materials in accordance with requirements for acceptance by designated facilities.

.1 On-site source separation is recommended.

.2 Remove co-mingled materials to off-site processing facility for separation.

.3 Provide waybills for separated materials.

1.6 DISPOSAL OF WASTES

.1 Do not bury rubbish or waste materials.

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

1.7 USE OF SITE AND FACILITIES

.1 Execute work with least possible interference or disturbance to normal use of premises.

.2 Maintain security measures established by existing facility and where required provide temporary security measures approved by Departmental Representative.

1.8 SCHEDULING

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

Part 2 Execution

2.1 APPLICATION

.1 Do Work in compliance with WRW.

.2 Handle waste materials not reused, salvaged, or recycled in accordance with appropriate regulations and codes.

2.2 CLEANING

.1 Remove tools and waste materials on completion of Work, and leave work area in clean and orderly condition.

.2 Clean-up work area as work progresses.

.3 Source separate materials to be reused/recycled into specified sort areas.

END OF SECTION

Part 1 General

1.1 INSPECTION AND DECLARATION

.1 Contractor's Inspection: Contractor and Subcontractors: 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 that corrections have been made.

.2 Request Departmental Representative Inspection.

.2 Departmental Representative Inspection: Departmental Representative and Contractor will perform inspection of Work to identify obvious defects or deficiencies. Contractor to correct Work accordingly.

.3 Completion: submit written certificate that following have been performed:

.1 Work has been completed and inspected for compliance with Contract Documents.

.2 Defects have been corrected and deficiencies have been completed.

.3 Equipment and systems have been tested, adjusted and balanced and are fully operational.

.4 Certificates required by Fire Commissioner and Utility companies have been submitted.

.5 Operation of systems have been demonstrated to Owner's personnel.

.6 Work is complete and ready for final inspection.

.4 Final Inspection: when items noted above are completed, request final inspection of Work by Departmental Representative, Consultants and Contractor. If Work is deemed incomplete by Departmental Representative, complete outstanding items and request re-inspection.

.5 Where re-inspection is required due to uncompleted deficiencies, the time required by the Departmental Representative and Consultants will be recorded and reimbursement of this time may be charges back to the Contractor by deducting from amounts retained.

1.2 CLEANING

.1 In accordance with Section 01 74 11 - Cleaning.

.2 Remove waste and surplus materials, rubbish and construction facilities from the site in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.

END OF SECTION

Part 1 General

1.1 SUBMITTALS

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

.2 Prepare instructions and data using personnel experienced in maintenance and operation of described products.

.3 Copy will be returned after final inspection, with Departmental Representative's comments.

.4 Revise content of documents as required prior to final submittal.

.5 Two weeks prior to Substantial Performance of the Work, submit to the Departmental Representative, four final copies of operating and maintenance manuals in English.

.6 Ensure spare parts, maintenance materials and special tools provided are new, undamaged or defective, and of same quality and manufacture as products provided in Work.

.7 Furnish evidence, if requested, for type, source and quality of products provided.

.8 Defective products will be rejected, regardless of previous inspections. Replace products at Contractor’s own expense.

.9 Pay costs of transportation.

1.2 FORMAT

.1 Organize data as instructional manual.

.2 Provide three (3) bound copies and two (2) PDF copies on DVD or CD.

.3 Binders: cloth, hard covered, expandable, loose leaf paper size 219 x 279 mm. Colour “black.” Provide three (3) copies.

.4 Provide draft manual for Consultant Review. This is an addition to the required copies. Consultant may choose to keep the draft manual for their use and reference.

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

.6 Cover: identify each binder with type or printed title 'Project Record Documents'; list title of project and identify subject matter of contents. Lettering to be “gold” colour.

.7 Provide printed title on DVD/CD version to coincide with title on bound version.

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

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

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

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

1.3 CONTENTS - EACH VOLUME

.1 Table of Contents: provide title of project;

.1 Date of submission; names.

.2 Addresses, and telephone numbers of Consultant and Contractor with name of responsible parties.

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

.2 For each product or system:

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

.3 Shop Drawings: illustrating details of a portion of work.

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

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

.6 Typewritten Text: as required to supplement product data. Provide logical sequence of instructions for each procedure, incorporating manufacturer's instructions specified in Section 01 45 00 - Quality Control.

1.4 AS-BUILTS AND SAMPLES

.1 Maintain, in addition to requirements in General Conditions, at site for Departmental Representative one record copy of:

.1 Contract Drawings.

.2 Specifications.

.3 Addenda.

.4 Change Orders and other modifications to Contract.

.5 Reviewed shop drawings, product data, and samples.

.6 Field test records.

.7 Inspection certificates.

.8 Manufacturer's certificates.

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

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

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

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

1.5 RECORDING ACTUAL SITE CONDITIONS

.1 Record information on set of opaque drawings, provided by Departmental Representative.

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

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

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

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

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

- .1 Manufacturer, trade name, and catalogue number of each product actually installed, particularly optional items and substitute items.
- .2 Changes made by Addenda and change orders.

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

1.6 EQUIPMENT AND SYSTEMS

.1 Each Item of Equipment and Each System: include description of unit or system, and component parts. Give function, normal operation characteristics, and limiting conditions. Include performance curves, with engineering data and tests, and complete nomenclature and commercial number of replaceable parts.

.2 Panel board circuit directories: provide electrical service characteristics, controls, and communications.

.3 Include installed colour coded wiring diagrams.

.4 Operating Procedures: include start-up, break-in, and routine normal operating instructions and sequences. Include regulation, control, stopping, shut-down, and emergency instructions. Include summer, winter, and any special operating instructions.

.5 Maintenance Requirements: include routine procedures and guide for trouble-shooting; disassembly, repair, and reassembly instructions; and alignment, adjusting, balancing, and checking instructions.

.6 Provide servicing and lubrication schedule, and list of lubricants required.

.7 Include manufacturer's printed operation and maintenance instructions.

.8 Include sequence of operation by controls manufacturer.

.9 Provide original manufacturer's parts list, illustrations, assembly drawings, and diagrams required for maintenance.

.10 Provide installed control diagrams by controls manufacturer.

.11 Provide Contractor's 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.

.15 Additional requirements: as specified in individual specification sections.

1.7 MATERIALS AND FINISHES

.1 Building Products, Applied Materials, and Finishes: include product data, with catalogue number, size, composition, and colour and texture designations. Provide information for re-ordering custom manufactured products.

.2 Instructions for cleaning agents and methods, precautions against detrimental agents and methods, and recommended schedule for cleaning and maintenance.

.3 Moisture-Protection and Weather-Exposed Products: include manufacturer's recommendations for cleaning agents and methods, precautions against detrimental agents and methods, and recommended schedule for cleaning and maintenance.

.4 Additional Requirements: as specified in individual specifications sections.

1.8 SPARE PARTS

.1 Provide spare parts, in quantities specified in individual specification sections.

.2 Provide items of same manufacture and quality as items in Work.

.3 Deliver to location as directed; place and store.

.4 Receive and catalogue items. Submit inventory listing to Departmental Representative. Include approved listings in Maintenance Manual.

.5 Obtain receipt for delivered products and submit prior to final payment.

1.9 MAINTENANCE MATERIALS

.1 Provide maintenance and extra materials, in quantities specified in individual specification sections.

.2 Provide items of same manufacture and quality as items in Work.

.3 Deliver to location as directed; place and store.

.4 Receive and catalogue items. Submit inventory listing to Departmental Representative. Include approved listings in Maintenance Manual.

.5 Obtain receipt for delivered products and submit prior to final payment.

1.10 SPECIAL TOOLS

.1 Provide special tools, in quantities specified in individual specification section.

.2 Provide items with tags identifying their associated function and equipment.

.3 Deliver to location as directed; place and store.

.4 Receive and catalogue items. Submit inventory listing to Departmental Representative. Include approved listings in Maintenance Manual.

1.11 STORAGE, HANDLING AND PROTECTION

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

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

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

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

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

1.12 WARRANTIES AND BONDS

.1 Submit, warranty information made available during construction phase, to Departmental Representative for approval prior to each monthly pay estimate.

.2 Assemble approved information in binder and submit upon acceptance of work. 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.

.3 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.

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

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

1.13 PRE-WARRANTY CONFERENCE

.1 Meet with Departmental Representative, to develop understanding of requirements of this section. Schedule meeting prior to contract completion, and at time designated by Departmental Representative.

.2 Departmental Representative will establish communication procedures for:

.1 Notification of construction warranty defects.

.2 Determine priorities for type of defect.

.3 Determine reasonable time for response.

.3 Provide name, telephone number and address of licensed and bonded company that is authorized to initiate and pursue 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.

END OF SECTION

Part 1 General

1.1 SUMMARY

.1 Section Includes:

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

.2 Refer to all project Specification Sections for detailed description of commissioning requirements.

.3 Acronyms:

.1 Cx - Commissioning.
.2 Cx Authority – Commissioning Authority.
.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 GENERAL

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

.1 Verify installed equipment, systems and integrated systems operate in accordance with contract documents and design criteria and intent.
.2 Ensure appropriate documentation is compiled into the O&M manual.
.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: as per client's requirements or determined by designer. To meet Project functional and operational requirements.

1.3 COMMISSIONING OVERVIEW

.1 Commissioning (Cx) Plan. The Contractor will be responsible for developing the Commissioning (Cx) Plan.

.2 The parties responsible for Cx activities shall be identified in the 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 installed systems are proven to operate satisfactorily under weather, environmental and occupancy conditions to meet functional and operational requirements. Cx activities include 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 Cx Authority.

.2 Equipment, components and systems have been commissioned.

.3 O&M training has been completed.

1.4 NON-CONFORMANCE TO PERFORMANCE VERIFICATION REQUIREMENTS

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

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

1.5 PRE-CX REVIEW

.1 Before Construction:

.1 Review contract documents, confirm by writing to Departmental Representative:

.1 Adequacy of provisions for Cx.

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

.2 During Construction:

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

.3 Before start of Cx:

.1 Have Cx Plan up-to-date.

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

.3 Fully understand Cx requirements and procedures.

.4 Have Cx documentation shelf-ready.

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

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

.7 Have Cx schedules up-to-date.

.8 Ensure systems have been cleaned thoroughly.

.9 Complete TAB procedures on systems; submit TAB reports to Departmental Representative for review and approval.

.10 Ensure "As-Built" system schematics are available.

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

1.6 CONFLICTS

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

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

1.7 SUBMITTALS

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

.1 Submit:

.1 Name of Contractor's Cx agent.

.2 Draft Cx documentation.

.3 Preliminary Cx schedule.

.2 Request in writing to Departmental Representative for changes to submittals and obtain written approval at least 8 weeks prior to start of Cx.

.3 Submit proposed Cx procedures to Departmental Representative where not specified and obtain written approval at least 8 weeks prior to start of Cx.

.4 Provide additional documentation relating to Cx process required by Departmental Representative.

1.8 COMMISSIONING DOCUMENTATION

.1 Refer to individual equipment Specification Sections for (Cx) forms: Installation Check Lists, Product Information (PI) and Performance Verification (PV) forms for requirements.

.2 Consultant and Cx Authority to review and approve Cx documentation.

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

1.9 COMMISSIONING SCHEDULE

.1 Provide detailed Cx schedule as part of construction schedule in accordance with Section 01 32 16.07 - Construction Progress Schedules.

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

.1 Approval of Cx reports.

.2 Verification of reported results.

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

.4 Training.

1.10 COMMISSIONING MEETINGS

.1 Cx meetings will be held following project meetings and as specifically requested.

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

.3 Cx meetings will be held on a regular basis until commissioning deliverables have been addressed.

.4 At approximately 50% completion stage a separate Cx scope meeting will be held to review progress, discuss schedule of equipment start-up activities and prepare for Cx. Issues at meeting to include:

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

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

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

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

.7 Ensure subcontractors and relevant manufacturer representatives are present at 50% and subsequent Cx meetings and as required.

1.11 STARTING AND TESTING

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

1.12 WITNESSING OF STARTING AND TESTING

.1 Provide 14 days notice prior to commencement.

.2 Departmental Representative may witness start-up.

.3 Consultant and Cx Authority will witness testing for PV.

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

1.13 MANUFACTURER'S INVOLVEMENT

.1 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.

.2 Integrity of warranties:

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

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

.3 Qualifications of manufacturer's personnel:

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

.2 Ability to interpret test results accurately.

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

1.14 PROCEDURES

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

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

.1 Included in delivery and installation:

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

.2 Visual inspection of quality of installation.

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

.3 Operational testing: document equipment performance.

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

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

.3 Correct deficiencies and obtain approval from Consultant and Cx Authority after distinct phases have been completed and before commencing next phase.

.4 Documents require tests on approved PV forms.

.5 Failure to follow accepted start-up procedures will result in re-evaluation of equipment by an independent testing agency selected by Departmental Representative. If results reveal that equipment start-up was not in accordance with requirements, and resulted in damage to equipment, implement following:

.1 Minor equipment/systems: implement corrective measures approved by Departmental Representative.

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

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

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

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

1.15 START-UP DOCUMENTATION

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

.2 Start-up documentation to include:

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

.2 Pre-start-up inspection reports.

.3 Signed installation/start-up check lists.

.4 Start-up reports,

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

1.16 OPERATION AND MAINTENANCE OF EQUIPMENT AND SYSTEMS

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

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

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

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

1.17 TEST RESULTS

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

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

1.18 START OF COMMISSIONING

.1 Notify Departmental Representative at least 14 days prior to start of Cx.

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

1.19 INSTRUMENTS / EQUIPMENT

.1 Submit to Departmental Representative for review and approval:

.1 Complete list of instruments proposed to be used.

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

.2 Provide the following equipment as required:

.1 2-way radios.

.2 Ladders.

.3 Equipment as required to complete work.

1.20 COMMISSIONING PERFORMANCE VERIFICATION

.1 Carry out Cx:

.1 Under actual 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.

1.21 WITNESSING COMMISSIONING

.1 Consultant and Cx Authority to witness activities and verify results following the Contractor’s performance verification.

1.22 AUTHORITIES HAVING JURISDICTION

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

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

.3 Provide copies to Departmental Representative within 10 days of test and with Cx report.

1.23 COMMISSIONING CONSTRAINTS

.1 Commissioning will be undertaken on new equipment and modified equipment provided under this contract. Where these are tied into existing building systems the Cx will need to be coordinated with the building operator.

1.24 EXTRAPOLATION OF RESULTS

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

1.25 EXTENT OF VERIFICATION

.1 Tenant areas:

.1 Provide manpower and instrumentation to verify up to 100% of reported results.

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

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

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

.5 Perform additional commissioning until results are acceptable to Consultant and Cx Authority.

1.26 REPEAT VERIFICATIONS

.1 Assume costs incurred by Departmental Representative for third and subsequent verifications where:

.1 Verification of reported results fail to receive Consultant's or Cx Authority approval.

.2 Repetition of second verification again fails to receive approval.

.3 Departmental Representative deems Contractor's request for second verification was premature.

1.27 SUNDRY CHECKS AND ADJUSTMENTS

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

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

1.28 DEFICIENCIES, FAULTS, DEFECTS

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

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

1.29 COMPLETION OF COMMISSIONING

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

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

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

1.30 ACTIVITIES UPON COMPLETION OF COMMISSIONING

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

1.31 TRAINING

.1 Provide training in accordance with Section 01 91 41 - Commissioning (Cx) - Training and requirements of Contract Specification Sections.

.2 Refer to requirements of ES/SOW-0101 Statement of Work for Procurement and Installation of Electronic Security Systems (CSC) and ES/SOW-0102 Statement of Work for Quality Control for Procurement and Installation of Electronic Security Systems (CSC).

1.32 MAINTENANCE MATERIALS, SPARE PARTS, SPECIAL TOOLS

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

1.33 OCCUPANCY

.1 Cooperate fully with Departmental Representative during stages of acceptance; facility will remain fully occupied.

1.34 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.

1.35 PERFORMANCE VERIFICATION TOLERANCES

.1 Application tolerances:

.1 Specified range of acceptable deviations of measured values from specified values or specified design criteria. Unless noted otherwise in this contract Specifications, 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 noted otherwise in this contract Specifications actual values to be within +/- 2 % of recorded values.

1.36 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.

Part 2 Schedules

2.1 SCHEDULE OF ARCHITECTURAL SYSTEMS

.1 Electronic door hardware

2.2 CX SCHEDULE FOR MECHANICAL SYSTEMS

.1 Produce schedule of Cx activities in bar chart format to a scale that will ensure legibility. Bar chart to indicate:

.2 Sequences of testing equipment and systems, interrelationship between tests, duration of tests and training periods.

.3 Cx resources which will be committed to this project to ensure completion by prescribed dates.

- .1 Training Plan.
- .2 Cx Documentation Plan.
- .3 Water/fire mains and related site fire hydrants:

.4 Commission as soon as installation is complete, using procedures described in NFPA reference standards to provide protection for exterior envelope of new building during construction.

.5 Wet pipe sprinkler systems:

- .1 Test completed systems in accordance with NFPA 13.

.6 Plumbing systems:

- .1 To be filled, then proceed with flushing, cleaning and disinfection processes.
- .2 Test plumbing and piping systems installed under this project

.7 HVAC systems:

- .1 Ductwork, piping and conduit systems that will be concealed to be tested and certified to specified standards before being concealed. This work is specified in relevant technical sections of Division 23.
- .2 HVAC systems to be initially started up, "bumped" in a stand-alone mode and pre-start-up inspections completed.
- .3 Start after dust-producing construction procedures have been completed and areas are dust-free.
- .4 Start HVAC to replace temporary heating systems after Consultant's written approval.
- .5 Operate HVAC to permit TAB and ensure full compliance with contract documents when weatherstripping, caulking and sealing of exterior envelope has been completed, and interior partitions and doors are installed and ceiling return plenums are in place.

.8 Hydronic systems:

- .1 To be filled, then undertake cleaning and flushing processes.
- .2 Commission at same time as HVAC systems are being TAB'd.

.9 HVAC and related hydronic systems:

- .1 Test in conjunction with EMCS, and fire and smoke detection systems.

.10 Vibration isolation and seismic control measures:

- .1 Test these measures at same time as connected system.

.11 Equipment and systems subject to specified codes and standards or subject to approval of an authority having jurisdiction:

.1 Commission equipment and systems in accordance with those requirements.

.2 Where testing is required as part of a regulatory process, and where Cx procedures are fully developed, are appropriate to project, ensure tests as required by such codes are performed. Consultant to witness tests as part of Quality Assurance role.

.12 EMCS:

.1 Testing and Cx to be specified in Section 25 01 11 - EMCS: Start-Up, Verification and Commissioning, which defines conditions for acceptance.

.2 Point-by-point and end-to-end testing to be carried out by installation Contractor, monitored by Consultant and CxA and verified as part of system verification.

.3 Demonstration of operation of systems under operating conditions and over full operating range to take place prior to 30-day test period and to be witnessed by Consultant and CxA. Includes simulated opposite-season tests. EMCS programming and operation to be verified after HVAC systems have been TAB'd and to include specified 30-day test period.

.13 To reduce VOC concentrations to acceptable levels:

.1 Flow rates of outside air into HVAC systems to be adjusted as required during Cx, and as necessary after occupancy.

.14 Commission Mechanical systems and associated equipment as follows:

.1 Plumbing systems:

.1 Installation and Operation of all working plumbing fixtures installed under this project.

.2 All piping installed to serve fixtures.

.2 HVAC and exhaust systems:

.1 HVAC systems

.2 Exhaust systems.

.3 Dedicated DX Systems

.3 Fire and life safety systems:

.1 Wet pipe sprinkler systems.

.2 Preaction sprinkler systems.

.3 Fire extinguishers.

.4 EMCS (Energy Management Control System:

.1 Entire EMCS system affected by scope of work from graphic to device (point-to-point) performance verification.

.15 Product Information forms and Performance Verification will be carried out on the following mechanical systems. Product information form are only required for new equipment specified under scope of work:

.1 All VAV boxes and air valves affected by scope of work (PV sample provided) – 30% to be reviewed with Cx Agent after commissioning is complete.

.2 All new control dampers installed – 100% to be reviewed with Cx Agent after commissioning is complete.

.3 Exhaust fans EF-31 (PV and PI sample provided) – 100% to be reviewed with Cx Agent after commissioning is complete.

.4 Existing air handling unit serving Room 158 (PV sample provided) – 100% to be reviewed with Cx Agent after commissioning is complete.

.5 Air Conditioning Units AC-1 and associated condensing units (PV and PI sample provided) – 100% to be reviewed with Cx Agent after commissioning is complete.

.6 Radiation: 30% to be reviewed with Cx Agent after commissioning is complete.

.7 Testing and Air Balancing Report: 30% to be reviewed with Cx Agent after commissioning is complete.

2.3 SCHEDULE OF ELECTRICAL SYSTEMS

.1 The following is a listing of the building electrical systems to be commissioned:

.1 Low Voltage Lighting Systems

.2 Low Voltage Switchboards

.3 Panelboards Breaker Type

.4 Motor Starters To 600 V

.5 Lighting

.6 Emergency Lighting

.7 Exit Signs

.8 Fire Alarm Systems

.9 Communication Cable Inside Building

2.4 INTEGRATED LIFE SAFETY SYSTEMS

.1 Upon completion of individual system tests, test for integration of life safety systems upon

.1 Loss of power

.2 Fire alarm signal

.2 Electronic Hardware: Test integration with fire alarm event.

.3 Fire Protection Systems: test integrated systems to verify that components work together as designed.

.4 Performance of HVAC, fire protection, EMCS and systems forming part of integrated systems to be verified after systems has been TAB'd to ensure compliance with prescribed requirements.

.5 Fire alarm call out, horn strobes.

.6 Emergency lighting, exit signage.

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 may 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 O&M Manual 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 Cx Manual at completion of work.

.2 Prior to Performance Verification (PV) of systems complete items on PI forms related to systems and obtain Consultant and Cx Authority approvals.

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, and records the measured data and readings taken during functional testing and Performance Verification procedures.

.3 Prior to PV of integrated system, complete the PV forms of related systems and obtain Consultant's and Cx Authority approval.

1.4 COMMISSIONING FORMS

.1 Example forms are included appended to this Section.

.2 The Consultant will develop and provide the Contractor with final project-specific Commissioning forms in hard-copy format complete with specification data.

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

1.5 COMMISSIONING VERIFICATION PROCESS

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

.2 Strategy for Use:

.1 Consultant 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 Reported results will be verified by the Consultant and Cx Authority.

.8 Form to bear signatures of recording technician and reviewed and signed off by Consultant and Cx Authority.

.9 Submit immediately after tests are performed.

.10 Reported results in true measured SI unit values.

.11 Originals of completed forms are to be retained on site during start-up, testing and commissioning period. Maintain in Commissioning Manual binder.

.12 Forms to be hard copy with type written results in Commissioning Manual Binder.

END OF SECTION

Project Name:	Project #:	13/2015
Interior Fit-Up	Component Form #:	CFM1.1

Component Verification Form

Section:

System:	*Equipment:*	*Tag:*
HVAC	EXHAUST FAN	EF-31

INSTALLED EQUIPMENT DATA:

Manufacturer	
Type	
Model Number	
Serial Number	

LOCATION DATA:

Building	
Area Served	158
Floor Located	Crawlspace
Room	Crawlspace

PERFORMANCE DATA:

	Specified	Shop Drawings	Required Modification	Installed	
Fan:					
Fan Type	Tubular Inline	BI	-	Eng: ☐	Con: ☐
Air Flow	2,360 L/s (5,003 CFM)	(0 CFM)	-	Eng: ☐	Con: ☐
E.S.P.	2 Pa (0.01 in.w.c.)	(0.00 in.w.c.)	-	Eng: ☐	Con: ☐
Sound			-	Eng: ☐	Con: ☐
Motor Size	2.49 kW (3.34 hp)	(0.00 hp)	-	Eng: ☐	Con: ☐
Motor Efficiency	Premium		-	Eng: ☐	Con: ☐
Voltage / Phase	600/3		-	Eng: ☐	Con: ☐
Drive Type	Belt		-	Eng: ☐	Con: ☐
Options:					
				☐	☐
				☐	☐
Isolators	Spring		-	Eng: ☐	Con: ☐

Comments

SIGN-OFFS:

Contractor: _____ Date: _____

Engineer: _____ Date: _____

CxA: _____ Date: _____

Project Name:	Project #:	13/2015
Interior Fit-Up	Component Form #:	CFM1.2

Component Verification Form		*Section:*
System: HVAC	*Equipment:* Packaged Cooling Equipment	*Tag:* AC-1

INSTALLED EQUIPMENT DATA:

Manufacturer	
Type	
Model Number	
Serial Number	

LOCATION DATA:

Building	
Area Served	213
Floor Located	Second Floor
Room	213

PERFORMANCE DATA:

	Specified	Shop Drawings	Required Modification	Installed	
Indoor Unit					
Air Flow	188 L/s (399 CFM)	(0 CFM)	-	Eng: ☐	Con: ☐
Entering Air Dry Bulb	22.20 C (71.96 F)	(32.00 F)	-	Eng: ☐	Con: ☐
Entering Air Wet bulb	14.80 C (58.64 F)	(32.00 F)	-	Eng: ☐	Con: ☐
Total Cooling	3.52 kW (12 MBH)	(0 MBH)	-	Eng: ☐	Con: ☐
% Sensible	95%	-	-	Eng: ☐	Con: ☐
Voltage / Phase	208/1	-	-	Eng: ☐	Con: ☐
SEER	21	-	-	Eng: ☐	Con: ☐
Breaker	15A	-	-	Eng: ☐	Con: ☐
Refrigerant	HFC (R410A)	-	-	Eng: ☐	Con: ☐
Outdoor Unit CU-1					
Voltage / Phase	208/1	-	-	Eng: ☐	Con: ☐
Full Load Amps	12	-	-	Eng: ☐	Con: ☐
Overcurrent Prot.	15	-	-	Eng: ☐	Con: ☐
Refrigerant	HFC (R410A)	-	-	Eng: ☐	Con: ☐
Accessories					
Filter Width	100mm	-	-	Eng: ☐	Con: ☐
Filter Efficiency	Merv 8	-	-	Eng: ☐	Con: ☐
Condensate Lift Pump	Yes	-		Eng: ☐	Con: ☐
Warranty	7 yr compressor	-		Eng: ☐	Con: ☐

Comments

SIGN-OFFS:

Contractor: _____ Date: _____

Engineer: _____ Date: _____

CxA: _____ Date: _____

Project Name: Interior Fit-Up	Project #: 13/2015
	Performance Verification #: PVM2.1

Performance Verification Test Form		*Section:*
System: **HVAC**	*Equipment:* **Terminal Units – Sequence D (laboratory)**	*Room #:* **151**

1. TEST PURPOSE

.1 To test operation of the terminal units and installation of the new Energy Management Control System to ensure that they operate as intended during normal and abnormal operating conditions.

.2 To document that each terminal device tested performs as intended.

.3 To highlight required modifications and corrections to terminal device operation and allow those corrections to take place prior to substantial completion and turn over to owner.

.4 To verify that the point-to-point commissioning carried out by the contractor was completed and successful based on a sampling of the spaces utilizing this control sequence.

2. Test Prerequisites

.1 Test prerequisites ---------- C ☐ E ☐

.1 All test prerequisites are completed and form submitted ---------- ☐ ☐

.2 Note any prerequisites not completed at time of test and identify reason for continuing with test despite prerequisites not being complete

_____

_____

_____

_____

.3 Establish trend logs where required to verify operation and provide supporting documentation.

3. Equipment Located in Spaces:

.1 List of all terminal unit equipment serving space and being controlled by sequence of operation:

.1 Supply Valve SV 1.39
.2 Reheat Coil RHC 1.39
.3 Exhaust Valve EV 1.38
.4 Wet sink - switched
.5 Cyano Acrylate chamber
.6 Thermostat

4. Schedule

.1 Occupied/Unoccupied Schedule ---------- C ☐ E ☐

.1 Follows unoccupied/occupied schedule for associated air handling unit: ---------- ☐ ☐

.2 Occupancy Override ---------- C ☐ E ☐

.1 Thermostat Occupancy override functions: ---------- ☐ ☐

.1 Override time set to? ---------- _____ minutes

5. Sensor Calibration Verification

.1 Temperature Sensors

.1 Space Temperature:

.1 Temperature indicated through BMS ----------_____---------- ^{O}C

.2 Actual measured temperature _____---------- ^{O}C

.2 Air Discharge temperature (SV1.3):

.1 Temperature indicated through BMS _____---------- ^{O}C

.2 Actual measured temperature ---------- ^{O}C

.2 Air Flows

.1 Airflow (SV1.39) – VAV control

.1 Specified Occupied Maximum Airflow ---------616 L/s

.2 Occupied airflow indicated at EMCS ----------_____----------L/s

.3 Occupied airflow shown on TAB report --------_____----------L/s

.4 Specified Occcupied Minimum Airflow --------503 L/s

.5 Unoccupied airflow shown EMCS ----------_____----------L/s

.6 Specified Unoccupied Airflow ----------252 L/s

.7 Unoccupied airflow shown EMCS ----------_____----------L/s

.2 Airflow (EV1.38) – VAV control

.1 Specified Occupied Maximum Airflow ---------664 L/s

.2 Occupied airflow indicated at EMCS ----------_____----------L/s

.3 Occupied airflow shown on TAB report --------_____----------L/s

.4 Specified Occcupied Minimum Airflow --------263 L/s

.5 Unoccupied airflow shown EMCS ----------_____----------L/s

.6 Specified Unoccupied Airflow ----------300 L/s

.7 Unoccupied airflow shown EMCS ----------_____----------L/s

.3 Airflow - Wet Sink Hood

.1 Specified Airflow ----------220 L/s

.2 Occupied airflow shown on TAB report --------_____----------L/s

.4 Airflow – Cyano Acrylate Chamber

.1 Specified Airflow ----------68 L/s

.2 Occupied airflow shown on TAB report --------_____----------L/s

6. Temperature Setpoint

.1 Median Reset Schedule

.1 Upper Limit

.1 Outside Temperature ----------_____---------- ^{O}C

.2 Median Setpoint _____---------- ^{O}C

.2 Lower Limit

.1 Outside Temperature ----------_____---------- ^{O}C

.2 Median Setpoint _____---------- ^{O}C

.2 Slider Range

.1 Range set to ± ----------_____ ^{O}C

.3 Night Setback
- .1 Winter Night Setback Temperature ---------- _____ ---------- ^{O}C
- .2 Summer Night Setback Temperature---------- _____ ---------- ^{O}C

		C	E
.4	Functional Test - Median Setpoint		
.1	Manually override EMCS outdoor temperature above upper limit:	☐	☐
.2	Median setpoint resets to upper limit on thermostat:	☐	☐
.3	Manually override EMCS outdoor temperature below lower limit:	☐	☐
.4	Median setpoint resets to lower limit on thermostat:	☐	☐
.5	Manually override EMCS outdoor temperature between upper and lower limit:	☐	☐
.6	Median setpoint resets to calculated position between upper and lower limit on thermostat:	☐	☐
.7	Reset EMCS outdoor temperature back to automatic:	☐	☐

		C	E
.5	Functional Test - Slider Adjustment		
.1	Set sliders to center on thermostat in space:	☐	☐
.2	Adjust slider up maximum amount for Thermostat:	☐	☐
.3	EMCS registers adjustment of slider:	☐	☐
.4	All systems move to control to new setpoint:	☐	☐
.5	Adjust slider down maximum amount for Thermostat:	☐	☐
.6	EMCS registers adjustment of slider on both thermostats:	☐	☐
.7	All systems move to control to new setpoint:	☐	☐
.8	Reset slider to center:	☐	☐

		C	E
.6	Functional Test - Night Setback		
.1	Set system to unoccupied:	☐	☐
.2	Verify space control reverts to night setback temperature setpoint:	☐	☐
.1	Record season _____		
.3	Set season flag to opposite of current season:	☐	☐
.4	Night setback control revert to correct season setpoint:	☐	☐
.5	Reset season flag to automatic	☐	☐
.6	Reset occupancy to occupied	☐	☐

7. Temperature Control - Summer Mode (Set system to summer mode if not already in summer mode)

		C	E
.1	Turn space temperature setpoint down to 15 deg.C.	☐	☐
.1	Reheat coil valves are closed:	☐	☐
.2	Record S/A discharge temperature:		
.1	At AHU-1 _____ ---------- ^{O}C		
.2	At VAV Box SV1.39 ---------- ^{O}C		
.3	Box airflow for SV1.39 increases airflow to suit cooling:	☐	☐
.4	Box airflow for EV1.38 increases airflow to maintain offset:	☐	☐
.5	Pressurization offset limits supply airflow:	☐	☐

.2 Turn space temperature setpoints to actual space temperature
- .1 Box airflow for SV1.39 decreases to minimum: ---------- ☐ ☐
- .2 Box airflow for EV1.38 decreases airflow to maintain offset: ---------- ☐ ☐
- .3 Reheat coil modulates to maintain discharge air temperature at 2 Deg.C. below room temperature : ---------- ☐ ☐

.3 Turn space temperature setpoints up to 25 Deg.C.
- .1 Box air flows stay at minimum : ---------- ☐ ☐
- .2 Reheat coil valves begin to modulate to increase discharge temperature up to 7 Deg.C. above space temperature:---------- ☐ ☐
- .3 If space cannot be maintained at minimum airflow, airflow shall increase ---------- ☐ ☐

.4 Reset control to normal operation. ----------C E
- .1 Reset summer / winter flag to automatic ---------- ☐ ☐
- .2 Reset space temperature setpoint to default---------- ☐ ☐

8. Temperature Control - Winter Mode (Set system to winter mode if not already in winter mode)

.1 Turn space temperature setpoint down to 15 deg.C.----------C E
- .1 Reheat coil valves are closed:---------- ☐ ☐
- .2 Record S/A discharge temperature:----------
- .3 Record S/A discharge temperature:----------
  - .1 At AHU-1---------- _____ ---------- ^{O}C
  - .2 At VAV Box SV1.39---------- ---------- ^{O}C
- .4 Box airflow for SV1.39 increases airflow to suit cooling: ---------- ☐ ☐
- .5 Box airflow for EV1.38 increases airflow to maintain offset:---------- ☐ ☐
- .6 Pressurization offset limits supply airflow: ---------- ☐ ☐

.2 Turn space temperature setpoint to actual space temperature
- .1 Box airflow for SV1.39 decreases to minimum: ---------- ☐ ☐
- .2 Box airflow for EV1.38 decreases airflow to maintain offset: ---------- ☐ ☐
- .3 Reheat coil modulates to maintain discharge air temperature at 2 Deg.C. below room temperature : ---------- ☐ ☐

.3 Turn space temperature setpoint up to 25 Deg.C.
- .1 Box air flows stay at minimum : ---------- ☐ ☐
- .2 Reheat coil modulates to increase discharge temperature up to 7 Deg.C. above space temperature:---------- ☐ ☐
- .3 If space cannot be maintained at minimum airflow, airflow shall increase ---------- ☐ ☐

.4 Unoccupied temperature control
- .1 Set space to unoccupied and temperature setpoint to actual space temperature: ----- ☐ ☐
- .2 Box airflows drop to unoccupied setpoint:---------- ☐ ☐

.5 Reset control to normal operation. ----------C E
- .1 Reset summer / winter flag to automatic ---------- ☐ ☐
- .2 Reset space temperature setpoint to default---------- ☐ ☐

9. Wet Sink Control (Wet Sink and EF-6)

		C	E
.1	Fume Hood operation (ambient above 5 deg.C.)		
.1	Override ambient temperature to above 5 deg.c. (unless already above):	☐	☐
.2	Ensure fume hood switch is off:	☐	☐
.3	Verify motorized damper is closed:	☐	☐
.4	Verify switch position is noted as off:	☐	☐
.5	Verify exhaust fan is off:	☐	☐
.6	Verify exhaust fan proof is off:	☐	☐
.7	Verify fan failure alarm is off:	☐	☐
.8	Verify power on is lit up:	☐	☐
.9	Turn fume hood switch to on:	☐	☐
.10	Verify motorized damper opens:	☐	☐
.11	Verify exhaust fan turns on:	☐	☐
.12	Verify fan status at EMCS:	☐	☐
.13	Verify switch position is noted as on:	☐	☐
.14	Verify exhaust fan proof is on:	☐	☐
.15	Verify fan failure alarm is off:	☐	☐
.16	Verify power on is lit up:	☐	☐
.17	Verify S/A tracks to maintain room offset:	☐	☐
.2	Fume Hood operation (ambient above 5 deg.C.)	C	E
.1	Turn fume hood switch to off:	☐	☐
.2	Drop ambient temperature at EMCS to below 5 Deg.C.:	☐	☐
.3	Fan enables:	☐	☐
.4	Verify motorized damper opens:	☐	☐
.5	Verify exhaust fan turns on:	☐	☐
.6	Verify fan status at EMCS:	☐	☐
.7	Verify switch position is noted as on:	☐	☐
.8	Verify exhaust fan proof is on:	☐	☐
.9	Verify fan failure alarm is off:	☐	☐
.10	Verify power on is lit up:	☐	☐
.11	Turn Fume Hood switch to on:	☐	☐
.12	Verify no change in fan status:	☐	☐
.13	Turn Fume Hood switch to off:	☐	☐
.14	Verify no change in fan status:	☐	☐
.15	Reset ambient temperature:	☐	☐
.16	Verify S/A tracks to maintain room offset:	☐	☐

10. Alarms

.1 Airflow Alarm ----------C E

.1 Airflow Offset

.1 Specified Occupied Offset ----------48 L/s

.2 Airflow indicated at EMCS ----------_____----------L/s

.2 Decrease airflow below required differential volume: ---------- ☐ ☐

.3 System alarms after delay:

.1 Record Delay ---------- _____ mins

.2 Discharge Air Temperature----------C E

.1 Raise temperature sensor five degrees above discharge air: ---------- ☐ ☐

.2 System alarms after delay:

.1 Record Delay ---------- _____ mins

.3 Wet Sink Hood----------C E

.1 Fail fan:---------- ☐ ☐

.2 Verify alarm at EMCS:---------- ☐ ☐

.3 Verify exhaust fan status at EMCS (off):---------- ☐ ☐

.4 Verify exhaust fan proof at VSP shows off: ---------- ☐ ☐

.5 Verify exhaust fan failure at VSP is on with audible alarm:---------- ☐ ☐

.6 Verify power on indicator at VSP indicates off: ---------- ☐ ☐

.7 Verify S/A tracks to maintain room offset: ---------- ☐ ☐

.4 Cyano Acrylate Chamber (Switch Enabled) ----------C E

.1 Fail fan:---------- ☐ ☐

.2 Verify alarm at EMCS:---------- ☐ ☐

.3 Verify exhaust fan status at EMCS (off):---------- ☐ ☐

.4 Verify exhaust fan proof at VSP shows off: ---------- ☐ ☐

.5 Verify exhaust fan failure at VSP is on with audible alarm:---------- ☐ ☐

.6 Verify power on indicator at VSP indicates off: ---------- ☐ ☐

.7 Verify S/A tracks to maintain room offset: ---------- ☐ ☐

Comments

SIGN-OFFS

Contractor: _____ Date:_____

Engineer:_____ Date:_____

CxA:_____ Date:_____

Project Name: Interior Fit-Up	Project #: 13/2015
	Performance Verification #: PVM1.1

Performance Verification Test Form		*Section:*
System: **Ventilation**	*Equipment:* **AHU-2: SF-2, EF-31, P-7, Hum-2**	*Tag:* **AHU-2**

1. TEST PURPOSE

.1 To test all components of the air handling unit to ensure that the system and all associated sub-systems operate as intended during normal and abnormal operating conditions.

.2 To document that the system operation performs as intended.

.3 To highlight required modifications and corrections to the system operation and allow those corrections to take place prior to substantial completion and turn over to owner.

.4 To ensure that the system and all sub-systems operates as required and intended and document that operation before turning over to the owner.

2. Test Prerequisites

.1 Controls:

.1 As-built points lists have been submitted and reviewed. ---------- ☐ ☐

.2 All associated controls have been verified point to point including: inputs, outputs, valves, actuators, interlocks, time delays, failure modes, restart modes, schedules, reset schedules, graphics and trending. ---------- ☐ ☐

.3 All sensors have been calibrated. ---------- ☐ ☐

.4 All sequences of operation at both extremes and at midpoints have been verified. ---------- ☐ ☐

.5 All manual overrides and jumpers have been removed to allow for automatic operation. ---------- ☐ ☐

.6 All hardware interlocks and safeties (if any) are operational. ---------- ☐ ☐

.7 Trending within the BMS is operational. ---------- ☐ ☐

3. Equipment Tested

.1 Supply Fan SF-2

.2 Exhaust Fan EF-31

.3 Pump P-7

.4 Humidifier Hum-2

4. Schedules

.1 Establish trend logs where required to verify operation and provide supporting documentation.

.2 Occupied/Unoccupied Schedule

.1 Weekday Schedule ---------- ON OFF

.2 Weekend Schedule ---------- ON OFF

.3 Holiday Schedule ---------- ON OFF

.3 S/A Temperature Discharge Reset Schedule

.1 Upper Limit

.1 Outside Temperature ---------- _____ ---------- ^{O}C

.2 S/A Setpoint---------- ---------- ^{O}C

.2 Lower Limit

.1 Outside Temperature ---------- _____ ---------- ^{O}C

.2 S/A Setpoint---------- ---------- ^{O}C

.4 Humidification Reset Schedule

.1 Upper Limit

.1 Outside Temperature ---------- _____ ---------- ^{O}C

.2 Humidification Setpoint ---------- --------%RH

.2 Lower Limit

.1 Outside Temperature ---------- _____ ---------- ^{O}C

.2 Humidification Setpoint ---------- --------%RH

5. Verification of field temperature devices.

.1 HRC Leaving Air Temperature (after HRC coil):

.1 Temperature indicated through BMS---------- OC

.2 Actual measured temperature ---------- _____ ^{O}C

.2 Preheat Leaving Air Temperature (after Pre-heat coil):

.1 Temperature indicated through BMS---------- OC

.2 Actual measured temperature ---------- _____ ^{O}C

.3 Outdoor Air Temperature (prior to HRC):

.1 Temperature indicated through BMS---------- _____ ^{O}C

.2 Actual measured temperature ---------- _____ ^{O}C

.4 Supply Air Temperature:

.1 Temperature indicated through BMS---------- _____ ^{O}C

.2 Actual measured temperature ---------- _____ ^{O}C

6. System Start Up and Speed Control (coordinate with freeze stat test)

.1 Following Freeze Stat

.1 Confirm outside air damper is fully closed---------- ☐ ☐

.2 Confirm mixed air damper is fully open---------- ☐ ☐

.3 Confirm exhaust air damper is fully closed ---------- ☐ ☐

.4 Confirm fans are off ---------- ☐ ☐

.2 Start-up system

.1 Confirm dampers are in 100% recirculation.

.2 Set room temperature below 15 Deg.C.---------- ☐ ☐

.3 Verify AHU SF starts and ramps to setpoint---------- ☐ ☐

.4 Verify EF-31 starts---------- ☐ ☐

.5 Verify economizer dampers modulate to occupied minimum---------- ☐ ☐

7. Discharge Air Control (Heating):

.1 Increase space temperature setpoint.

.2 Cooling coil valves are move or remain in closed position ---------- ☐ ☐

.3 Verify pump P-7 is on---------- ☐ ☐

.4 Heating valves are modulating to maintain space setpoint ---------- ☐ ☐

.5 Increase setpoint to full heating ---------- ☐ ☐

.6 Valves modulate to full heating ---------- ☐ ☐

.7 Record Water Temperatures

Entering Water Temperature---------- OC

Leaving Water Temperature ---------- OC

.8 Decrease setpoint until 2/3 valve closes ---------- ☐ ☐

.9 Decrease setpoint further, 1/3 valve modulates to control ---------- ☐ ☐

.10 Reset overrides and record Water Temperatures

Entering Water Temperature---------- OC

Leaving Water Temperature ---------- OC

8. Discharge Air Control (Cooling):

.1 Ensure Chilled Water plant is fully operational.

.2 Put AHU into free cooling

.1 Adjust space temperature setpoint to call for cooling and permit free cooling---------- ☐ ☐

.2 Cooling coil valves are closed position ---------- ☐ ☐

.3 Economizer damper modulates to maintain desired setpoint ---------- ☐ ☐

.4 Heating coil valves are closed ---------- ☐ ☐

.3 Put AHU into mechanical cooling

.1 Adjust space temperature setpoint to call for mechanical cooling------ ☐ ☐

.2 Heating coil valves remain closed position ---------- ☐ ☐

.3 Verify pump P-7 is off ---------- ☐ ☐

.4 Modify SAT setpoint below current setpoint, valve modulates to control---------- ☐ ☐

.5 Increase setpoint to full cooling (add load if required) ---------- ☐ ☐

.6 Valve modulates to full cooling ---------- ☐ ☐

.7 Record Water Temperatures

Chilled Water Temperature ---------- OC

Leaving Water Temperature ---------- OC

.8 Decrease setpoint until valve closes ---------- ☐ ☐

.9 Reset overrides and record Water Temperatures

Chilled Water Temperature ---------- OC

Leaving Water Temperature ---------- OC

9. Humidification:

.1 Ensure humidification is fully operational.

.2 Put AHU into humidification

.1 Humidifiers modulate to maintain setpoint ---------- ☐ ☐

.2 Increase setpoint, humidifiers modulate to maintain ---------- ☐ ☐

.3 Reset override ---------- ☐ ☐

.3 Humidification High Limit

.1 Override high limit setpoint below current SAH ---------- ☐ ☐

.2 Humidifier H-2 modulates to maintain ---------- ☐ ☐

.3 Reset overrides ---------- ☐ ☐

.4 Humidification Enable

.1 Set OAT above enable setpoint ---------- ☐ ☐

.2 Humidification disables ---------- ☐ ☐

.3 Reset override, humidification enables ---------- ☐ ☐

10. Failure Mode Testing Procedures

.1 Freezestat:

.1 Manipulate control to simulate freezestat.

.1 Freeze Setpoint (5 deg.C.)---------- ---------- ☐ ☐

.2 Supply Fan Off ---------- ---------- ☐ ☐

.3 Exhaust Fan Off ---------- ---------- ☐ ☐

.4 Heating Valves open ---------- ---------- ☐ ☐

.5 Coil Circ Pumps On ---------- ---------- ☐ ☐

.6 Alarm at Operator Work Screen ---------- ---------- ☐ ☐

.2 Reset Freeze Alarm

.1 Fan system remains off ---------- ---------- ☐ ☐

.3 Command Fan system on (ccordinate with system start-up test)

.1 Confirm system starts under control ---------- ---------- ☐ ☐

.2 Banner shows return to normal ---------- ---------- ☐ ☐

.2 Supply Fan Failure:

.1 Switch Power Off at Disconnect for SF-2

.1 Critical alarm after delay:

.2 Record Delay ---------- _____ mins

.3 EF-31 fan turns off---------- ---------- ☐ ☐

.4 Outside air damper closes (AHU-2) ---------- ---------- ☐ ☐

.5 Relief air damper closes (EF-31)---------- ---------- ☐ ☐

.6 Mixed air damper opens ---------- ---------- ☐ ☐

.2 Turn Power back on at SF-2
- .1 Fan system starts ---------- ☐ ☐
- .2 EMCS shows return to normal.---------- ☐ ☐

.3 Exhaust Fan Failure (EF-31):

.1 Switch Power Off at Disconnect
- .1 Critical Alarm after delay ---------- ☐ ☐
- .2 Record Delay ---------- _____ mins
- .3 AHU supply fan turns off ---------- ☐ ☐
- .4 Outside air damper closes (AHU-2)---------- ☐ ☐
- .5 Relief air damper closes (EF-31)---------- ☐ ☐
- .6 Mixed air damper opens ---------- ☐ ☐

.2 Turn Power back on at EF-30
- .1 Fan systems start (AHU-2 and EF-31)---------- ☐ ☐
- .2 EMCS show return to normal.---------- ☐ ☐

.4 Temperature Alarms:

.1 Increase room temperature above 28 Deg.c.
- .1 System alarms after delay: ---------- ☐ ☐
- .2 Record Delay ---------- _____ mins

.2 Decrease room temperature below 15 Deg.c.
- .1 System alarms after delay: ---------- ☐ ☐
- .2 Record Delay ---------- _____ mins

.3 Reset override, and acknowledge alarms.

.4 Increase discharge temperature above 30 Deg.c.
- .1 System alarms after delay: ---------- ☐ ☐
- .2 Record Delay ---------- _____ mins

.5 Decrease room temperature below 5 Deg.c.
- .1 System alarms after delay: ---------- ☐ ☐
- .2 Record Delay ---------- _____ mins

.6 Reset override, and acknowledge alarms.

.5 High Supply Static:

.1 Supply air static high limit _____kPa ---------- ☐ ☐

.2 Set high limit below static pressure
- .1 Alarm at Operator Work Station for SF-2------- ☐ ☐
- .2 Record Delay ---------- _____ mins

.3 Reset static high limit
- .1 System returns to normal ---------- ☐ ☐

.6 Filter Alarm (Filter 3):

.1 Filter alarm limit _____ ---------- kPa ☐ ☐

.2 Set high limit below filter pressure
- .1 Alarm at Operator Work Station ---------- ☐ ☐
- .2 Record Delay ---------- ---------- mins

.3 Reset override ---------- ☐ ☐

.7 Filter Alarm (Filter 4):

- .1 Filter alarm limit _____ ---------- kPa ☐ ☐
- .2 Set high limit below filter pressure
  - .1 Alarm at Operator Work Station ---------- ---------- ☐ ☐
  - .2 Record Delay ---------- _____ mins
- .3 Reset override ---------- ☐ ☐

.8 Exhaust Humidity Alarms:

- .1 Decrease exhaust air high humidity alarm setpoint below current ----- ☐ ☐
  - .1 System alarms after delay ---------- ---------- ☐ ☐
  - .2 Record Delay ---------- _____ mins
- .2 Increase exhaust air low humidity alarm setpoint above current ------- ☐ ☐
  - .1 System alarms after delay ---------- ---------- ☐ ☐
  - .2 Record Delay ---------- _____ mins
- .3 Reset override, and acknowledge alarms.

.9 Supply Humidity Alarms:

- .1 Decrease supply air high humidity alarm setpoint below current
  - .1 System alarms after delay ---------- ---------- ☐ ☐
  - .2 Record Delay ---------- _____ mins
- .2 Increase supply air low humidity alarm setpoint above current
  - .1 System alarms after delay ---------- ---------- ☐ ☐
  - .2 Record Delay ---------- _____ mins
- .3 Reset override, and acknowledge alarms.

.10 Heating Coil pump failure:

- .1 Switch Power Off at Disconnect for P-7
  - .1 System alarms after delay ---------- ---------- ☐ ☐
  - .2 Record Delay ---------- _____ mins
- .2 Turn Power back on at P-7
  - .1 Pump starts ---------- ---------- ☐ ☐
  - .2 EMCS shows return to normal.---------- ---------- ☐ ☐

.11 Maintenance runtime:

- .1 Supply Fan SF-2
  - .1 Confirm EMCS tracks runtime ---------- ---------- ☐ ☐
  - .2 Record maintenance alarm time---------- _____ hours
- .2 Exhaust Fan EF-31
  - .1 Confirm EMCS tracks runtime ---------- ---------- ☐ ☐
  - .2 Record maintenance alarm time---------- _____ hours
- .3 Pump P-7
  - .1 Confirm EMCS tracks runtime ---------- ---------- ☐ ☐
  - .2 Record maintenance alarm time---------- _____ hours

Comments

SIGN-OFFS

Contractor: _____ Date:_____

Engineer:_____ Date:_____

CxA:_____ Date:_____

Project Name: Interior Fit-Up	Project #: 13/20515
	Performance Verification #: PVM3.1

Performance Verification Test Form		*Section:*
System: HVAC	*Equipment:* Room 213 Air Conditioning	*Tag:* ACU-1/CU-1,

1. TEST PURPOSE

.1 To test installation of the air conditioning equipment, ventilation equipment and controls to ensure that the systems and all associated sub-systems operate as intended during normal and abnormal operating conditions.

.2 To document that the system operation performs as intended.

.3 To highlight required modifications and corrections to the system operation and allow those corrections to take place prior to substantial completion and turn over to owner.

2. Test Prerequisites

		C	E
.1	Mechanical:		
.1	As-built drawings are complete and have been submitted	☐	☐
.2	All component verifications are complete and reviewed	☐	☐
.3	Testing, adjusting and balancing (TAB) is complete for all associated systems.	☐	☐
.4	TAB report is complete and reviewed.	☐	☐
.5	Manufacturer start-up is completed and report submitted, approved.	☐	☐
.2	Controls:		
.1	As-built points lists have been submitted and reviewed.	☐	☐
.2	All associated controls have been verified point to point including: inputs, outputs, valves, actuators, interlocks, time delays, failure modes, restart modes, schedules, reset schedules, graphics and trending.	☐	☐
.3	All sensors/devices have been calibrated.	☐	☐
.4	All sequences of operation at both extremes and at midpoints have been verified.	☐	☐
.5	All manual overrides and jumpers have been removed to allow for automatic operation.	☐	☐
.6	Trending within the BMS is operational.	☐	☐
.3	Equipment		
.1	Verify ACU-1 is complete and clean	☐	☐
.2	Verify CU-1 is complete and clean	☐	☐
.3	Verify ACU-2 is complete and clean	☐	☐
.4	Verify CU-2 is complete and clean	☐	☐
.5	Verify filters are reasonably clean (testing filters, not final)	☐	☐
.6	Verify ACU-1 has an electric reheat coil	☐	☐
.7	Verify ACU-1 electric reheat coil is disabled as per manufacturers requirements	☐	☐
.8	Verify ACU-2 has an electric reheat coil	☐	☐
.9	Verify ACU-2 electric reheat coil is disabled as per manufacturers requirements	☐	☐
.10	Exhaust system is functioning in condenser room	☐	☐

3. Functional Performance Tests

.1 Establish trend logs where required to verify operation and provide supporting documentation.

.2 Verification of field temperature devices.

.1 Space Temperature:

.1 Temperature indicated through BMS ---------- _____ ^{O}C ------ ☐

.2 Temperature indicated at ACU-1 control---------- _____ ^{O}C ------ ☐

.3 Actual measured temperature---------- ^{O}C ------ ☐

.2 Space Humidity:----------C E

.1 Humidity indicated at ACU-1 control---------- _____ % ------- ☐

.2 Actual measured humidity ---------- % ------- ☐

.3 Normal Space Tempering Operation C E

.1 Set space setpoint to current space temperature---------- ☐ ☐

.2 ACU-1 to be off ---------- ☐ ☐

.3 Decrease setpoint to below current space temperature---------- ☐ ☐

.4 ACU-1 energizes ---------- ☐ ☐

.5 CU-1 operates to reject heat---------- ☐ ☐

.6 Reset space temperature setpoints ---------- ☐ ☐

4. Failure Modes

.1 High Temperature

.1 Decrease High Temperature limit to below current room temperature---------- ☐ ☐

.2 Verify alarm registers at BMS---------- ☐ ☐

.3 Reset high temperature limit ---------- ☐ ☐

.2 High Humidity

.1 Decrease High Humidity limit to below current room humidity---------- ☐ ☐

.2 Verify alarm registers at BMS---------- ☐ ☐

.3 Reset high humidity limit---------- ☐ ☐

Comments

SIGN-OFFS

Contractor: _____ Date:_____

Engineer:_____ Date:_____

CxA:_____ Date:_____

Ritenburg & Associates Ltd.
Consulting Electrical Engineers

Owner:
Project Name:
RAL File No:
Owner File No:

Item: **CABLE TRAY**

EQUIPMENT DATA:

DATE / CHECKED BY: _____

Manufacturer _____

Catalogue Number _____

Cable Tray Type _____

Width _____

Depth _____

Colour _____

_____

Options _____

_____

Match Installed ___ Yes ___ No

_____

_____

SIGN-OFFS:

Contractor: Signature: _____ Date:_____

Consultant: Ritenburg & Associates Ltd. Signature: _____ Date:_____

Ritenburg & Associates Ltd.
Consulting Electrical Engineers

Owner:
Project Name:
RAL File No:
Owner File No:

Item: **EQUIPMENT RACK**

LOCATION DATA:

Floor _____ Room _____ Panel ID _____

EQUIPMENT RACK:

Manufacturer _____ Match Installed ___ Yes ___ No
Series _____
Model Number _____

STATIC CHECKS: **DATE / CHECKED BY:** _____

Components Installed

19-inch mounting rails	___ Yes	___ No	Fibre Patch Panel - Qty:	_____	
42U Rack Units	___ Yes	___ No	Data Patch Panel - Qty:	_____	
152mm Side Channels	___ Yes	___ No			
2-Ring horizontal managers	___ Yes	___ No			
2 - Shelves	___ Yes	___ No	Min Clearance - Front: 914mm	___ Yes	___ No
6-Outlet Power Bar	___ Yes	___ No	Min Clearance - Back: 1067mm	___ Yes	___ No
12-foot Shielded Cord Set	___ Yes	___ No	Min Clearance - Side: 762mm	___ Yes	___ No
Integral on/off Switch	___ Yes	___ No			
15A Breaker Reset	___ Yes	___ No			
EMI/RFI Filtering	___ Yes	___ No			
Ground Lug Terminated	___ Yes	___ No			

Cabling

Fibre Cable:	Type:	_____	Size:	_____	Colour:	_____
Data Cables:	Category:	_____	Size:	_____	Colour:	_____

Connectors:

Fibre Connectors	Type:	_____	Size:	_____	Colour:	_____
Data Connectors	Category:	_____	Size:	_____	Colour:	_____

OPERATION CHECKS:

Cable installation and testing:

Installed and Certified by:
Company: _____ Name: _____ Date: _____

Labeling info provided by Owner	___ Yes	___ No	Rack layout info provided	___ Yes	___ No
Patch Cords Supplied	___ Yes	___ No	by Owner:		
Cable Test Report Submitted	___ Yes	___ No	All Cables Passed Tests:	___ Yes	___ No

SIGN-OFFS:

Contractor: Signature: _____ Date:_____

Consultant: Ritenburg & Associates Ltd. Signature: _____ Date:_____

Ritenburg & Associates Ltd.
Consulting Electrical Engineers

Owner:
Project Name:
RAL File No:
Owner File No:

Item: **DISCONNECT SWITCHES**

LOCATION DATA:

Floor _____ Room _____ Equipment: _____

EQUIPMENT DATA:

Manufacturer _____
Model Number _____
Volt/Phase/Amperage _____
Horsepower _____ Match Installed ___ Yes ___ No

STATIC CHECKS: **DATE / CHECKED BY:** _____

Elevator Main Disconnect Switch

Fusible Switch	___ Yes	___ No
Volt/Phase	_____	
Pole/Wire	_____	
Switch Amperage - 60A	___ Yes	___ No
Fuse Amperage - 35A	___ Yes	___ No

Enclosure Details

Mounting	___ Flush	___ Surface
EEMAC Enclosure Type	_____	
Padlockable	___ Yes	___ No
Label	___ Yes	___ No

Elevator Cab Light Main Disconnect Switch

Breaker Switch	___ Yes	___ No
Volt/Phase	_____	
Pole/Wire	_____	
Switch Amperage - 15A	___ Yes	___ No

Enclosure Details

Mounting	___ Flush	___ Surface
EEMAC Enclosure Type	_____	
Padlockable	___ Yes	___ No
Label	___ Yes	___ No

SIGN-OFFS:

Contractor: Signature: _____ Date:_____

Consultant: Ritenburg & Associates Ltd. Signature: _____ Date:_____

Ritenburg & Associates Ltd.
Consulting Electrical Engineers

Owner:
Project Name:
RAL File No:
Owner File No:

Item:

EMERGENCY LIGHTING

FIXTURE TYPE: _____ Number Installed: _____

EQUIPMENT DATA:

DATE / CHECKED BY: _____

Manufacturer _____

Catalogue Number _____

Voltage _____

LED / Lamp Type _____

LED / Lamp Wattage _____

Number of Lamps _____

Battery Size _____

Nexus RF Compatible _____

Nexus RF Area Controller _____

Nexus RF Repeater _____

Mounting _____

Options _____

_____

Match Installed ___ Yes ___ No

SIGN-OFFS:

Contractor: _____ Signature: _____ Date:_____

Cx Rep: _____ Signature: _____ Date:_____

Ritenburg & Associates Ltd.
Consulting Electrical Engineers

Owner:
Project Name:
RAL File No:
Owner File No:

Item: **EXIT SIGN**

FIXTURE TYPE: _____ Number Installed: _____

EQUIPMENT DATA:

DATE / CHECKED BY: _____

Manufacturer _____

Catalogue Number _____

Fixture Type _____

Housing _____

Voltage _____

Lamp Wattage _____

Lamp Type _____

Lettering Type _____

Number of Faces _____

Circuit _____

Mounting

Nexus Compatible _____

Options _____

_____

Match Installed ___ Yes ___ No

_____

_____

SIGN-OFFS:

Contractor: Signature: _____ Date:_____

Consultant: Ritenburg & Associates Ltd. Signature: _____ Date:_____

Ritenburg & Associates Ltd.
Consulting Electrical Engineers

Owner:
Project Name: *Section:*
RAL File No:
Owner File No: *Item:* **F/A COMPONENTS**

EQUIPMENT DATA:

Manufacturer _____ Match Installed ___ Yes ___ No
System _____

STATIC CHECKS: **DATE / CHECKED BY:** _____

System Devices	**Model Number**	**Match installed**
Manual Pull Stations		___ Yes ___ No
Smoke Detectors		___ Yes ___ No
Monitor Modules		___ Yes ___ No
Control Modules		___ Yes ___ No
Relay Modules		___ Yes ___ No
Fault Isolator Modules		___ Yes ___ No
Power Supply		___ Yes ___ No
Pre-Action Releasing Panel		___ Yes ___ No
Annunciator Panel		___ Yes ___ No
Horn Strobes		___ Yes ___ No
Wall Speakers & Speaker Strobes for Future Code Spear		___ Yes ___ No

SIGN-OFFS:

Contractor: Signature: _____ Date:_____

Consultant: Ritenburg & Associates Ltd. Signature: _____ Date:_____

Ritenburg & Associates Ltd.
Consulting Electrical Engineers

Owner:
Project Name: *Section:*
RAL File No:
Owner File No: *Item:* **GROUNDING**

STATIC CHECKS: **DATE / CHECKED BY:** _____

Grounded Systems

Communications	___ Yes	___ No
Switchboard	___ Yes	___ No
Transformers	___ Yes	___ No
Lay-in Trays	___ Yes	___ No
Feeder Conduits	___ Yes	___ No
Green Insul. on Branch Conduits	___ Yes	___ No

Miscellaneous

Riser _____

Ground Bus _____

SIGN-OFFS:

Contractor: Signature: _____ Date:_____

Consultant: Ritenburg & Associates Ltd. Signature: _____ Date:_____

Ritenburg & Associates Ltd.
Consulting Electrical Engineers

Owner:
Project Name:
RAL File No:
Owner File No:

Item: **LIGHTING**

FIXTURE TYPE: _____ Number Installed: _____

EQUIPMENT DATA: **DATE / CHECKED BY:** _____

Manufacturer _____

Catalogue Number _____

Voltage _____

LED / Lamp Type _____

LED / Lamp Wattage _____

Number of Lamps _____

Driver / Ballast Type _____

Size _____

Mounting _____

Diffuser _____

Options _____

_____

Match Installed ___ Yes ___ No

SIGN-OFFS:

Contractor: _____ Signature: _____ Date:_____

Cx Rep: _____ Signature: _____ Date:_____

Ritenburg & Associates Ltd.
Consulting Electrical Engineers

Owner:
Project Name: *Section:*
Location:
RAL File No:
Owner File No: *Item:* **LV PANELS**

LOCATION DATA:

Floor: _____ Room: _____ ID: _____

EQUIPMENT DATA:

Manufacturer _____ Match Installed ___ Yes ___ No
System _____
Model Number _____ Relay Capacity: _____ Relays: _____

STATIC CHECKS: **DATE / CHECKED BY:** _____

Components Installed

Intelligent Card	___ Yes	___ No	Data-Line	___ Yes	___ No
Photo Control Package	___ Yes	___ No	BMS Interface Module	___ Yes	___ No
Networking Modules	___ Yes	___ No	Photo-control Module	___ Yes	___ No
Power Supply Units	___ Yes	___ No	OCC Sensors	___ Yes	___ No
Digital Switches w/ Pilot Light	___ Yes	___ No	Photo Sensors (Indoor)	___ Yes	___ No
Relays w/ Pilot Light Switch	___ Yes	___ No	Photo Sensors (Outdoor)	___ Yes	___ No
Channel Bushbuttons	___ Yes	___ No			

Panel Installation

Power supply terminated	___ Yes	___ No	Operating manuals provided	___ Yes	___ No
Panel relays terminated	___ Yes	___ No			
Remote relays terminated	___ Yes	___ No			
Class 2 wiring terminated	___ Yes	___ No			
Lamecoid Identification	___ Yes	___ No			

OPERATION CHECKS:

Programming and Start-up

Start-up and programming verified by:
Company: _____ Name: _____ Date: _____

Control Devices:

LV Switching conforms to drawings	___ Yes	___ No
Indoor Photo Sensors Operational	___ Yes	___ No
Outdoor Photo Sensors Operational	___ Yes	___ No
Occupancy Sensors Operational	___ Yes	___ No

SIGN-OFFS:

Contractor: Signature: _____ Date:_____

Consultant: Ritenburg & Associates Ltd. Signature: _____ Date:_____

Ritenburg & Associates Ltd.
Consulting Electrical Engineers

Owner:
Project Name: *Section:*
Location:
RAL File No:
Owner File No: *Item:* **PUBLIC ADDRESS**

LOCATION DATA:

Floor: _____ Room: _____ ID: _____

EQUIPMENT DATA:

Manufacturer _____ Match Installed ___ Yes ___ No
System _____
Model Number _____ _____ _____

STATIC CHECKS: **DATE / CHECKED BY:** _____

Components Installed

Speakers (4 Types)	___ Yes	___ No
Public Address Amplifier	___ Yes	___ No
DSP / Matrix Routing	___ Yes	___ No
Desktop Paging Microphone	___ Yes	___ No
Wall Mounted Audio Rack	___ Yes	___ No
Cable & Connector Panels	___ Yes	___ No
Cable Jack Terminations	___ Yes	___ No
Spare Devices	___ Yes	___ No
Receptacle Provided	___ Yes	___ No
Zones Provided	___ Yes	___ No
Intelligibility Test	___ Yes	___ No

Operating manuals provided ___ Yes ___ No

Owner Training provided ___ Yes ___ No

OPERATION CHECKS:

Programming and Start-up

Start-up and programming verified by:
Company: _____ Name: _____ Date: _____

SIGN-OFFS:

Contractor: Signature: _____ Date:_____

Consultant: Ritenburg & Associates Ltd. Signature: _____ Date:_____

Ritenburg & Associates Ltd.
Consulting Electrical Engineers

Owner:
Project Name: *Section:*
Location:
RAL File No:
Owner File No: *Item:* **SOUND MASKING**

LOCATION DATA:

Floor: _____ Room: _____ ID: _____

EQUIPMENT DATA:

Manufacturer _____ Match Installed ___ Yes ___ No
System _____
Model Number _____ _____ _____

STATIC CHECKS: **DATE / CHECKED BY:** _____

Components Installed

Control Module	___ Yes	___ No
Audio Inputs	___ Yes	___ No
Wireless Remote Control	___ Yes	___ No
Transducers/Emitters	___ Yes	___ No
Finish/Colour as Specified	___ Yes	___ No
Cabling	___ Yes	___ No
Cable Jack Terminations	___ Yes	___ No
Spare Devices	___ Yes	___ No
Receptacle Provided	___ Yes	___ No
Zones Provided	___ Yes	___ No
Intelligibility Test	___ Yes	___ No

Operating manuals provided ___ Yes ___ No

Owner Training provided ___ Yes ___ No

OPERATION CHECKS:

Programming and Start-up

Start-up and programming verified by:
Company: _____ Name: _____ Date: _____

SIGN-OFFS:

Contractor: Signature: _____ Date:_____

Consultant: Ritenburg & Associates Ltd. Signature: _____ Date:_____

Ritenburg & Associates Ltd.
Consulting Electrical Engineers

Owner:
Project Name:
RAL File No:
Owner File No:

Item: **MOTOR STARTER**

LOCATION DATA:

Floor _____ Room _____ ID _____

EQUIPMENT DATA:

Manufacturer	_____	Thermal Protection	___ Yes ___ No
Model Number	_____	Panel/Cct Fed From	_____
Starter Volt/Phase/Wire	_____	Starter Size	_____
Starter Type	_____	Match Installed	___ Yes ___ No

STATIC CHECKS: **DATE / CHECKED BY:** _____

Motor Protection Switch

Type	___ Fuse ___ Breaker	Pilot Lights Checked	___ Yes ___ No
Size	_____		

Overload Elements

Overload Correctly Sized	___ Yes ___ No	Amperage Range	_____ Amps

Motor Data

Service Factor	_____	Full Load Current	_____ Amps
Motor Volt/Phase/Wire	_____	Motor Horsepower	_____ HP
Motor Design Type	_____	Motor Code	_____
Motor Insulation	_____	Motor Locked Rotor Current	_____ Amps
Cable Distance to Drive	_____	Motor RPM	_____ RPM

Enclosure Details

Mounting	___ Flush ___ Surface		
EEMAC Enclosure Type	_____		
Door Type	_____		
Drip Hood	___ Yes ___ No	Door Lock	___ Yes ___ No

Miscellaneous

Exterior Clean	___ Yes ___ No	Top Connectors Water Tight	___ Yes ___ No
Interior Clean	___ Yes ___ No	Conduit Connectors Sealed	___ Yes ___ No
Indicating Lights Operate	___ Yes ___ No	Ground Wire Type & Size	___ Type ___ AWG
Hand/Off/Auto Switch	___ Yes ___ No	Phase Rotation Confirmed	___ Yes ___ No
Air Filters Present	___ Yes ___ No	Operation Manual Included	___ Yes ___ No
Air Filters Changed Pre-Startup	___ Yes ___ No	Record of VFD Settings	___ Yes ___ No

OPERATION CHECKS: **DATE / MEASURED BY:** _____

Starter Operation

Manual Operation Checked	___ Yes ___ No	Auto Operation Checked	___ Yes ___ No
Disconnect Function Checked	___ Yes ___ No	Fire Alarm Shutdown Checked	___ Yes ___ No
VFD Display Calibrated	___ Yes ___ No	Auto Restart Checked	___ Yes ___ No
Motor RPM Verified	___ Yes ___ No	Owner Training Completed	___ Yes ___ No

Measured Values	**Amperage**		**Voltage**		**Voltage**	
	Line A	_____ Amps	AB	_____ Volts	AN	_____ Volts
	Line B	_____ Amps	BC	_____ Volts	BN	_____ Volts
	Line C	_____ Amps	CA	_____ Volts	CN	_____ Volts

Motor Terminal Waveforms Taken	___ Yes ___ No	Skip Frequencies	_____
Acceleration Time	_____	Carries Frequency	_____
Deceleration Time	_____	Maximum Speed	_____
Output Pulse Risetime	_____	Minimum Speed	_____
Speed Control	☐-10VDC ☐4-20mA ☐ +/-10VDC	Speed Display	☐ % ☐ Hz

SIGN-OFFS:

Contractor: Signature: _____ Date: _____

Consultant: Ritenburg & Associates Ltd. Signature: _____ Date: _____

Ritenburg & Associates Ltd.
Consulting Electrical Engineers

Owner:
Project Name:
Location:
Owner File No:

Item: **Wiring Devices**

STATIC CHECKS: **DATE / CHECKED BY:** _____

Receptacles location and operation confirmation

Duplex Receptacles (5-15R)	_____ Yes	_____ No
Single Receptacles (5-15R)	_____ Yes	_____ No
T-Slot Receptacles (5-20R)	_____ Yes	_____ No
Twist-Lock Receptacles (L6-30R)	_____ Yes	_____ No
Tamper resistant safety Receptacles (5-15R)	_____ Yes	_____ No
GFCI (Safe-Lock - 5mA Ground Fault)	_____ Yes	_____ No

Switches location and operation confirmation

120V Switches (SPST, 15A)	_____ Yes	_____ No
120V Pilot Light Switches (SPST - 15A)	_____ Yes	_____ No
347V Switches (SPST, 15A)	_____ Yes	_____ No
Fractional HP/KW Manual Starters	_____ Yes	_____ No
Illuminated Switches	_____ Yes	_____ No
Dimmers	_____ Yes	_____ No

Comments:

SIGN-OFFS:

Contractor: Signature:_____ Date:_____

Consultant: Ritenburg & Associates Ltd. Signature:_____ Date:_____

Ritenburg & Associates Ltd.
Consulting Electrical Engineers

Performance Checks
CABLE TRAY

Owner:
Project Name:
RAL File No:
Owner File No:

Activities, Checks and Tests by the Electrical Contractor

- ☐ Verify the products used meet the requirements of the electrical Specification and complies with the shop drawings.
- ☐ Perform the installation and performance tests according to the Canadian Electrical Code, ANSI/NETA standards, manufacturer's recommendations and Specification.
- ☐ Verify that the Site Acceptance Test has been completed.
- ☐ Preventative Maintenance Plan and Quality Assurance Plans have been submitted.
- ☐ Ensure that all parts of this commissioning form and performance checks have been completed. Enter into the notes areas of any unfinished work or problems encountered during installation or commissioning.

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Contractor: Signature: _____ Date: _____

Consultant: Ritenburg & Associates Ltd. Signature: _____ Date: _____

Ritenburg & Associates Ltd.
Consulting Electrical Engineers

Performance Checks
Data/Voice System

Owner:
Project Name:
RAL File No:
Owner File No:

Activities, Checks and Tests by the Electrical Contractor

- ☐ Verify the products used meet the requirements of the specifications and comply with the shop drawings.
- ☐ Perform the installation in accordance with the manufacturer's recommendations and in accordance with the specifications and drawings.
- ☐ Conduct testing of the cabling system in accordance the standards outlined in the specifications.
- ☐ Confirm termination of all vertical and horizontal copper cable.
- ☐ Confirm termination of all fibre cable.
- ☐ All fibre and copper cables are provided with service loops at the equipment racks and BIX blocks.
- ☐ In all wall or pac pole drops, a 300mm cable slack is provided before entering wall or pac pole suspended in the ceiling.
- ☐ Confirm identification of equipment and all tagging is completed in accordance with the specifications and Owner's requirements.
- ☐ Confirm management of all vertical and horizontal cables, including installation of waterfalls at equipment racks.
- ☐ Confirm velcor straps are used. Cable ties are unacceptable.
- ☐ Confirm grounding within the Data/Com Rooms in accordance with the requirements of the Canadian Electrical Code, specifications and drawings, including bonding of the equipment racks, conduit stubs and cable trays.
- ☐ Confirm clearances at the equipment racks.
- ☐ Each equipment racks is supplied with a floor mounting base, fibre and copper patch panels, cable managers, power bar, and shelves.
- ☐ Confirm equipment racks are secured to floor.
- ☐ Confirm power to server equipment is energized and polarity of all wiring devices is checked.
- ☐ Supply and turn-over to Owner the fibre and copper patch cords in the quantities, types and lengths noted in the specifications.
- ☐ Submit cable test reports, include copies or CD disk in the Operating and Maintenance Manual.
- ☐ Conduct Owner training on the layout and installation of this system.
- ☐ Ensure that all parts of this commissioning form and performance checks have been completed. Enter into the notes areas of any unfinished work or problems encountered during installation or commissioning.

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Contractor: Signature: _____ Date: _____

Consultant: Ritenburg & Associates Ltd. Signature: _____ Date: _____

Ritenburg & Associates Ltd.
Consulting Electrical Engineers

Performance Checks
DISCONNECT SWITCHES F/NF

Owner:
Project Name:
RAL File No:
Owner File No:

Activities, Checks and Tests by the Electrical Contractor

- ☐ Verify the products used meet the requirements of the electrical specifications and complies with the shop drawings.
- ☐ Perform the installation and performance tests according to the Canadian Electrical Code, manufacturer's recommendations and Specifications.
- ☐ Confirm that the disconnect switches has been securely fastened.
- ☐ Confirm that all feeder and branch circuit conductors are properly sized, terminated with the proper torque, identified as required by the Specifications.
- ☐ Mark all lugs and terminals that have been torqued with red lacquer or marker.
- ☐ Ensure that the branch circuits and their fuses are correctly matched.
- ☐ Ensure that the disconnect switches lamecoid tags conforms to the drawings & Specification.
- ☐ Ensure that all sections of the Contractor Start-up and Testing Sheet(s) are signed or initialed and dated.
- ☐ Complete record drawings.
- ☐ Conduct Owner training on the operation and maintenance of the panelboards.
- ☐ Ensure that all parts of this commissioning form and performance checks have been completed. Enter into the notes areas of any unfinished work or problems encountered during installation or commissioning.

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Contractor: Signature: _____ Date: _____

Consultant: Ritenburg & Associates Ltd. Signature: _____ Date: _____

Ritenburg & Associates Ltd.
Consulting Electrical Engineers

Performance Checks
EXIT AND EMERGENCY LIGHTING

Owner:
Project Name:
RAL File No:
Owner File No:

Activities, Checks and Tests by the Electrical Contractor

- ☐ Verify the products used meet the requirements of the electrical specifications and complies with the shop drawings (if provided).
- ☐ The installation is completed in accordance with the Canadian Electrical Code, specifications and manufacturer's recommendations.
- ☐ Confirm that all conductors for supply and control are properly sized, terminated with proper torque.
- ☐ Confirm exit lighting clearly indicate the means of egress and are visible in all public areas.
- ☐ Confirm exit light fixtures are connected to a dedicated emergency circuit as indicated on the floor plans.
- ☐ Ensure that exit light circuit breaker is locked in on position.
- ☐ Confirm complete illumination of the emergency battery units and exit signs.
- ☐ Confirm complete emergency battery units and exit signs are connected to the Nexus RF system.
- ☐ Perform functional & other tests (as applicable) required by the Specifications, the Manufacturer or the Design Consultant.
- ☐ Conduct Owner training in regards to the operation and maintenance of the emergency battery lighting and exit lighting.
- ☐ Ensure that all parts of this commissioning form and performance checks have been completed. Enter into the notes areas of any unfinished work or problems encountered during installation or commissioning.

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Contractor: Signature: _____ Date: _____

Consultant: Ritenburg & Associates Ltd. Signature: _____ Date: _____

Ritenburg & Associates Ltd.
Consulting Electrical Engineers

Performance Checks
FIRE ALARM

Owner:
Project Name:
RAL File No:
Owner File No:

Activities, Checks and Tests by the Electrical Contractor

- ☐ Verify the products used meet the requirements of the electrical specifications and complies with the shop drawings.
- ☐ Complete installation and wiring of all components of the fire alarm system in accordance with the manufacturer's recommendations, specifications, and in accordance with the National Standard of Canada/Underwriters' Laboratory of Canada Standards CAN/ULC-S524-M06 "Standard for the Installation of Fire Alarm Systems".
- ☐ Complete the inspection and testing of the fire alarm system in accordance with the National Standard of Canada/Underwriters' Laboratory of Canada Standards CAN/ULC-S536-04 "Standard for the Inspection and Testing of Fire Alarm Systems".
- ☐ Complete the verification of the fire alarm system in accordance with the National Standard of Canada/Underwriters' Laboratory of Canada Standards CAN/ULC-S537-04 "Standard for the Verification of Fire Alarm System Installations".
- ☐ Confirm fire alarm system connected to a dedicated circuit with breaker lock-on device on branch breaker.
- ☐ Confirm fire alarm system is connected to new sprinkler pre-action system as per drawings, specifications and system supplier..
- ☐ Initiate alarm from each breakglass station.
- ☐ Initiate an alarm from each smoke detector and heat detector by initiating an alarm using a magnet, artificial smoke, or by jumping out device in case of fixed temperature heat detectors. The method to activate a detector shall be confirmed by the manufacturer's verification agent.
- ☐ Initiate an alarm from the sprinkler system by testing flow within a floor control zone valve.
- ☐ Conduct an open circuit tests at various points on the Class B tolerant loops. Initiate an alarm from various points on the open circuit.
- ☐ Initiate an alarm to check supervisory and control functions at the fire alarm control and annunciator panel.
- ☐ Check correctness of identification of annunciator zones and device mapping at the annunciator.
- ☐ Initiate one test alarm to central supervisory station after notice of test is given.
- ☐ Check operation of all auxiliary contacts and devices, and verify that auxiliary control door holders, fan shut-down, elevator homing, etc, is fully operational.
- ☐ Perform functional and other tests (as applicable) as required by the Specifications, the Manufacturer or the Consultant.
- ☐ Check operation of fire alarm audible and visual signal appliances in public areas.
- ☐ Record sound levels for fire alarm signal devices within public areas.
- ☐ Confirm signal to the municipal fire department in accordance with the requirements of the 2010 National Building Code.
- ☐ Submit manufacturer's fire alarm certificate of verification and fire alarm test report.
- ☐ Confirm spared devices are provided to the owner as required by the Specifications.
- ☐ Complete record drawings.

- ☐ Conduct Owner training on the operation and maintenance of the fire alarm system.
- ☐ Ensure that all parts of this commissioning form and performance checks have been completed. Enter into notes areas of any unfinished areas or problems encountered during installation or commissioning.

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Contractor: Signature: _____ Date: _____

Consultant: Ritenburg & Associates Ltd. Signature: _____ Date: _____

Ritenburg & Associates Ltd.
Consulting Electrical Engineers

Performance Checks
GROUNDING

Owner:
Project Name:
RAL File No:
Owner File No:

Activities, Checks and Tests by the Electrical Contractor

- ☐ Verify the products used meet the requirements of the electrical specifications and complies with the shop drawings (if provided).
- ☐ Perform tests that are required by the Canadian Electrical Code, ANSI/NETA standard's, manufacturer's recommendations and Specifications.
- ☐ All electrical equipment and wiring grounded in accordance with the Canadian Electrical Code, and local inspection authority's rules and regulations.
- ☐ The ground bus in each switchboard, transformer, motor control centre, etc., connected to the grounding network by two AWG #3/0 bare copper conductors.
- ☐ All motors with flexible connections have separate insulated ground wire run bridging the flexible connections with the ground wire run back to the nearest junction box or motor control centre.
- ☐ Exposed copper cleaned to a bright surface, and finished with two coats of clean, insulating varnish.
- ☐ Where bonds are covered with soil, the conductors are to be coated with anti-corrosion compound "Kopr-Shield" (Thomas & Betts Co.) before compression connector is applied. All bonding done with 'C' tap and lug compression connectors.
- ☐ All grounding connectors, conductor and terminations checked and approved by the Consultant prior to concealment by fill or architectural finishes.
- ☐ The main grounding electrode or system shall have a fall-of-potential test. Refer to IEEE Standard 81. Five ohms is the maximum allowable resistance between the main grounding electrode and ground.
- ☐ Determine resistance between main grounding system and all major electrical equipment frames, system neutral and any floating neutrals. Any resistance values greater than 0.5 ohm shall be examined.
- ☐ Ensure that all parts of this commissioning form and performance checks have been completed. Enter into the notes areas of any unfinished work or problems encountered during installation or commissioning.

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Contractor: Signature: _____ Date: _____

Consultant: Ritenburg & Associates Ltd. Signature: _____ Date: _____

Ritenburg & Associates Ltd.
Consulting Electrical Engineers

Performance Checks
LIGHTING

Owner:
Project Name:
RAL File No:
Owner File No:

Activities, Checks and Tests by the Electrical Contractor

- ☐ Verify the products used meet the requirements of the electrical specifications and complies with the shop drawings.
- ☐ Perform the installation and performance tests according to the Canadian Electrical Code, specifications, and manufacturer's recommendations.
- ☐ Confirm that all circuit conductors for supply and control are properly sized, terminated with proper torque, identified as required by the Specifications.
- ☐ Confirm proper ballast and voltage ratings are installed within the fixtures.
- ☐ Confirm correct lamps are provided for the fixture in accordance with the specifications and manufacturer's requirements. Ensure lamp colour temperatures and colour rendering index (CRI) are in accordance with the requirements of the specifications.
- ☐ Confirm fixtures are clean, proper fit of lenses and fixture trims.
- ☐ Confirm installation of switches, occupancy sensors and photocells.
- ☐ Adjust coverage and time delay-off to all wall and ceiling occupancy sensors.
- ☐ Complete record drawings for layout of lighting, circuit identification and control.
- ☐ Conduct Owner training in regards to the operating and maintenance of lighting fixtures, including the type of LEDS or lamps installed, lamp, driver, and ballast replacement, ballast and driver warranties, and general maintenance of the fixtures.
- ☐ Ensure that all parts of this commissioning form and performance checks have been completed. Enter into the notes areas of any unfinished work or problems encountered during installation or commissioning.

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Contractor: Signature: _____ Date: _____

Consultant: Ritenburg & Associates Ltd. Signature: _____ Date: _____

Ritenburg & Associates Ltd.
Consulting Electrical Engineers

Performance Checks
LOW VOLTAGE LIGHTING

Owner:
Project Name:
RAL File No:
Owner File No:

Activities, Checks and Tests by the Electrical Contractor

- ☐ Verify the products used meet the requirements of the electrical Specification and complies with the shop drawings.
- ☐ Perform the installation and performance tests according to the Canadian Electrical Code, ANSI/NETA standards, manufacturer's recommendations and Specification.
- ☐ Confirm that all line voltage and class II wiring for supply and control are properly sized, terminated, identified as required by the specifications.
- ☐ Day-light sensors installed for interior perimeter lighting.
- ☐ Exterior photo-sensors installed for exterior lighting.
- ☐ Low voltage power packs are installed and locations marked on as-built drawings.
- ☐ Verify and adjust photo control sensitivity for interior and exterior lighting.
- ☐ Occupancy sensors interconnected to switches as shown on drawings.
- ☐ Provide record of occupancy sensor and photocell programming.
- ☐ Aim and adjust photo controls to optimize function.
- ☐ Conduct Owner training in regards to the operation, programming and maintenance of the lighting control system.
- ☐ Complete record drawings.
- ☐ Ensure that all parts of this commissioning form and performance checks have been completed. Enter into the notes areas of any unfinished work or problems encountered during installation or commissioning.

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Contractor: Signature: _____ Date: _____

Consultant: Ritenburg & Associates Ltd. Signature: _____ Date: _____

Ritenburg & Associates Ltd.
Consulting Electrical Engineers

Performance Checks
OVERCURRENT PROTECTIVE DEVICES

Owner:
Project Name:
RAL File No:
Owner File No:

Activities, Checks and Tests by the Electrical Contractor

- ☐ Verify the products used meet the requirements of the electrical Specification and complies with the shop drawings.
- ☐ Perform the installation and performance tests according to the Canadian Electrical Code, ANSI/NETA standards, manufacturer's recommendations and Specification.
- ☐ Confirm that the overcurrent protection device is correctly sized and has been securely fastened.
- ☐ Confirm that all supply and load feeders are properly sized, terminated with the proper torque, identified as required by the Specification. Ensure that the supply and load feeders have been Megger tested.
- ☐ Mark all lugs and terminals that have been torqued with red lacquer or marker.
- ☐ Ensure that all sections of the Contractor Start-up and Testing Sheet(s) are signed or initialed and dated.
- ☐ Complete record drawings
- ☐ Conduct Owner training on the operation and maintenance of the overcurrent protective equipment.
- ☐ Ensure that all parts of this commissioning form and performance checks have been completed. Enter into the notes areas of any unfinished work or problems encountered during installation or commissioning.

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Contractor: Signature: _____ Date: _____

Consultant: Ritenburg & Associates Ltd. Signature: _____ Date: _____

Ritenburg & Associates Ltd.
Consulting Electrical Engineers

Performance Checks
PUBLIC ADDRSS SYSTEM

Owner:
Project Name:
RAL File No:
Owner File No:

Activities, Checks and Tests by the Electrical Contractor

- ☐ Verify the products used meet the requirements of the electrical Specification and complies with the shop drawings.
- ☐ Perform the installation and performance tests according to the Canadian Electrical Code, ANSI/NETA standards, manufacturer's recommendations and Specification.
- ☐ Conduct Owner training in regards to the operation, programming and maintenance of the system.
- ☐ Verify that the Site Acceptance Test has been completed.
- ☐ Preventative Maintenance Plan and Quality Assurance Plans have been submitted.
- ☐ Ensure that all parts of this commissioning form and performance checks have been completed. Enter into the notes areas of any unfinished work or problems encountered during installation or commissioning.

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Contractor: Signature: _____ Date: _____

Consultant: Ritenburg & Associates Ltd. Signature: _____ Date: _____

Ritenburg & Associates Ltd.
Consulting Electrical Engineers

Performance Checks
SOUND MASKING

Owner:
Project Name:
RAL File No:
Owner File No:

Activities, Checks and Tests by the Electrical Contractor

- ☐ Verify the products used meet the requirements of the electrical Specification and complies with the shop drawings.
- ☐ Perform the installation and performance tests according to the Canadian Electrical Code, ANSI/NETA standards, manufacturer's recommendations and Specification.
- ☐ Conduct Owner training in regards to the operation, programming and maintenance of the system.
- ☐ Verify that the Site Acceptance Test has been completed.
- ☐ Preventative Maintenance Plan and Quality Assurance Plans have been submitted.
- ☐ Ensure that all parts of this commissioning form and performance checks have been completed. Enter into the notes areas of any unfinished work or problems encountered during installation or commissioning.

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Contractor: Signature: _____ Date: _____

Consultant: Ritenburg & Associates Ltd. Signature: _____ Date: _____

Ritenburg & Associates Ltd.
Consulting Electrical Engineers

Performance Checks
WIRING DEVICES

Owner:
Project Name:
RAL File No:
Owner File No:

Activities, Checks and Tests by the Electrical Contractor

- ☐ Verify the products used meet the requirements of the electrical specifications and complies with the shop drawings.
- ☐ Perform the installation and performance tests according to the Canadian Electrical Code, manufacturer's recommendations and Specifications.
- ☐ Test receptacles for polarity.
- ☐ Test GFCI Receptacles with an appropriate ground fault tester.
- ☐ Verify panel directories and circuit identification indicated on the record drawings are consistent and correct.
- ☐ Record drawings are completed, indicating actual location of devices and circuit identification.
- ☐ Ensure that all parts of this commissioning form and performance checks have been completed. Enter into the notes areas of any unfinished work or problems encountered during installation or commissioning.

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Contractor: Signature: _____ Date: _____

Consultant: Ritenburg & Associates Ltd. Signature: _____ Date: _____

Part 1 General

1.1 SUMMARY

.1 Section Includes:

.1 This Section specifies roles and responsibilities of Training.

1.2 TRAINEES

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

.2 Trainees will be available for training for purposes of familiarization with systems.

1.3 INSTRUCTORS

.1 Consultant will provide:

.1 Descriptions of systems.

.2 Instruction on design philosophy, design criteria, and design intent.

.2 Contractor and certified factory-trained manufacturers' personnel: to provide instruction on the following:

.1 Start-Up, operation, shut-down of equipment, components and systems.

.2 Control features, reasons for, results of, implications on associated systems of, adjustment of set points of control and safety devices.

.3 Instructions on servicing, maintenance and adjustment of systems, equipment and components.

.3 Contractor and equipment manufacturer to provide instruction on:

.1 Start-up, operation, maintenance and shut-down of equipment they have certified installation, started up and carried out PV tests.

1.4 TRAINING OBJECTIVES

.1 Training to be detailed and duration to ensure:

.1 Safe, reliable, cost-effective, energy-efficient operation of systems in normal and emergency modes under all conditions.

.2 Effective on-going inspection, measurements of system performance.

.3 Proper preventive maintenance, diagnosis and trouble-shooting.

.4 Ability to update documentation.

.5 Ability to operate equipment and systems under emergency conditions until appropriate qualified assistance arrives.

1.5 TRAINING MATERIALS

.1 Instructors to be responsible for content and quality.

.2 Training materials to include:

.1 "As-Built" Contract Documents.

.2 Operating & Maintenance Manual.

.3 TAB and PV Reports.

.3 Departmental Representative will review training manuals.

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

.5 Supplement training materials:

.1 Transparencies for overhead projectors.

.2 Multimedia presentations.

.3 Manufacturer's training videos.

.4 Equipment models.

1.6 SCHEDULING

.1 Include in Commissioning Schedule time for training.

.2 Deliver training during regular working hours, training sessions to be for duration specified in relevant Specification Sections.

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

1.7 RESPONSIBILITIES

.1 Be responsible for:

.1 Implementation of training activities,

.2 Coordination among instructors,

.3 Quality of training, training materials,

.2 Departmental Representative will evaluate training and materials.

.3 Upon completion of training, provide written report, signed by Instructors, with complete list of attendees, and witnessed by Consultant and Cx Authority.

.4 Coordination with Departmental Representative.

1.8 TRAINING CONTENT

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

.2 Provide specialized training as specified in relevant Sections of the Specifications.

.3 Content to include the following plus any items required by the relevant Sections of the Specifications:

.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.

END OF SECTION

Part 1 General

1.1 REFERENCES

.1 Canadian Standards Association (CSA International)

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

1.2 SUBMITTALS

.1 Submit shop drawings in accordance with Sections 01 33 00 - Submittal Procedures.

.2 Before proceeding with demolition of load bearing walls or other walls and where required by authority having jurisdiction submit for review by Departmental Representative shoring and underpinning drawings prepared by qualified professional engineer registered or licensed in the Province of Saskatchewan, showing proposed method.

.3 Prior to beginning of Work on site submit detailed Waste Reduction Workplan in accordance with Sections 01 74 21 - Construction/Demolition Waste Management and Disposal and indicate:

.1 Descriptions of and anticipated quantities of materials to be salvaged, reused, recycled and landfilled.

.2 Schedule of selective demolition.

.3 Number and location of dumpsters.

.4 Anticipated frequency of tippage.

.5 Name and address of haulers, waste facilities, and waste receiving organizations.

1.3 WASTE MANAGEMENT AND DISPOSAL

.1 Separate waste materials for reuse and recycling in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.

1.4 SITE CONDITIONS

.1 Should material resembling spray or trowel-applied asbestos or other designated substance listed as hazardous be encountered, stop work, take preventative measures, and notify Departmental Representative immediately.

.1 Do not proceed until written instructions have been received from Departmental Representative.

.2 Notify Departmental Representative before disrupting building access or services.

Part 2 Execution

2.1 PREPARATION

.1 Inspect building and site with Departmental Representative and verify extent and location of items designated for removal, disposal, alternative disposal, recycling, salvage and items to remain.

.2 Locate and protect utilities. Preserve active utilities traversing site in operating condition.

.3 Notify and obtain approval of utility companies before starting demolition.

.4 Disconnect, cap, plug or divert, as required, existing public utilities within the property where they interfere with the execution of the work, in conformity with the requirements of the authorities having jurisdiction. Mark the location of these and previously capped or plugged services on the site and indicate location (horizontal and vertical) on the record drawings. Support, shore up and maintain pipes and conduits encountered.

.1 Immediately notify Departmental Representative and utility company concerned in case of damage to any utility or service, designated to remain in place.

.2 Immediately notify the Departmental Representative should uncharted utility or service be encountered, and await instruction in writing regarding remedial action.

2.2 PROTECTION

.1 Prevent movement, settlement, or damage to adjacent structures, utilities, and parts of building to remain in place. Provide bracing and shoring required.

.2 Keep noise, dust, and inconvenience to occupants to minimum.

.3 Protect building systems, services and equipment.

.4 Provide temporary dust screens, covers, railings, supports and other protection as required.

.5 Do Work in accordance with Section 01 35 29.06 - Health and Safety Requirements.

2.3 SALVAGE

.1 Refer to drawings and specifications for items to be salvaged for reuse.

.2 Remove items to be reused, store as directed by Departmental Representative, and re-install under appropriate section of specification.

2.4 DEMOLITION

.1 Remove parts of existing building to permit new construction. Sort materials into appropriate piles for reuse and recycling.

.2 Trim edges of partially demolished building elements to tolerances as defined by Departmental Representative to suit future use.

2.5 DISPOSAL

.1 Dispose of removed materials, to appropriate recycling facilities or reuse facilities except where specified otherwise, in accordance with authority having jurisdiction.+

END OF SECTION

Part 1 General

1.1 REFERENCES

.1 Canadian Environmental Protection Act,1999 (CEPA 1999).

.1 Export and Import of Hazardous Waste Regulations (SOR/2002-300).

.2 Health Canada/Workplace Hazardous Materials Information System (WHMIS)

.1 Material Safety Data Sheets (MSDS).

.3 National Fire Code of Canada [2005].

.4 Transportation of Dangerous Goods Act (TDG Act) [1999], (c. 34).

.5 Transportation of Dangerous Goods Regulations (T-19.01-SOR/2003-400).

1.2 DEFINITIONS

.1 Dangerous Goods: product, substance, or organism that is specifically listed or meets hazard criteria established in Transportation of Dangerous Goods Regulations.

.2 Hazardous Material: product, substance, or organism that is used for its original purpose; and that is either dangerous goods or a material that may cause adverse impact to environment or adversely affect health of persons, animals, or plant life when released into the environment.

.3 Hazardous Waste: any hazardous material that is no longer used for its original purpose and that is intended for recycling, treatment or disposal.

.4 Workplace Hazardous Materials Information System (WHMIS): Canada-wide system designed to give employers and workers information about hazardous materials used in workplace. Under WHMIS, information on hazardous materials is provided on container labels, material safety data sheets (MSDS), and worker education programs. WHMIS is put into effect by combination of federal and provincial laws.

1.3 SUBMITTALS

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

.2 Product Data:

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

.1 Submit to Departmental Representative current Material Safety Data Sheet (MSDS) for each hazardous material required prior to bringing hazardous material on site.

.2 Submit hazardous materials management plan to Departmental Representative that identifies hazardous materials, their use, their location, personal protective equipment requirements, and disposal arrangements.

1.4 DELIVERY, STORAGE, AND HANDLING

.1 Co-ordinate storage of hazardous materials with Departmental Representative and abide by internal requirements for labelling and storage of materials and wastes.

.2 Store and handle hazardous materials and wastes in accordance with applicable federal and provincial laws, regulations, codes, and guidelines.

.3 Store and handle flammable and combustible materials in accordance with current National Fire Code of Canada requirements.

.4 Keep no more than 45 litres of flammable and combustible liquids such as gasoline, kerosene and naphtha for ready use.

.1 Store flammable and combustible liquids in approved safety cans bearing the Underwriters' Laboratory of Canada or Factory Mutual seal of approval.

.2 Storage of quantities of flammable and combustible liquids exceeding 45 litres for work purposes requires the written approval of the Departmental Representative.

.5 Transfer of flammable and combustible liquids is prohibited within buildings.

.6 Do not transfer of flammable and combustible liquids in vicinity of open flames or heat-producing devices.

.7 Do not use flammable liquids having flash point below 38 degrees C, such as naptha or gasoline as solvents or cleaning agents.

.8 Store flammable and combustible waste liquids for disposal in approved containers located in safe, ventilated area. Keep quantities to minimum.

.9 Observe smoking regulations, smoking is prohibited in areas where hazardous materials are stored, used, or handled.

.10 Storage requirements for quantities of hazardous materials and wastes in excess of 5 kg for solids, and 5 litres for liquids:

.1 Store hazardous materials and wastes in closed and sealed containers.

.2 Label containers of hazardous materials and wastes in accordance with WHMIS.

.3 Store hazardous materials and wastes in containers compatible with that material or waste.

.4 Segregate incompatible materials and wastes.

.5 Ensure that different hazardous materials or hazardous wastes are not mixed.

.6 Store hazardous materials and wastes in secure storage area with controlled access.

.7 Maintain clear egress from storage area.

.8 Store hazardous materials and wastes in location that will prevent them from spilling into environment.

.9 Have appropriate emergency spill response equipment available near storage area, including personal protective equipment.

.10 Maintain inventory of hazardous materials and wastes, including product name, quantity, and date when storage began.

.11 Ensure personnel have been trained in accordance with Workplace Hazardous Materials Information System (WHMIS) requirements.

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

1.5 TRANSPORTATION

.1 Transport hazardous materials and wastes in accordance with federal Transportation of Dangerous Goods Act, Transportation of Dangerous Goods Regulations, and applicable provincial regulations.

.2 If exporting hazardous waste to another country, ensure compliance with federal Export and Import of Hazardous Waste Regulations.

.3 If hazardous waste is generated on site:

- .1 Co-ordinate transportation and disposal with Departmental Representative.
- .2 Ensure compliance with applicable federal, provincial and municipal laws and regulations for generators of hazardous waste.
- .3 Use licensed carrier authorized by provincial authorities to accept subject material.
- .4 Prior to shipping material obtain written notice from intended hazardous waste treatment or disposal facility that it will accept material and that it is licensed to accept this material.
- .5 Label container[s] with legible, visible safety marks as prescribed by federal and provincial regulations.
- .6 Ensure that trained personnel handle, offer for transport, or transport dangerous goods.
- .7 Provide photocopy of shipping documents and waste manifests to Departmental Representative.
- .8 Track receipt of completed manifest from consignee after shipping dangerous goods. Provide a photocopy of completed manifest to Departmental Representative.
- .9 Report discharge, emission, or escape of hazardous materials immediately to Departmental Representative and appropriate provincial authority. Take reasonable measures to control release.

Part 2 Products

2.1 MATERIALS

.1 Only bring on site quantity of hazardous materials required to perform work.

.2 Maintain MSDS in proximity to where materials are being used. Communicate this location to personnel who may have contact with hazardous materials.

Part 3 Execution

3.1 DISPOSAL

.1 Dispose of hazardous waste materials in accordance with applicable federal and provincial acts, regulations, and guidelines.

.2 Recycle hazardous wastes for which there is approved, cost effective recycling process available.

.3 Send hazardous wastes to authorized hazardous waste disposal or treatment facilities.

.4 Burning, diluting, or mixing hazardous wastes for purpose of disposal is prohibited.

.5 Disposal of hazardous materials in waterways, storm or sanitary sewers, or in municipal solid waste landfills is prohibited.

.6 Dispose of hazardous wastes in timely fashion in accordance with applicable provincial regulations.

.7 Minimize generation of hazardous waste to maximum extent practicable. Take necessary precautions to avoid mixing clean and contaminated wastes.

.8 Identify and evaluate recycling and reclamation options as alternatives to land disposal, such as:

.1 Hazardous wastes recycled in manner constituting disposal.

.2 Hazardous waste burned for energy recovery.

.3 Lead-acid battery recycling.

.4 Hazardous wastes with economically recoverable precious metals.

END OF SECTION

Part 1 General

1.1 GENERAL CONDITIONS

.1 The General Conditions of the Contract, Supplementary General Conditions and General Requirements are hereby made part of this section.

1.2 WORK INCLUDED

.1 Cast-in-Place Concrete required for this work is indicated on drawing and includes, but is not necessarily limited to:

.1 Concrete Slabs
.2 Concrete Toppings
.3 Miscellaneous Concrete
.4 Finishing of all Formed Concrete Surfaces.

1.3 RELATED WORK

.1	Concrete Forming and Accessories	Section 03 10 00
.2	Concrete Reinforcing	Section 03 20 00
.3	Concrete Finishing	Section 03 35 00
.4	Structural Steel for Buildings	Section 05 12 23
.5	Metal Fabrications	Section 05 50 00

1.4 QUALITY ASSURANCE

.1 Provide at least one person who shall be present at all times during execution of this portion of the Work and who shall be thoroughly trained and experienced in placing the types of concrete specified and who shall direct all work performed under this Section.

.2 For finishing of exposed surfaces of the concrete, use only thoroughly trained and experienced journeyman concrete finishers.

.3 Perform cast-in-place concrete work to requirements of CAN/CSA-A23.1-09 - "Concrete Materials and Methods of Concrete Construction".

1.5 PRODUCT HANDLING

.1 Use all means necessary to protect cast-in-place concrete materials before, during and after installation and to protect the installed work and materials of all other trades.

.2 In the event of damage, immediately make all repairs and replacements necessary to approval of the Consultant and at no additional cost to the Owner.

1.6 INSPECTION AND TESTING

.1 Inspection and testing will be performed by a firm approved by the Consultant and paid for by the Contractor. Unless approved otherwise, the testing agency must perform all aspects of testing including cylinder preparation.

.2 Provide free access to all portions of work and co-operate with appointed firm.

.3 Submit proposed mix design for each class of concrete to Consultant for approval two (2) weeks prior to commencement of work.

.4 Tests of cement and aggregates may be performed to ensure conformance with requirements stated herein.

.5 One concrete test, consisting of three test cylinders, will be taken for every 50 cubic meters or less of each class of concrete placed. One cylinder to be tested at seven (7) days, the remaining two cylinders to be tested at twenty-eight (28) days.

.6 One (1) additional test cylinder will be taken during cold weather concreting, and be cured on job site under same conditions of concrete it represents.

.7 One (1) slump test and one (1) air content test will be taken for each set of test cylinders taken.

.8 Testing of concrete will be performed in accordance with CAN/CSA-A23.2-09 "Method of Test for Concrete".

.9 Test results will be issued to the Contractor, Consultant and Owner. Test reports are to be numbered consecutively beginning with number one.

.10 Required retesting will be paid for by the Contractor.

.11 The Consultant may order additional testing any time even though the required tests indicate the strength requirements have been met. In this instance, the Owner will pay for those tests that meet the specified requirements and the Contractor will pay for those that do not.

.12 Non-destructive methods for testing concrete shall be according to CAN/CSA A23.2-09.

1.7 SHOP DRAWINGS

.1 Submit shop drawings in accordance with General Conditions.

.2 Prepare and submit to the Consultant for review, shop drawings showing detailed layout of form dimensions, form joint fitting, form sealing and placement, location of openings and placement of form ties. Submit a detailed description of the exact construction method to be used, for all area designated as sand blasted finish, exposed aggregate finish and architectural exposed concrete.

Part 2 Products

2.1 CONCRETE MATERIALS

.1 *Cement:* Normal - N Portland Type, to CSA A3000-08 - "Portland Cements".

.2 *Fine and Coarse Aggregates:* conforming to CAN/CSA-A23.1-09 - "Concrete Material and Methods of Concrete Construction".

.3 *Fine and Coarse Aggregates:* conforming to CAN/CSA-A23.1-09 - "Concrete Materials and Methods of Concrete Construction". The fine and coarse aggregate for concrete floor slabs and finish toppings shall contain a maximum of 0.4% low density particles as determined by CSA Test A23.2-09 "Low Density Material in Aggregate". Test results shall be submitted to Consultant for review.

.4 *Water:* clean and free from injurious amounts of oil, alkali, organic matter, or other deleterious material.

2.2 ADMIXTURES

.1 *Air Entrainment:* to ASTM C260-06 - "Air-Entraining Admixtures for Concrete".

.2 *Chemical:* to ASTM C494-08a - "Chemical Admixtures for Concrete"; water reducing, strength increasing type WN - normal setting.

.3 *Pozzolanic Mineral:* to CSA A3000-08 "Supplementary Cementing Materials and Their Use in Concrete Construction", fly ash permitted only as approved by Consultant.

2.3 ACCESSORIES

.1 *Vapour Barrier:* 6 mil polyethylene film, to CGSB 70-GP-1a, Type 1 - low permeance heavy duty.

.2 *Curing Compounds:* shall conform to the requirements of the latest issue of ASTM Standard C309.

.3 *Non-shrink Grout:* premixed compound consisting of non-metallic aggregate, cement, water reducing and plasticizing agents; capable of developing minimum compressive strength of 20 MPa at 3 days and 50 MPa at 28 days. CPD Non Shrink Grout by CPD Construction Products or approved equivalents.

.4 *Joint Filler:* pre moulded bituminous impregnated cane fibre board Flexcell as manufactured by Sternson or approved equal.

.5 *Concrete Expansion Anchors:* to be Hilti Kwik-Bolt or approved equivalent. Sized as per drawings. Minimum embedment length of all Hilti Kwik-Bolt to be 150 mm unless noted otherwise.

.6 *Concrete Inserts with Bolt Extension:* Concrete inserts to be Hilti HKD Anchors or approved equivalent, sized as detailed on drawings. Bolt extensions to be mild steel threaded extensions sized as detailed on drawings.

.7 *Concrete Patching Material:* pre-packaged, polymer modified, cementitious product containing graded natural aggregate, Planitop X - Rapid Setting Mortar as manufactured by MAPEI Inc.

2.4 CONCRETE MIXES

.1 Mechanical mix concrete in accordance with the requirements of CAN/CSA A23.1-09.

.2 All concrete shall have the following minimum properties.

Based on 2010 National Building Code

Location	Exposure Class	Comp. Strength (MPa) and Age	Aggregate	Air Entrainment	Slump
1. Interior Grade Supported Slab and topping	N	25 @ 28 d	20	0	80 ± 30

Minimum cement content for Type N or HS cement to be 280 kg/m3.
Maximum free water/cement ratio for Type N or HS cement to be 0.5.

Semi-lightweight concrete to have unit weight of 2075 ± 75kg/m3.
Lightweight concrete to have unit weight of 1850 ± 75 kg/m3.

.3 Each load of ready-mixed or transit-mixed concrete delivered to the project site shall be accompanied by duplicate delivery slips providing the following information:

.1 Name of ready-mix batch plant
.2 Serial number of ticket
.3 Date and truck number
.4 Name of contractor
.5 Specific designation of project
.6 Specific class of concrete
.7 Amount of concrete in cubic metres
.8 Time of loading or first mixing of aggregate, cement and water.

Part 3 Execution

3.1 INSPECTION

.1 Prior to all work of this Section, carefully inspect the installed work of all other trades and verify that all such work is complete to the point where this installation may properly commence.

.2 Verify that all items to be embedded in concrete are in place.

.3 Verify that concrete may be placed to the lines and elevations indicated on the Drawings, with all required clearance from reinforcement.

3.2 DISCREPANCIES

.1 In the event of discrepancy, immediately notify the Consultant.

.2 Do not proceed with installation in areas of discrepancy until all such discrepancies have been fully resolved.

3.3 PREPARATION

.1 Remove all wood scraps and debris from the formed areas in which concrete will be placed.

.2 Thoroughly clean the forms to ensure proper placement and bonding of concrete.

.3 Thoroughly wet the forms, except in freezing weather, or oil them; remove all standing water.

.4 Thoroughly clean all transporting and handling equipment.

3.4 PLACING CONCRETE

.1 Place concrete in accordance with requirements of CAN/CSA A23.1-09 and as indicated on Drawings.

.2 Notify Consultant and Inspection and Testing Firm a minimum of twenty-four (24) hours prior to commencement of concreting operations.

.3 Ensure all anchors, seats, plates and other items to be cast into concrete are placed, held securely and will not cause undue hardship in placing concrete.

.4 Maintain accurate records of poured concrete items. Record date, location of pour, quantity, air temperature and test samples taken.

.5 Ensure reinforcement, inserts, embedded parts, formed joints and fitments are not disturbed during concrete placement.

.6 Prepare previously placed concrete by cleaning with steel brush.

.7 Pour concrete continuously between predetermined construction and control joints. All construction joints subject to approval of the Consultant.

.8 Approval to place concrete shall be contingent on the formwork and reinforcing steel placement and evidence that the Contractor can place the planned casting without stopping.

.9 Pour slabs on grade in checkerboard pattern or saw cut, as indicated on Drawings. Saw cut control joints within twenty-four (24) hours after finishing. Use 6 mm thick blades, cutting 20 mm into depth of slab thickness. Vacuum clean saw cut prior to installation of sealant.

.10 Excessive honeycomb or embedded debris in concrete is not acceptable. Remove and replace defective concrete. Excessive honeycomb is when eraser end of a pencil fits into cavity.

3.5 COLD WEATHER REQUIREMENTS

.1 When the air temperature is at or below 5^0 C. or when there is a probability of it falling to this limit during the placing or curing period, cold weather requirements shall be applicable.

.2 Provide heating equipment or heating plant on the job ready for use when concrete is being placed during cold weather. Such equipment shall be adequate for the purpose of maintaining the required temperature during the placing and curing of the concrete. The methods used for heating shall be approved by the Consultant. Equipment inducing carbon monoxide gas in the building shall not be accepted.

.3 Concrete shall not be placed on or against reinforcement, formwork, ground or any surface that is at a temperature less than 5^0 C.

.4 The temperature of the concrete at all surfaces shall be maintained at not less than 15^0 C for three (3) days, or at not less than 10^0 C for five days after placing. Means shall be provided to humidify the air within enclosures and to keep the concrete and formwork continuously moist if dry heat is used. The concrete shall be kept above freezing temperature for a period of seven (7) days, and shall be kept from alternate freezing and thawing for at least fourteen (14) days after placement.

.5 At the end of the specified protection period the temperature of the concrete shall be reduced gradually at a rate not exceeding that shown in CAN/CSA A23.1-09.

.6 Accelerator or so-called anti-freeze compounds shall ***not*** be permitted unless otherwise approved in writing by the Consultant.

.7 All protective coverings shall be kept clear of the concrete and form surfaces to permit free circulation of air and shall be maintained intact for at least twenty-four (24) hours after artificial heat is discontinued.

3.6 HOT WEATHER REQUIREMENTS

.1 When the air temperature exceeds 27^0, hot weather requirements shall be applicable.

.2 Time of initial mixing to complete discharge shall not exceed 1 hour and 15 minutes and concrete placed shall not exceed 27^0.

.3 Concrete forming surfaces and reinforcing steel shall be sprinkled with cool water just prior to placing concrete. Standing water or puddles shall be removed prior to concrete placement.

.4 Special wind protection will be required as directed by the Consultant.

.5 Columns, walls, beams and slabs shall be kept continuously damp for twenty-four (24) hours by normal curing procedures as outlined by this Specification. Slabs cured by the applications of sealing, shall have curing compound applied immediately after finishing of the slab but before evaporation of surface moisture.

.6 The use of water reducing agents shall be subject to the approval of the Consultant when hot weather conditions prevail.

3.7 DEFECTIVE CONCRETE

.1 Concrete not meeting the requirements of the Specifications and drawings shall be considered defective concrete.

.2 Concrete not conforming to the lines, details and grade specified herein or as shown on the drawings shall be modified or replaced at the Contractor's expense and to the satisfaction of the Consultant. Finished lines, dimensions and surfaces shall be correct and true within tolerances specified in the Formwork Section of these Specifications.

.3 Concrete not properly placed resulting in excessive honeycombing and all honeycombing and other defects in critical areas of stress, shall be repaired or replaced at the Contractor's expense and to the satisfaction of the Consultant.

.4 Concrete of insufficient strength or improper consistency shall be, as required by the Consultant, subject to one or more of the following:

.1 Changes in mix proportions for the remainder of the work.

.2 Cores drilled and tested from the areas in question as directed by the Consultant and in accordance with CAN/CSA A23.2-09. The test results shall be indicative of the in-place concrete.

.3 Load testing of the structural elements in accordance with CAN3 A23.3-04.

.4 The changes in the mix proportions and the testing shall be at the Contractor's expense.

.5 Concrete failing to meet the strength requirements of this Specification shall be strengthened or replaced at the Contractor's expense and to the satisfaction of the Consultant.

3.8 PATCHING CONCRETE

.1 After the removal of the forms concrete surfaces may be subject to inspection by the Consultant.

.2 All exposed metal form ties, nails, wires, shall be removed, fins broken off and all loose concrete removed.

.3 Form tie pockets shall be thoroughly wetted and patched with patching concrete followed by proper curing.

.4 Honeycombed and other defective surfaces shall be chipped away to a depth of not less than 25 mm with the edges perpendicular to the surface, thoroughly wetted and patched with patching concrete followed by proper curing.

.5 Patching concrete shall be thoroughly compacted into place and finished in such a manner as to match the adjoining concrete. The design mix of the patching concrete shall be approved by the Consultant.

3.9 FINISHING OF FORMED SURFACES

.1 On all exposed formed concrete surfaces, except at unfinished areas: remove blemishes, formwork joint marks by rubbing with carborundum block and water. Leave finished surfaces smooth, unmarred. Complete rubbing within twenty-four (24) hours for stripping formwork.

3.10 CONCRETE TOPPING

.1 All concrete toppings indicated on drawings are to be bonded toppings.

.2 Concrete toppings are to be bonded by either of the following methods unless specifically directed:

.1 Application of cement/bonding agent/sand grout to prepared base course in accordance with CAN/CSA A23.1-09, Clause 7.6.4.2.2 (b).
.2 Application of approved bonding agent to prepared base course.

.3 The following toppings are to be bonded specifically by application of approved bonding agent:

.1 All toppings cast over existing slabs.
.2 All interior toppings.

.4 New concrete slabs which are to receive toppings are to be prepared in accordance with CAN/CSA A23.1-09, Clause 23 and Section 03 35 00.

.5 Existing concrete slabs which are to receive toppings are to be prepared in accordance with Specification Section 03 35 00 and as detailed on the Drawings.

END OF SECTION

Part 1 General

1.1 GENERAL CONDITIONS

.1 The General Conditions of the Contract, Supplementary General Conditions and General Requirements are hereby made part of this section.

1.2 WORK INCLUDED

.1 Finish separate floor toppings, slabs on fill and monolithic floor slabs.

.2 Apply concrete hardener, sealer.

.3 Cure finished surfaces.

1.3 RELATED WORK

.1 Cast-in-Place Concrete Section 03 30 00

Part 2 Products

2.1 COMPOUNDS/HARDENERS/SEALERS

.1 *Non-metallic Surface Sealer:* premixed natural mineral type; "Eurocure 700, by Elsro Ltd., "Flor Seal" by Sternson Ltd., "Master Seal" by Master Builders, "Sealtight CS-309" by W. R. Meadows or approved equal.

Part 3 Execution

3.1 FLOOR FINISHING

.1 All concrete slabs noted in Architect's Room Finish Schedule as receiving application of Penetrating Epoxy Sealer are to be final finished with a swirl trowel finish suitable for the application of penetrating type epoxy sealer. Slab is to be finished to a hard, smooth surface free from blemishes. Final finish to achieve a “flat” floor in accordance with CAN/CSA A23.1, Clause 7.5.6.1 to produce floor surface of pleasing appearance, easily cleaned and maintained with high wear-resistance qualities. Maintain surface flatness with maximum variation of 5 mm in 3 M and absolute maximum of ± 6 mm. Co-ordinate suitable curing method for slabs where penetrating type of sealer is used. Supplier's representative must be on site prior to application to advise on finishing procedures and application rate. Apply sealer at rate recommended for medium traffic in a minimum of two passes.

.2 Apply concrete Surface Sealer on floor surfaces noted in Architect's Room Finish Schedule as exposed concrete. Apply strictly in accordance with manufacturer's recommendations.

3.2 CURING AND PROTECTION

.1 All equipment needed for the curing and protection of the concrete shall be on hand and ready for use before actual placing is started.

.2 All exposed non-formed surfaces shall be kept continuously moist for a minimum of seven consecutive days after placement of the concrete. The water for curing shall be clean and free from any materials that will cause staining or discolouration of the concrete. A liquid, membrane forming, curing compound shall be used under circumstances where the application of moisture is impracticable and where such compounds will not jeopardize the appearance of the concrete nor the bonding of future floor finishes.

.3 Special curing techniques shall be employed when the concrete is subject to drying conditions such as high temperatures, low relative humidity and high winds. Concrete wall and column forms shall be kept continuously moist.

.4 Freshly placed concrete shall be protected from the effects of direct sunshine, drying winds, cold, excessive heat and running water by the use of adequate tarpaulins or other suitable material to cover completely or enclose all freshly finished surfaces until the end of the curing period specified.

END OF SECTION

Part 1 General

1.1 SUBMITTALS

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

.2 Product Data: Submit manufacturer's technical literature for each product indicated, specified, or required. Include manufacturer's technical data, application instructions, and recommendations.

.3 Maintenance Manuals:

.1 Conform to Section 01 78 00 - Closeout Submittals.

.2 Include instructions for maintenance of installed work, including methods and frequency recommended for maintaining optimum condition under anticipated use.

.3 Include precautions against cleaning products and methods which may be detrimental to finishes and performance.

1.2 DELIVERY, STORAGE, AND HANDLING

.1 Deliver, handle, store and protect materials in accordance with Section 01 61 00 - Common Product Requirements.

.2 Deliver and store materials in original wrappings and containers with manufacturer's seals and labels, intact. Protect from freezing, moisture, water and contact with ground or floor.

1.3 QUALITY ASSURANCE

.1 Experience: Company experienced in performing specified work similar in design, products, and extent to scope of this Project; with a record of successful in-service performance; and with sufficient production capability, facilities, and personnel to produce specified work.

.2 Supervision: Maintain competent supervisor who is at Project during times specified work is in progress.

.3 Manufacturer Qualification: Approved by manufacturer to apply liquid applied products.

.4 Pre-Installation of Concrete Conference: Prior to placing concrete for areas scheduled for polishing, conduct meeting. Meeting attendees to include Architect, Contractor, Concrete supplier, concrete finisher, concrete polisher and technical representative of liquid applied products.

.5 Coefficient of Friction: Achieve following coefficient of friction by field quality control testing in accordance to the following standards:

.1 ANSI B101.3 Dynamic Coefficient of Friction - Achieve a minimum of .35 for level floor surfaces.

.6 Field Mock-up: Before performing work of this Section, provide following field mock-up to verify selections made under submittals and to demonstrate aesthetic effects of

polishing. Approval does not constitute approval of deviations from Contract Documents, unless Architect specifically approves deviations in writing.

.1 Provide 5 square meter mock-up.

.2 Concrete shall be same mix design as scheduled for Project.

.3 Placement and finishing work shall be performed by same personnel as will finish concrete for Project.

.4 Mock-up shall be representative of work to be expected.

.5 Perform grinding, honing, and polishing work as scheduled for Project using same personnel as will perform work for Project.

.6 Approval is for following aesthetic qualities:

.1 Compliance with approved submittals.

.7 Compliance with specified aggregate exposure.

.8 Compliance with specified finished gloss level.

.9 Compliance with Specified colour.

.10 Approved field mock-ups mock-up may remain as part of finished work as a standard for judging completed work.

1.4 SITE CONDITIONS

.1 Damage and Stain Prevention: Prevent damage and staining of concrete surfaces to be polished.

.2 Prohibit use of markers, spray paint, and soapstone.

.3 Prohibit improper application of liquid membrane film forming curing compounds.

.4 Prohibit pipe-cutting operations over concrete surfaces.

.5 Prohibit storage of any items over concrete surfaces for not less than 28 days after concrete placement.

.6 Prohibit ferrous metals storage over concrete surfaces.

.7 Protect from petroleum, oil, hydraulic fluid, or other liquid dripping from equipment working over concrete surfaces.

.8 Protect from acids and acidic detergents contacting concrete surfaces.

.9 Protect from painting activities over concrete surfaces.

Part 2 PRODUCTS

2.1 LIQUID APPLIED PRODUCTS

.1 Liquid Densifier: An Aqueous solution of Silicon Dioxide dissolved in one of the following Hydroxides that penetrates into the concrete surface and reacts with the Calcium Hydroxide to provide a permanent chemical reaction that hardens and densifies the wear surface of the cementitious portion of the concrete. All of the following have the same chemistry varying only by the alkali used for solubility of the Silicon Dioxide.

.1 Sodium Silicate

.2 Potassium Silicate

.3 Lithium Silicate

.4 Alkalis solution of Colloidal Silicates or Silica

2.2 DYE

.1 Non-film forming soluble colorant dissolved in a carrier designed to penetrate and alter coloration and appearance of a concrete floor surface without a chemical reaction.

.2 Colours to be selected by Consultant from standard range.

2.3 SEALER

.1 Impregnating Stain Protection: Non film forming stain and food resistant penetrating sealer designed to be applied to densified and polished concrete which meets the requirements of OSHA for slip resistance as tested by ASTM D 2047 and stain resistance of ASTM D 1308.

2.4 ACCESSORIES

.1 Repair Material: The material must have sufficient bonding capabilities to adhere after the polishing to the concrete surface and provide abrasion resistance equal to or greater than the surrounding concrete substrate.

.2 Grout Material: A thin mortar used for filling spaces. Acceptable products shall be:

.1 Epoxy, urethane, poluyrea, or polyaspartic resins.

.2 Latex or acrylic binders mixed with cement dust from previous grinding steps.

.3 Silicate binders mixed with cement dust from previous grinding steps.

.3 Protective Cover: Non-woven, puncture and tear resistant, polypropylene fibers laminated with a multi-ply, textured membrane, not less than 18 mils in thickness.

2.5 POLISHING EQUIPMENT

.1 Multiple head, counter rotating, walk behind or ride on machine, of various size and weights, with diamond tooling affixed to the head for the purpose of grinding concrete.

.2 If dry grinding, honing, or polishing, use dust extraction equipment with flow rate suitable for dust generated, with squeegee attachments.

.3 If wet grinding, honing, or polishing, use slurry extraction equipment suitable for slurry removal and containment prior to proper disposal.

.4 Edge Grinding and Polishing Equipment: Hand-held or walk-behind machines which produces same results, without noticeable differences, as field grinding and polishing equipment.

.5 Burnishing Equipment: High speed walk-behind or ride-on machines capable of generating 1000 to 2000 revolutions per minute and with sufficient head pressure of not less than 20 pounds to raise floor temperature by 20 degrees F.

.6 Diamond Tooling: Abrasive tools that contain industrial grade diamonds within a bonded matrix (such as metallic, resinous, ceramic, etc) that are attached to rotating heads to refine the concrete substrate. Select tool and abrasives are required to achieve specified appearance and gloss level and as recommend by manufacturer.

.1 Bonded Abrasive: Abrasive medium held within a bonding that erodes away to expose new abrasive medium as it is used.

.2 Metal Bond Tooling: Diamond tooling containing industrial grade diamonds with a metallic bonded matrix attached to rotating heads to refine the concrete substrate.

.3 Resin Bond Tooling: Diamond tooling containing industrial grade diamonds within a resinous bonded matrix (poly-phenolic, ester-phenolic, thermoplastic-phenolic) attached to rotating heads to refine the concrete substrate.

.4 Hybrid Tooling: Diamond tooling combines metal bond and resin bond having the characteristics of both types of tooling. These types of tools are used as either transitional tooling from metal bond tools to resin bond tools or as a first cut tool on smooth concrete surfaces.

.5 Transitional Tooling: Diamond tooling is used to refine the scratch pattern of metal bond tooling prior to the application of resin bond tooling in an effort to extend the life of resin bond tooling and to create a better foundation for the polishing process.

.6 Abrasive Pad: An abrasive pad, resembling a typical floor maintenance burnishing pad, has the capability of refining the concrete surface on a microscopic level that may or may not contain industrial grade diamonds. These pads are typically used for the maintenance and/or restoration of previously installed polished concrete flooring.

Part 3 Execution

3.1 EXAMINATION

.1 Examine substrates to be polished for compliance with requirements and other conditions affecting performance.

.2 Concrete curing methods according to applicable Division 03 Section on cast-in-place concrete.

.3 Proceed only when unsatisfactory conditions have been corrected in a manner complying with Contract Documents.

.4 Starting work within a particular area will be construed as acceptance of surface conditions.

3.2 PREPARATION

.1 Prepare and clean concrete surfaces.

.2 Provide sound concrete surfaces free of laitance, glaze, efflorescence, curing compounds, form-release agents, dust, dirt, grease, oil, paint splatter, and other contaminants incompatible with liquid applied products and polishing.

3.3 TESTING

.1 Alkalinity:

.1 Test Method: Measure pH according to method indicated in ASTM F 710.

.2 Acceptable Results: pH between 8 and 10.

.2 Moisture Vapor Transmission Rate:

.1 Test Method: Perform anhydrous calcium chloride test according to ASTM F 1869.

.2 Acceptable Results: Not more than 5 pounds per 1000 square feet in 24 hours.

.3 Relative Humidity:

.1 Test Method: Perform relative humidity test using in situ probes according to ASTM F 2170.

.2 Acceptable Results: Not more than 75 percent

3.4 COLOURING CONCRETE FLOORS

.1 Apply solution by methods and techniques required by manufacturer to produce finish matching approved field mock-ups.

.2 Maintain wet edge, working newly applied solution into edges of adjacent wet edges of previously treated surfaces.

.3 Maintain consistent saturation throughout application.

.4 Avoid splashing, dripping, or puddling of solution on adjacent substrates.

.5 When color matches approved mock-ups, neutralize as required by manufacturer.

3.5 GRINDING AND POLISHING

.1 Perform all polishing procedures to ensure a consistent appearance from wall to wall.

.2 Initial Grinding:

.1 Use grinding equipment with metal or semi-metal bonded tooling.

.2 Begin grinding in one direction using sufficient size equipment and diamond tooling to meet specified aggregate exposure class.

.3 Make sequential passes with each pass perpendicular to previous pass using finer grit tool with each pass, up to 100 grit metal bonded tooling.

.4 Achieve maximum refinement with each pass before proceeding to finer grit tools.

.5 Clean floor thoroughly after each pass using dust extraction equipment properly fitted with squeegee attachment or walk behind auto scrubber suitable to remove all visible loose debris and dust.

.6 Continue grinding until aggregate exposure matches approved field mock-ups

.3 Treating Surface Imperfections:

.1 Mix patching compound or grout material with dust created by grinding operations, manufacturer's tint, or sand to match color of adjacent concrete surfaces.

.2 Fill surface imperfections including, but not limited to, holes, surface damage, small and micro cracks, air holes, pop-outs, and voids with grout to eliminate micro pitting in finished work.

.3 Work compound and treatment until color differences between concrete surface and filled surface imperfections are not reasonably noticeable when viewed from 10 feet away under lighting conditions that will be present after construction.

.4 Liquid Densifier Application

.1 Apply undiluted to point of rejection, remove excess liquid, and allow curing according to manufacturers instructions.

.5 Grout Grinding:

.1 Use grinding equipment and appropriate grit and bond diamond tooling.

.2 Apply grout, forced into the pore structure of the concrete substrate, to fill surface imperfections.

.3 Clean floor thoroughly after each pass using dust extraction equipment properly fitted with squeegee attachment or walk behind auto scrubber suitable to remove all visible loose debris and dust.

.6 Honing:

.1 Use grinding equipment with hybrid or resin bonded tooling.

.2 Hone concrete in one direction starting with a 100 grit tooling and make as many sequential passes as required to remove scratches, each pass perpendicular to previous pass, up to 400 grit tooling reaching maximum refinement with each pass before proceeding to finer grit tooling.

.3 Clean floor thoroughly after each pass using dust extraction equipment properly fitted with squeegee attachment or walk behind auto scrubber suitable to remove all visible loose debris and dust.

.7 Polishing:

.1 Use polishing equipment with resin-bonded tooling.

.2 Begin polishing in one direction starting with 800 grit tooling.

.3 Make sequential passes with each pass perpendicular to previous pass using finer grit tooling with each pass until the specified level of gloss has been achieved.

.4 Achieve maximum refinement with each pass before proceeding to finer grit pads.

.5 Clean floor thoroughly after each pass using dust extraction equipment properly fitted with squeegee attachment or walk behind auto scrubber suitable to remove all visible loose debris and dust.

.6 Stain Protection: Uniformly apply and remove excessive liquid according to manufacturer's instructions. Final film thickness should be less than .05 mils after cure.

.7 Final Polish: Using burnishing equipment and finest grit abrasive pads, burnish to uniform reflective sheen matching approved field mock-up.

.8 Final Polished Concrete Floor Finish

.1 Aggregate Exposure Class C – Medium Aggregate Finish: Remove not more than 1/8 inch of concrete surface by grinding and polishing resulting in majority of exposure displaying medium aggregate with no, or small amount of, large aggregate at random locations.

.9 Finished Gloss Level

.1 Finished Gloss Level 3 – High Gloss Appearance:

.1 Procedure: Not less than 4 steps with full refinement of each diamond tool with one application of densifier.

.2 Gloss Measurement: Determine the specular gloss by incorporating the following:

.3 Reflective Clarity Reading: Not less than 65 according to ASTM D5767 prior to the application of sealers.

.4 Reflective Sheen Reading: Not less than 35 according to ASTM D523 prior to the application of sealers.

3.1 CLEANING

.1 Perform cleaning as soon as possible after installation to remove construction and accumulated environmental dirt.

.2 Protect finished floor surface.

END OF SECTION

Part 1 General

1.1 REFERENCES

.1 Canadian Standards Association (CSA International)

.1 CAN/CSA A165 SERIES-04(R2009), CSA Standards on Concrete Masonry Units (Consists of A165.1, A165.2, A165.3).

.2 CAN/CSA A179-04(R2009), Mortar and Grout for Unit Masonry.

.3 CAN/CSA-A370-04(R2009), Connectors for Masonry.

.4 CAN/CSA-A371-04(R2009), Masonry Construction for Buildings.

.5 CSA G30.18-09, Carbon Steel Bars for Concrete Reinforcement.

.6 CSA-S304.1-04(R2010), Design of Masonry Buildings.

1.2 SUBMITTALS

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

.1 Submit duplicate full size samples of each type masonry units.

.2 Product Data:

.1 Submit manufacturer's printed product literature, specifications and data sheet in accordance with Sections 01 33 00 - Submittal Procedures.

.2 Submit WHMIS MSDS - Material Safety Data Sheets in accordance with Section 01 33 00 - Submittal Procedures.

.1 Indicate VOC's for epoxy coatings and galvanized protective coatings and touch-up products.

.2 Indicate VOC's for mortar, grout, parging, colour additives and admixtures.

.3 Shop Drawings :

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

.2 Shop drawings consist of bar bending details, lists and placing drawings.

.3 On placing drawings, indicate sizes, spacing, location and quantities of reinforcement and connectors.

1.3 STORAGE AND HANDLING

.1 Protect on site stored or installed material from moisture damage in accordance with manufacturer's printed instructions.

Part 2 Products

2.1 MASONRY UNITS

.1 Standard concrete block units: to CAN3-A165 Series (CAN3-A165.1).

.1 Classification: H/15/C/M.

.2 Size: modular. Refer to drawings for sizes.

.3 Special shapes: provide square units for exposed corners. Provide purpose-made shapes for lintels and bond beams. Provide additional special shapes as indicated.

2.2 REINFORCEMENT AND CONNECTORS

.1 Bar reinforcement: to CSA-A371 and CAN/CSA G30.18, Grade 400.

.2 Wire reinforcement: to CSA-A371, truss type.

.3 Connectors shall be corrosion resistant: to CSA-A370 and CSA-S304.

2.3 MORTAR AND GROUT

.1 Mortar: to CSA A179.

.1 Use aggregate passing 1.18 mm sieve where 6 mm thick joints are indicated.

.2 Mortar Type: N based on property specifications,

.3 Following applies regardless of mortar types and uses specified above:

.1 Mortar for grouted reinforced masonry: type S based on property specifications.

.4 Grout: to CSA A179, Table 3.

2.4 ACCESSORIES

.1 Nailing Inserts: 0.5 mm minimum thickness, galvanized.

.2 Bolts: 12 mm diameter x 150 mm long with ends bent 50 mm at 90 degrees.

.3 Lateral restraint angles: 150mm long 75x75x6mm angles each side of wall at top of wall for lateral restraint. Install 1800mm apart maximum spacing. Bolt into underside of floor or roof deck. Use appropriate fasteners for material to be anchored to. Do not fasten to block.

Part 3 Execution

3.1 INSTALLATION

.1 Do masonry work in accordance with CSA-A371 except where specified otherwise.

.1 Bond: running stretcher bond with vertical joints in perpendicular alignment and centred on adjacent stretchers above and below.

.2 Coursing height: 200 mm for one block and one joint.

.3 Jointing: tool where exposed or where paint or other finish coating is specified to provide smooth compressed concave surface.

.2 Build masonry plumb, level, and true to line, with vertical joints in alignment.

.3 Layout coursing and bond to achieve correct coursing heights, and continuity of bond above and below openings, with minimum of cutting.

.4 Install lateral restraint angles at top of walls as indicated.

3.2 CONSTRUCTION

.1 Exposed masonry:

.1 Remove chipped, cracked, and otherwise damaged units, in exposed masonry and replace with undamaged units.

.2 Cut out for electrical switches, outlet boxes, and other recessed or built-in objects. Make cuts straight, clean, and free from uneven edges.

.2 Building-In:

.1 Install masonry connectors and reinforcement where indicated on drawings.

.2 Build in items required to be built into masonry.

.3 Prevent displacement of built-in items during construction. Check plumb, location and alignment frequently, as work progresses.

.4 Brace door jambs to maintain plumb. Fill spaces between jambs and masonry with mortar.

.5 Install loose steel lintels over openings where indicated.

.3 Concrete block lintels:

.1 Install reinforced concrete block lintels over openings in masonry where steel or reinforced concrete lintels are not indicated.

.2 End bearing: not less than 200 mm.

.4 Support of loads:

.1 Use noted MPa concrete to Section 03 30 00 - Cast-in-Place Concrete, where concrete fill is used in lieu of solid units.

.2 Use grout to CSA A179 where grout is used in lieu of solid units.

.5 Provision for movement:

.1 Leave 3 mm space below shelf angles.

.2 Leave 6 mm space between top of non-load bearing walls and partitions and structural elements. Do not use wedges.

.3 Built masonry to tie in with stabilizers, with provision for vertical movement.

.6 Interface with other work:

.1 Cut openings in existing work as indicated.

.2 Openings in walls: approved by Departmental Representative.

.3 Make good existing work. Use materials to match existing.

3.3 REINFORCING AND CONNECTING

.1 Install masonry connectors and reinforcement in accordance with CSA-A370, CSA-A371 and CSA-S304.1 unless indicated otherwise.

.2 Prior to placing concrete, mortar, and grout, obtain Engineer's approval of placement of reinforcement and connectors.

3.4 BONDING AND TYING

.1 Bond walls of two or more wythes using metal connectors in accordance with CSA-S304, CSA-A371 and as indicated.

.2 Tie masonry veneer to backing in accordance with NBC, CSA-S304.1, CSA-A371 and as indicated.

3.5 REINFORCED LINTELS AND BOND BEAMS

.1 Reinforce masonry lintels and bond beams as indicated.

.2 Place and grout reinforcement in accordance with CSA-S304.1, CSA-A371, and CSA-A179.

3.6 GROUTING

.1 Grout masonry in accordance with CSA-S304.1, CSA-A371 and CSA-A179 and as indicated.

3.7 ANCHORS

.1 Supply and install metal anchors as indicated.

3.8 LATERAL SUPPORT AND ANCHORAGE

.1 Supply and install lateral support and anchorage in accordance with CSA-S304.1 and as indicated.

3.9 SITE TOLERANCES

.1 Tolerances in notes to Clause 5.3 of CSA-A371 apply.

3.10 FIELD QUALITY CONTROL

.1 Inspection and testing will be carried out by Testing Laboratory designated by Engineer.

3.11 CLEANING

.1 Perform cleaning after installation to remove construction and accumulated environmental dirt.

.2 Upon completion of installation, remove surplus materials, rubbish, tools and equipment barriers.

3.12 PROTECTION

.1 Protect masonry and other work from marking and other damage. Protect completed work from mortar droppings. Use non-staining coverings.

END OF SECTION

Part 1 General

1.1 GENERAL CONDITIONS

.1 The General Conditions of the Contract, Supplementary General Conditions and General Requirements are hereby made part of this Section.

1.2 WORK INCLUDED

.1 Structural steel framing members, structural steel support members, struts, complete with required bracing, welds, washers, nuts, shims, anchor plates and bolts.

.2 Baseplates, connectors and bearing plates.

.3 Field and shop welded composite beam studs shall be supplied and installed under this section.

.4 Erection.

1.3 RELATED WORK

.1	Cast-in-Place Concrete	Section 03 30 00
.2	Painting and Finishing	Section 09 90 00

1.4 QUALITY ASSURANCE

.1 Structural steel fabricator to be certified as minimum Division 2 Company under CSA W47.1-09 - "Certification of Companies for Fusion Welding of Steel Structures" or CSA Standard W55.3-08 "Resistance Welding Qualification Code for Fabricators of Structural Members" or both, as applicable.

.2 Design to strictly adhere to all codes and standards as enumerated under Section 1.5 Reference Standards.

.3 In the event of conflict between pertinent codes, standards and/or regulations, most stringent shall govern.

1.5 REFERENCE STANDARDS

.1 CSA Standard CAN/CSA-S16-01 - "Limit States Design of Structural Steel Buildings".

.2 CSA G40.21-04 (R2009) - "Structural Quality Steel".

.3 ASTM Standard A325M - "High Strength Bolts for Structural Steel Joints including Suitable Nuts and Plane Hardened Washers".

.4 CSA Standard W59-03 (R2008) - 'Welded Steel Construction".

.5 CSA Standard W47.1-09 - "Certification of Companies for Fusion Welding of Steel Structures".

.6 ASTM Standard A53 - "Welded and Seamless Steel Pipe".

1.6 SHOP DRAWINGS

.1 Submit shop drawings in accordance with General Conditions.

.2 Clearly indicate sizes, spacing and locations of structural members, connections, attachments, anchorages, framed openings and size and type of fasteners and welds.

.3 Indicate all shop and erection details including cuts, copes, connections, holes, threaded fasteners and welds.

.4 Show all welds, both shop and field, by the currently recommended symbols of the Canadian Welding Bureau.

.5 Provide drawings stamped and signed by a Professional Engineer registered in the Province of Saskatchewan.

.6 Review of shop drawings for size and arrangement of principal and auxiliary members only. Such review will not relieve the Contractor of responsibility for general and detail dimension and fit, or any errors or omissions.

1.7 INSPECTION AND TESTING

.1 Materials and workmanship subject to inspection on behalf of Owner.

.2 Report failure of material to fit together properly to Consultant. No corrective measures permitted unless approved by Consultant in writing.

Part 2 Products

2.1 MATERIALS/COMPONENTS

.1 *Standard Rolled Sections:* new material conforming to CSA G40.21-04 (R2009), Grade 350W.

.2 *Hollow Structural Sections:* new material conforming to CSA G40.21-04 (R2009), Grade 350W, Class C.

.3 *Base and Cap Plates:* new material conforming to CSA G40.21-04 (R2009), Grade 300W.

.4 *Beam End Plates, Ledger Angles and Miscellaneous Steel:* new material conforming to CSA G40.21-04 (R2009), Grade 300W.

.5 *Anchor Bolts:* new material conforming to CSA G40.21-04 (R2009), Grade 260W.

.6 *Bolts, Nuts and Washers:* high strength type recommended for structural steel joints, conforming to requirements of ASTM A325M-83c.

.7 *Paint for Primer:* shall be grey (unless approved otherwise) and meet requirements of one of the following:

.1 CGSB 1-GP-40d, Primer, Structural Steel, oil alkyd type.
.2 CISC/CPMA Standard 1-73a, quick drying one-coat paint for use on structural steel.

2.2 FABRICATION

.1 Fabricate structural steel members in accordance with building design drawings and all requirements of CAN/CSA S16-01. Welding to conform to CSA W59-03 (R2008) "Welded Steel Construction". Verify all dimensions prior to fabrication.

.2 No cutting of openings in structural members except as shown on structural drawings. Reinforce openings to maintain required design strength.

.3 Accurately cut and mill column ends to assure full contact of bearing surfaces.

.4 Camber horizontal members as specified on drawings. Mill camber up where not specifically detailed.

.5 All bolted connections to be "bearing" type connections except where subject to stress reversal which are to be "slip resistant" type connections.

.6 All connections showing combined axial load (tension or compression) across the joint to be designed for loads shown. Such connection to be bolted through columns only.

.7 All beams to be connected for the greater of the following conditions.

.1 Loads shown on drawings.
.2 50% of the total uniformly distributed load resistance of the member.
.3 Half depth of the connected member using M20 bolts (minimum two bolts) in double shear.

.8 Shop installed shear studs to be installed in strict conformance with requirements of CSA Standard W59. Refer to Part 3 Execution for additional requirements.

.9 All exposed steel and all related bridging and bracing shall be fabricated with clean, neat fitting welded connections.

2.3 PAINTING

.1 All steel in contact with concrete and all faying surfaces of high strength bolted slip-resistant connections shall <u>not</u> be primed.

.2 Top flange of steel beams that have shop or field installed shear studs shall <u>not</u> be painted.

.3 Structural steel to be cleaned to SSPC-3, primed and ready for painting.

.4 Hot dipped galvanizing zinc coating. 600 grams/m^2 to CAN/CSA G164.M92.

Part 3 Execution

3.1 ERECTION

.1 Erect structural steel in accordance with building design drawings and all requirements on CAN/CSA S16-01.

.2 Make adequate provision for all erection loads and for sufficient temporary bracing to maintain structure safe, plumb and in true alignment until completion of erection. Leave such bracing in place as long as required for safety and integrity of the structure.

.3 As erection progresses, securely bolt work to take care of full design loads and to provide structural integrity as required.

.4 Use high tensile bolts for field connections unless otherwise noted on building design drawings.

.5 Set all baseplates which are shop welded to columns to proper elevation on steel shims. Maximum tolerance from stated elevations to be ± 2mm.

.6 Tolerances

.1 Tolerance of all other structural steel shall be maintained strictly in accordance with CAN/CSA S16-01.

.7 After erection, prime all welds, abrasions, bolted connections and all other surfaces not shop primed, except surfaces to be in contact with concrete.

.8 Obtain written permission of Consultant prior to altering or field welding of structural members.

END OF SECTION

Part 1 General

1.1 GENERAL CONDITIONS

.1 The General Conditions of the Contract, Supplementary General Conditions and General Requirements are hereby made part of this Section.

1.2 WORK INCLUDED

.1 Steel roof and floor deck, complete with cover plates, cell closures and flashings.

.2 All closure angles, channels, plates, as well as supplementary deck support or anchorage where required to provide continuous deck membrane.

.3 Contractor to study Contract Drawings and Specifications with regard to the work shown and required under this Section to ensure its completeness. Supplementary items necessary to complete the work although not specifically shown or specified shall be supplied and installed.

.4 Steel roof deck designed as a structural diaphragm. Contractor to ensure all side lap fastening and welding is as per the Drawings and Specifications.

.5 Field and shop welded composite beam studs are to be supplied and installed by the structural steel subcontractor.

1.3 RELATED WORK

.1	Cast-in-Place Concrete	Section 03 30 00
.2	Structural Steel for Buildings	Section 05 12 23
.3	Steel Joist Framing	Section 05 21 00
.4	Metal Fabrications	Section 05 50 00
.5	Painting and Finishing	Section 09 90 00

1.4 REFERENCE STANDARDS

.1 Canadian Sheet Steel Building Institute (CSSBI) - "Standard Steel Roof Deck" and "Steel Roof Deck".

.2 CAN/CSA S136-07 - "Cold Formed Steel Structural Members".

.3 ASTM A446 - "Steel Sheet, Zinc Coated (Galvanized) by the Hot Dip Process, Physical (Structural Quality)".

.4 Welding to CSA W59-03 (R2008) except where specified elsewhere.

1.5 SHOP DRAWINGS

.1 Submit shop drawings in accordance with General Conditions.

.2 Clearly indicate decking plan, deck profile, dimensions, anchorage, supports, projects, openings and reinforcement, applicable details and accessories.

.3 Clearly indicate position of temporary shoring of decking if required by design criteria.

.4 Review of shop drawings will not relieve Contractor of responsibility for general and detail dimensions and fit, or any errors or omissions.

.5 Prepare shop drawings under the direction of a professional engineer registered in the Province of Saskatchewan, Canada.

.6 Submit shop drawings stamped and signed by qualified professional engineer registered in Province of Saskatchewan, Canada.

Part 2 Products

2.1 MATERIALS/COMPONENTS

.1 *Sheet Steel:* Grade A or Grade B structural quality, conforming to ASTM A446.

2.2 DECKING/RELATED ACCESSORIES

.1 *Roof Decking:* RD938 Roof Deck - 38 mm deep by 914 mm wide sheets by 0.76 mm core thickness, as manufactured by VicWest or approved equivalent. Galvanized to Z275 (G90) standard or ZF075 (A25) wiped coat.

.2 *Floor Decking:* HB938 Hi-Bond Steel Floor Deck - 38 mm deep by 914 mm wide sheets by 0.76 mm core thickness as manufactured by VicWest or approved equivalent. Galvanized to ZF075 (Wipe Coat) Standard.

.3 Any substitution of specified material to be approved in writing by the Consultant.

.4 *Closure Strips, Flashings, Cover Plates and Related Accessories:* minimum 1.6 mm (16 gauge) sheet steel.

.5 *Primer:* Zinc rich, ready mix to CGSB-1-GP-181M.

.6 *Closures to external walls:* neoprene as recommended by manufacturer.

2.3 FABRICATION

.1 Fabricate metal decking in accordance with Drawings and as recommended by the Canadian Sheet Steel Building Institute (CSSBI) Standards. Fabricate to accommodate maximum deflections of 1/360 span.

.2 Supply steel fillers between decking and supporting members where required.

.3 Deck units to be 3 span continuous where possible; under no circumstances should deck be less than 2 span continuous except where detailed.

Part 3 Execution

3.1 INSTALLATION

.1 Erect metal decking in accordance with drawings and as recommended by the CSSBI. Properly align and level on structural supports.

.2 Allow minimum 40 mm bearing when supported by structural steel and minimum 100 mm bearing when supported by masonry or concrete.

.3 Mechanical fasten male/female side laps at maximum 300 mm.

.4 Fasten deck to ALL supporting steel with 20 mm fusion welds at maximum 300 mm on centre. Secure "V" rib pans to structure with plug welds through 19 mm diameter steel washers at 300 mm on centre.

.5 Reinforce openings 150 mm to 450 mm in size with L51 x 51 x 4.8 steel angles or as indicated on the Drawings. Place angles perpendicular to flutes, extended minimum two flutes each side of openings and weld to deck.

.6 Reinforce openings over 450 mm in accordance with details indicated on Drawings.

.7 Install minimum 150 mm cover plates where deck changes direction. Spot weld in place at maximum 300 mm on centre.

.8 Install strip closures at slab edges to match thickness of slab, as required to contain poured concrete. Ensure closures are of sufficient strength to remain in place without distortion.

.9 Install acoustical closures in locations above walls and partitions in areas where partitions butt to decking.

.10 Immediately after installation, touch up welds, burned areas and damaged spots with prime paint. Use type of primer recommended for galvanized surfaces.

END OF SECTION

Part 1 General

1.1 REFERENCES

.1 American Society for Testing and Materials International, (ASTM)

- .1 ASTM A53/A53M-12, Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated Welded and Steamless.
- .2 ASTM A276-13a, Standard Specification for Stainless Steel Bars and Shapes.
- .3 ASTM A307-12, Standard Specification for Carbon Steel Bolts and Studs, 60,000 PSI Tensile Strength.

.2 Canadian General Standards Board (CGSB)

- .1 CAN/CGSB-1.40-97, Anti-corrosive Structural Steel Alkyd Primer.
- .2 CAN/CGSB-1.181-99, Ready-Mixed, Organic Zinc-Rich Coating.

.3 Canadian Standards Association (CSA International)

- .1 CSA-G40.20/G40.21-13, General Requirements for Rolled or Welded Structural Quality Steel.
- .2 CAN/CSA-G164-M92(R2003), Hot Dip Galvanizing of Irregularly Shaped Articles.
- .3 CAN/CSA-S16.1-01, Limit States Design of Steel Structures.
- .4 CSA W48-06(R2011), 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).

1.2 SUBMITTALS

.1 Product Data:

- .1 Submit manufacturer's printed product literature, specifications and data sheet in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Submit two copies of WHMIS MSDS - Material Safety Data Sheets in accordance with Section 01 33 00 - Submittal Procedures. Indicate VOC's:
  - .1 For finishes, coatings, primers and paints.

.2 Shop Drawings

- .1 Submit shop drawings in accordance with Section 01 33 00 - Submittal Procedures.
- .2 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: Certified test reports showing compliance with specified performance characteristics and physical properties.

.2 Certificates: Product certificates signed by manufacturer certifying materials comply with specified performance characteristics and criteria and physical requirements.

.3 Pre-installation Meetings: Conduct pre-installation meeting to verify project requirements, manufacturer's installation instructions and manufacturer's warranty requirements.

1.4 DELIVERY, STORAGE, AND HANDLING

.1 Packing, Shipping, Handling and Unloading:

.1 Deliver, store, handle and protect materials in accordance with Section 01 61 00 - Common Product Requirements.

.2 Storage and Protection:

.1 Cover exposed stainless steel surfaces with pressure sensitive heavy protection paper or apply strippable plastic coating, before shipping to job site.

.2 Leave protective covering in place until final cleaning of building. Provide instructions for removal of protective covering.

1.5 WASTE MANAGEMENT AND DISPOSAL

.1 Separate and recycle waste materials in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.

.2 Remove from site and dispose of packaging materials at appropriate recycling facilities.

.3 Divert unused metal materials from landfill to metal recycling facility approved by Departmental Representative.

Part 2 Products

2.1 MATERIALS

.1 Steel sections and plates: to CAN/CSA-G40.20/G40.21, Grade 300W or 350W.

.2 Steel pipe: to ASTM A53/A53M extra strong, galvanized finish where indicated.

.3 Welding materials: to CSA W59.

.4 Welding electrodes: to CSA W48 Series.

.5 Bolts and anchor bolts: to ASTM A307.

.6 Stainless steel: to ASTM A276, Type 302 commercial grade.

.7 Welded wire mesh: 5mm diameter, 50mm x 50mm square opening, (prime and paint).

.8 Expanded Mesh: To EMMA 557-99. Style 19mm-9F. 19mm #9/10 roll-flattened steel mesh. Nominal strand thickness of 3mm. Diamond opening of 14mm x 43mm.

.9 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 flat headed screws on items requiring assembly by screws or as indicated.

.3 Where possible, fit and shop assemble work, ready for erection.

.4 Ensure exposed welds are continuous for length of each joint. File or grind exposed welds smooth and flush.

2.3 FINISHES

.1 Shop coat primer: to CAN/CGSB-1.40.

.2 Galvanizing: hot dipped galvanizing with zinc coating 600 g/m^2 to CAN/CSA-G164.

.3 Zinc primer: zinc rich, ready mix to CAN/CGSB-1.181.

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 Apply one shop coat of primer to metal items, with exception of galvanized or concrete encased items.

.2 Use primer unadulterated, as prepared by manufacturer. Paint on dry surfaces, free from rust, scale, grease. Do not paint when temperature is lower than 7 degrees C.

.3 Clean surfaces to be field welded; do not paint.

2.6 ANGLES AND ANGLE LINTELS

.1 Steel angles: prime painted, and galvanized. Sizes indicated.

.2 Weld or bolt back-to-back angles to profiles as indicated.

2.7 SECURITY BARS

.1 Security bars: 9mm diameter steel bars. Hot dipped galvanized.

.2 Cut length to suit installation.

2.8 PIPE RAILINGS

.1 Steel pipe: 38 mm nominal outside diameter, formed to shapes and sizes as indicated.

2.9 CORNER GUARDS

.1 Stainless steel angle: 89 x 89 x 2 mm thick x 1220 mm high (or height to suit below window), with 6 anchors each guard.

.2 Satin finish for all applications.

2.10 CHECKER PLATE FLOORING – WALK-IN FREEZER

.1 Stainless steel 6mm thick plate cut to suit installation in Freezer. Polish cut edges to avoid sharp edges prior to installation.

Part 3 Execution

3.1 ERECTION

.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 Provide components for building by other sections in accordance with shop drawings and schedule.

.6 Make field connections with bolts to CAN/CSA-S16.1, or weld.

.7 Hand items over for casting into concrete or building into masonry to appropriate trades together with setting templates.

.8 Touch-up rivets, field welds, bolts and burnt or scratched surfaces after completion of erection with primer.

.9 Touch-up galvanized surfaces with zinc rich primer and zinc finish coating where burned by field welding.

3.2 PIPE RAILINGS

.1 Install pipe railings where noted on drawings.

.2 Modify existing pipe railings on existing relocated stair in Room 156.

.3 Grind smooth all welds.

.4 Prime unpainted areas. Prepare previously painted railings for re-coating.

3.3 SECURITY BARS

.1 Install security bars into steel angle frames as shown on drawings.

.2 Weld security bars to steel angle frames.

.3 Coordinate with mechanical for duct penetrations. Seal all duct penetrations.

.4 Install welded angle frame using 6mm hex steel through bolt. Weld bolt head in 3 spots on attack side.

.5 Touch up all welded areas using zinc-rich coating.

3.4 CHECKER PLATE

.1 Install checker plate flooring in Freezer.

.2 Use flush stainless steel fasteners countersunk in face of checker plate to securely fasten checker plate floor.

.3 Ensure all joints between stainless steel panels are flush within 0.5mm tolerance.

.4 Cut around mobile file support rails.

.5 Bevel front edge at ramp up into room so that leading edge of ramp is flush to main floor with minimal gap.

3.5 EXPANDED MESH

.1 Refer to Section 09 22 16 Non-Structural Metal Framing for installation of expanded mesh.

3.6 CLEANING

.1 Perform cleaning after installation to remove construction and accumulated environmental dirt.

.2 Upon completion of installation, remove surplus materials, rubbish, tools and equipment barriers.

END OF SECTION

Part 1 General

1.1 REFERENCES

.1 American Society for Testing and Materials International (ASTM)

.1 ASTM C36/C36M-03e1, Standard Specification for Gypsum Wallboard.

.2 Canadian General Standards Board (CGSB)

.1 CAN/CGSB-51.32-M77, Sheathing, Membrane, Breather Type.

.2 CAN/CGSB-51.34-M86, Vapour Barrier, Polyethylene Sheet for Use in Building Construction.

.3 CAN/CGSB-71.26-M88, Adhesive for Field-Gluing Plywood to Lumber Framing for Floor Systems.

.3 Canadian Standards Association (CSA International)

.1 CSA B111-1974(R2003), Wire Nails, Spikes and Staples.

.2 CAN/CSA-G164-M92(R2003), Hot Dip Galvanizing of Irregularly Shaped Articles.

.3 CSA O112 Series-M1977(R2006), CSA Standards for Wood Adhesives.

.4 CSA O141-05(R2009), Softwood Lumber.

.5 CSA O151-09, Canadian Softwood Plywood.

.6 CAN/CSA-O325.0-92(R2003), Construction Sheathing.

.4 National Lumber Grades Authority (NLGA)

.1 Standard Grading Rules for Canadian Lumber 2010.

1.2 SUBMITTALS

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

1.3 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.

1.4 DELIVERY, STORAGE, AND HANDLING

.1 Waste Management and Disposal:

.1 Separate waste materials for reuse and recycling in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.

Part 2 Products

2.1 FRAMING AND STRUCTURAL MATERIALS

.1 Lumber: unless specified otherwise, 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 Structural Composite Lumber (SCL) in accordance with ASTM D5456.

.3 Framing and board lumber: in accordance with NBC.

.4 Furring, blocking, nailing strips, grounds, rough bucks:

- .1 Board sizes: "Standard" or better grade.
- .2 Dimension sizes: "Standard" light framing or better grade.
- .3 Post and timbers sizes: "Standard" or better grade.

.5 Use pressure (preservative) treated lumber material for wood nailers at roof.

2.2 PANEL MATERIALS

.1 Plywood, OSB and wood based composite panels: to CAN/CSA-O325.0.

.2 Canadian softwood plywood (CSP): to CSA O151, standard construction.

.3 Gypsum sheathing: to ASTM C36/C36M.

2.3 ACCESSORIES

.1 Polyethylene film: to CAN/CGSB-51.34, Type 1, 0.15 mm thick.

.2 Air seal: closed cell polyurethane or polyethylene.

.3 Sealants: in accordance with Section 07 92 10 - Joint Sealing.

- .1 Maximum allowable VOC limit 250 g/L.

.4 Subflooring adhesive: to CGSB-71.26, cartridge loaded.

- .1 Maximum allowable VOC limit 30 g/L.

.5 General purpose adhesive: to CSA O112 Series.

- .1 Maximum allowable VOC limit 140 g/L.

.6 Nails, spikes and staples: to CSA B111.

.7 Bolts: 12.5 mm diameter unless indicated otherwise, complete with nuts and washers.

.8 Proprietary fasteners: toggle bolts, expansion shields and lag bolts, screws and lead or inorganic fibre plugs, recommended for purpose by manufacturer.

2.4 FASTENER FINISHES

.1 Galvanizing: to CAN/CSA-G164, use galvanized fasteners for exterior work, interior highly humid areas, pressure-preservative, fire-retardant, and treated lumber.

Part 3 Execution

3.1 PREPARATION

.1 Store wood products in a dry location, off the ground.

3.2 INSTALLATION

.1 Comply with requirements of NBC 2005 Part 9 supplemented by following paragraphs.

.2 Install members true to line, levels and elevations, square and plumb.

.3 Construct continuous members from pieces of longest practical length.

.4 Install spanning members with "crown-edge" up.

.5 Select exposed framing for appearance. Install lumber and panel materials so that grade-marks and other defacing marks are concealed or are removed by sanding where materials are left exposed.

.6 Install wall sheathing in accordance with manufacturer's printed instructions.

.7 Install furring and blocking as required to space-out and support casework, cabinets, wall and ceiling finishes, facings, electrical equipment mounting boards, and other work as required.

.8 Install rough bucks, nailers and linings to rough openings as required to provide backing for frames and other work.

.9 Use dust collectors and high quality respirator masks when cutting or sanding wood panels.

3.3 ERECTION

.1 Frame, anchor, fasten, tie and brace members to provide necessary strength and rigidity.

.2 Countersink bolts where necessary to provide clearance for other work.

.3 Use nailing disks for soft sheathing as recommended by sheathing manufacturer.

3.4 SCHEDULES

.1 Refer to drawings for various items requiring furring, blocking, nailing strips, grounds and rough bucks.

.2 Provide backing in walls for all millwork, shelving and wall mounted items requiring solid blocking. Blocking to be 400mm high in walls where required.

END OF SECTION

Part 1 General

1.1 REFERENCES

.1 American National Standards Institute (ANSI)

.1 ANSI/HPVA HP-1-2009, Standard for Hardwood and Decorative Plywood.

.2 ANSI/NPA A208.1-2009, Particleboard.

.2 Architectural Woodwork Manufacturers Association of Canada (AWMAC) and Architectural Woodwork Institute (AWI)

.1 Architectural Woodwork Quality Standards Illustrated, 1st edition, 2009.

.3 Canadian General Standards Board (CGSB)

.1 CAN/CGSB-71.20-M88, Adhesive, Contact, Brushable.

.4 Canadian Standards Association (CSA International)

.1 CSA B111-74(R2003), Wire Nails, Spikes and Staples.

.2 CSA O112.4 Series-M1977(R2006), Standards for Wood Adhesives.

.3 CSA O121-08(R2013), Douglas Fir Plywood.

.4 CSA O141-05(R2009), Softwood Lumber.

.5 National Electrical Manufacturers Association (NEMA)

.1 ANSI/NEMA LD-3-2005, High-Pressure Decorative Laminates (HPDL).

.6 National Hardwood Lumber Association (NHLA)

.1 Rules for the Measurement and Inspection of Hardwood and Cypress 2011.

.7 National Lumber Grades Authority (NLGA)

.1 Standard Grading Rules for Canadian Lumber 2010.

1.2 PERFORMANCE REQUIREMENTS

.1 Perform architectural casework work in accordance with the recommendations of the "Architectural Woodwork Quality Standards Illustrated" of the Architectural Woodwork Institute and Architectural Woodwork Manufacturers Association of Canada (AWMAC), 2009 Edition, together with authorized additions and amendments, Custom Grade.

.2 Where modifications to the AWMAC Quality Standards are included in this project specification, then such modifications shall govern in case of conflict.

.3 Materials and installation shall be in metric measurement as specified.

1.3 SUBMITTALS

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

.2 Provide shop drawings in accordance with Section 01 33 00 - Submittal Procedures.

.1 Indicate details of construction, profiles, jointing, fastening and other related details.

.1 Scales: profiles full size, details half full size.

.2 Indicate materials, thicknesses, finishes and hardware.

.3 Indicate locations of service outlets in casework, typical and special installation conditions, and connections, attachments, anchorage and location of exposed fastenings.

.3 Provide samples in accordance with Section 01 33 00 - Submittal Procedures.

.1 Provide duplicate samples: sample size 300 x 300 mm or 600 mm long unless specified otherwise.

.2 Provide two (2) samples of each wood species for review.

.3 Provide duplicate colour samples of laminated plastic for colour selection.

.4 Provide duplicate samples of laminated plastic joints, edging, cutouts and postformed profiles.

.4 Quality assurance submittals:

.1 Manufacturer's Instructions: manufacturer's installation instructions.

1.4 QUALITY ASSURANCE

.1 Lumber by grade stamp of an agency certified by Canadian Lumber Standards Accreditation Board.

.2 Plywood and wood based composite panels in accordance with CSA and ANSI standards.

.3 Delivery, Storage, and Handling:

.1 Deliver, handle, store and protect materials of this section in accordance with Section 01 61 00 - Common Product Requirements.

.1 Protect millwork against dampness and damage during and after delivery.

.2 Store millwork in ventilated areas, protected from extreme changes of temperature or humidity.

.2 Waste Management and Disposal:

.1 Separate waste materials for reuse and recycling in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.

Part 2 Products

2.1 MATERIALS

.1 Softwood lumber: unless specified otherwise, S4S, moisture content 19% or less in accordance with following standards:

.1 CSA O141.

.2 NLGA Standard Grading Rules for Canadian Lumber.

.3 AWMAC custom grade, moisture content as specified.

.2 Hardwood lumber: moisture content 6% or less in accordance with following standards:

.1 National Hardwood Lumber Association (NHLA).

.2 AWMAC custom grade, moisture content as specified.

.3 Douglas fir plywood (DFP): to CSA O121, standard construction.

.1 Urea-formaldehyde free.

.4 Hardwood plywood: to ANSI/HPVA HP-1.

.1 Urea-formaldehyde free.

.5 Birch plywood: to AWMAC Natural and Select White.

.1 Urea-formaldehyde free.

.6 Engineered Combination core – 5 ply veneer: to ANSI A208-1

.1 Urea-formaldehyde free.

.7 Laminated plastic for flatwork: to NEMA LD3, Grade VGL, Type HD, 1.6 mm thick; based on solid, woodgrain, printed pattern, and metallic, colour range with satin, matt, textured, and embossed finish.

.8 Laminated plastic backing sheet: Grade BK, Type HD not less than 0.5 mm thick or same thickness and colour as face laminate.

.9 Thermofused Melamine: to NEMA LD3 Grade VGL.

.1 High wear resistant thermofused melamine: equal or exceed 400 cycles (Minimum standard for HPL abrasion test).

.10 Nails and staples: to CSA B111.

.11 Wood screws: plain, type and size to suit application.

.12 Splines: wood and metal.

.13 Sealant: in accordance with Section 07 92 00 - Joint Sealants.

.14 Laminated plastic adhesive:

.1 Adhesive: contact adhesive to CAN/CGSB-71.20.

.1 Maximum VOC limit 250 g/l.

.2 Adhesives urea-formaldehyde free.

2.2 MANUFACTURED UNITS

.1 Casework:

.1 Fabricate caseworks to AWMAC custom quality grade.

.2 Furring, blocking, nailing strips, grounds and rough bucks

.1 S2S is acceptable for concealed products.

.2 Board sizes: "standard" or better grade.

.3 Dimension sizes: "standard" light framing or better grade.

.4 Urea-formaldehyde free.

.3 Case bodies (ends, divisions and bottoms).

.1 Particleboard core, grade, square edge, 19mm thick. Laminated with high pressure laminate on exposed ends and thermofused melamine on concealed interios.

.4 Backs:

.1 Particleboard core, square edge, 12.7mm thick, laminated with thermofused melamine.

.5 Shelving:

.1 Particleboard core, laminated with thermofused melamine, 19 mm thick.

.2 Edge banding: provide matching colour PVC, 3 mm thickness.

.2 Drawers:

.1 Fabricate drawers to AWMAC custom grade supplemented as follows:

.2 Sides and Backs.

.1 Thermofused melamine: 15 mm thick.

.3 Bottoms:

.1 Thermofused melamine: 15 mm thick.

.4 Fronts:

.1 Engineered composite core, 19 mm thick, laminated with high-pressure plastic laminate.

.1 Exposed finish: high-pressure plastic laminate

.2 Semi-exposed surface: plastic laminate.

.3 Edges: banded with 3 mm PVC edge, colour to match exposed faces.

.3 Casework Doors:

.1 Fabricate doors to AWMAC custom grade supplemented as follows:

.2 Engineered composite core, 19 mm thick, laminated with high-pressure plastic laminate.

.1 Exposed finish: high-pressure plastic laminate

.2 Semi-exposed surface: plastic laminate.

.3 Edges: banded with 3 mm PVC edge, colour to match exposed faces.

.4 Countertops

.1 High-pressure plastic laminate: edged with matching plastic laminate edge unless indicated otherwise on details. Backsplash to match countertop unless indicated otherwise on drawings.

.2 Engineered composite core, 19 mm thick.

2.3 FABRICATION

.1 Assemble cabinets in flush overlay style.

.2 Set nails and countersink screws apply plain wood filler to indentations, sand smooth and leave ready to receive finish.

.3 Shop install cabinet hardware for doors, shelves and drawers. Recess shelf standards unless noted otherwise.

.4 Shelving to cabinetwork to be adjustable unless otherwise noted.

.5 Provide cutouts for plumbing fixtures, inserts, appliances, outlet boxes and other fixtures.

.6 Shop assemble work for delivery to site in size easily handled and to ensure passage through building openings.

.7 Obtain governing dimensions before fabricating items which are to accommodate or abut appliances, equipment and other materials.

.8 Ensure adjacent parts of continuous laminate work match in colour and pattern.

.9 Veneer laminated plastic to core material in accordance with adhesive manufacturer's instructions. Ensure core and laminate profiles coincide to provide continuous support and bond over entire surface. Use continuous lengths up to 2400 mm. Keep joints 600 mm from sink cutouts.

.10 Use straight self-edging laminate strip for flatwork to cover exposed edge of core material. Chamfer exposed edges uniformly at approximately 20 degrees. Do not mitre laminate edges.

.11 Apply laminate backing sheet to reverse side of core of plastic laminate work.

2.4 HARDWARE

.1 Hinges: European concealed hinges, 110 degree opening. Only screw fastened hardware will be accepted, no friction fit hardware will be accepted.Use plastic insertion dowels to receive screws of hinge baseplates.

.1 Acceptable manufacturers: Hettich, Blum, Hafele or Richelieu.

.2 Drawer slides: full extension, bearing type, secured to sides of drawers and to gable, 45kg static load capacity, integral stop, self-closing

.1 Acceptable product: Accuride 3832, or Knape & Vogt 8400.

.3 Shelf standards: Safety shelf support pin for 5mm diameter holes, steel pin with mounded on clear plastic.

.4 Pulls: semi-circular style, satin stainless steel finish, 160mm centre to centre.

.1 Acceptable product: Richelieu 496160, or Amerock BP19004.

.5 Cabinet locks: Cam type cylinder lock. Satin stainless steel finish. Install where shown on details. Key locks that are in the same room alike.

.6 Clear plastic silencers to be installed on all cabinet doors.

Part 3 Execution

3.1 INSTALLATION

.1 Do architectural woodwork to Quality Standards of the Architectural Woodwork Manufacturers Association of Canada (AWMAC), except where specified otherwise.

.2 Install prefinished millwork at locations shown on drawings. Position accurately, level, plumb straight.

.3 Fasten and anchor millwork securely. Provide heavy duty fixture attachments for wall mounted cabinets.

.4 Use draw bolts in countertop joints.

.5 Scribe and cut as required to fit abutting walls and to fit properly into recesses and to accommodate piping, columns, fixtures, outlets or other projecting, intersecting or penetrating objects.

.6 At junction of plastic laminate counter back splash and adjacent wall finish, apply small bead of sealant.

.7 Apply water resistant building paper over wood framing members in contact with masonry or cementitious construction.

.8 Fit hardware accurately and securely in accordance with manufacturer's written instructions.

.9 Site apply laminated plastic to units as indicated. Adhere laminated plastic over entire surface. Make corners with hairline joints. Use full sized laminate sheets. Make joints only where indicated or approved. Slightly bevel arises.

.10 For site application, offset joints in plastic laminate facing from joints in core.

.11 Coordinate installation of continuous wood blocking behind adjustable shelving units. Attach standards to studs at a maximum spacing of 400mm on centre. Adjustable shelf shall extend a maximum of 100mm beyond the final standard, install standard as required.

3.2 CLEANING

.1 Proceed in accordance with Section 01 74 11 - Cleaning.

.2 Clean millwork and cabinet work, inside cupboards and drawers and outside surfaces.

.3 Remove excess glue from surfaces.

3.3 PROTECTION

.1 Protect millwork and cabinet work from damage until final inspection.

END OF SECTION

Part 1 General

1.1 REFERENCES

.1 American Society for Testing and Materials International (ASTM)

.1 ASTM C553-11, Standard Specification for Mineral Fibre Blanket Thermal Insulation for Commercial and Industrial Applications.

.2 ASTM C1320-10, Standard Practice for Installation of Mineral Fiber Batt and Blanket Thermal Insulation for Light Frame Construction.

.2 Underwriters Laboratories of Canada (ULC)

.1 CAN/ULC-S702-09, Standard for Thermal Insulation, Mineral Fibre for Buildings.

.2 CAN/ULC-S102.2, Standard Method of Test for Surface Burning Characteristics of Building Materials and assemblies.

1.2 SUBMITTALS

.1 Product Data:

.1 Submit manufacturer's printed product literature, specifications and data sheet in accordance with Section 01 33 00 - Submittal Procedures.

.2 Manufacturer's Instructions:

.1 Submit manufacturer's installation instructions.

1.3 QUALITY ASSURANCE

.1 Test Reports: certified test reports showing compliance with specified performance characteristics and physical properties.

.2 Certificates: product certificates signed by manufacturer certifying materials comply with specified performance characteristics and criteria and physical requirements.

.3 Health and Safety Requirements: do construction occupational health and safety in accordance with Section 01 35 29.06 - Health and Safety Requirements.

1.4 WASTE MANAGEMENT AND DISPOSAL

.1 Separate waste materials for reuse and recycling in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.

.2 Remove from site and dispose of packaging materials at appropriate recycling facilities.

Part 2 Products

2.1 INSULATION

.1 Batt and blanket mineral fibre: CAN/ULC S702, Type 1

.1 Non-combustible: to CAN/ULC S114.

.1 Flame spread: 0 to 10

.2 Smoke developed: 0 to 10

.2 Thickness: as indicated on drawings and to suit partition framing (fill cavity).

.3 Zero formaldehyde content.

.4 Acoustical performance:

.1 Airborne sound transmission loss: To ASTM E90

.2 Rating sound insulation: To ASTM E413

.3 Sound absorption co-efficients: To ASTM E423 (NRC 1.10 for 102mm thickness)

.5 Density: To ASTM C612, 45 kg/m^3

Part 3 Execution

3.1 MANUFACTURER'S INSTRUCTIONS

.1 Compliance: comply with manufacturer's written data, including product technical bulletins, product catalogue installation instructions, product carton installation instructions, and data sheets.

3.2 INSULATION INSTALLATION

.1 Install insulation to maintain continuity of thermal protection to building elements and spaces and to ASTM C1320.

.2 Fit insulation closely around electrical boxes, pipes, ducts, frames and other objects in or passing through insulation.

.3 Do not compress insulation to fit into spaces.

.4 Fill cavity to full depth for partitions and floor assemblies.

.5 Keep insulation minimum 75 mm from heat emitting devices such as recessed light fixtures, and minimum 50 mm from sidewalls of CAN/ULC-S604 Type A chimneys and CSA-B149.1 and CSA-B149.2 Type B and L vents.

3.3 CLEANING

.1 Upon completion of installation, remove surplus materials, rubbish, tools and equipment barriers.

END OF SECTION

Part 1 General

1.1 REFERENCES

.1 Health Canada/Workplace Hazardous Materials Information System (WHMIS)

.1 Material Safety Data Sheets (MSDS).

.2 Underwriter's Laboratories of Canada (ULC)

.1 ULC-S115-05, Fire Tests of Fire stop 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 non-combustible 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 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 datasheet and include product characteristics, performance criteria, physical size, finish and limitations.

.2 Submit two copies of WHMIS MSDS - Material Safety Data Sheets in accordance with Section 02 81 01 - Hazardous Materials.

.3 Shop Drawings:

.1 Submit shop drawings to show location, proposed material, reinforcement, anchorage, fastenings and method of installation.

.2 Construction details should accurately reflect actual job conditions.

.4 Samples:

.1 Submit duplicate 300 x 300 mm samples showing actual fire stop material proposed for project.

.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: submit certificates signed by manufacturer certifying that materials comply with specified performance characteristics and physical properties.

.3 Manufacturer's Instructions: submit manufacturer's installation instructions and special handling criteria, installation sequence, and cleaning procedures.

1.4 QUALITY ASSURANCE

.1 Qualifications:

.1 Installer: company specializing in fire stopping installations with 5 years' experience.

.2 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 Upon completion of Work, after cleaning is carried out.

1.5 DELIVERY, STORAGE AND HANDLING

.1 Packing, shipping, handling and unloading:

.1 Deliver, store and handle materials in accordance with Section 01 61 00 - Common Product Requirements.

.2 Deliver, store and handle materials in accordance with manufacturer's written instructions.

.3 Deliver materials to the site in undamaged condition and in original unopened containers, marked to indicate brand name, manufacturer, and ULC markings.

.2 Storage and Protection:

.1 Store materials 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.

.3 Waste Management and Disposal:

.1 Separate waste materials for reuse and recycling in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.

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 Fire stop system rating: as indicated on drawings.

.2 Re-penetrable fire stop system for power and communication cables and cable trays.

.1 Square profile, heavy guage galvanized steel with intumescent material for rapid expansion.

.2 Wall and floor applications.

.3 Accessories including manufactured multi-gang plates, brackets, extensions and multi-slot frames.

.3 Service penetration assemblies: systems tested to CAN-ULC-S115.

.4 Service penetration fire stop components: certified by test laboratory to CAN-ULC-S115.

.5 Fire-resistance rating of installed fire stopping assembly in accordance with NBC.

.6 Fire stopping and smoke seals at openings intended for ease of re-entry such as cables: elastomeric seal.

.7 Fire stopping and smoke seals at openings around penetrations for pipes, ductwork and other mechanical items requiring sound and vibration control: elastomeric seal.

.8 Primers: to manufacturer's recommendation for specific material, substrate, and end use.

.9 Water (if applicable): potable, clean and free from injurious amounts of deleterious substances.

.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.

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 PREPARATION

.1 Examine sizes and conditions of voids to be filled to establish correct thicknesses and installation of materials.

.1 Ensure that substrates and surfaces are clean, dry and frost free.

.2 Prepare surfaces in contact with fire stopping materials and smoke seals to manufacturer's instructions.

.3 Maintain insulation around pipes and ducts penetrating fire separation [without interruption to vapour barrier.

.4 Mask where necessary to avoid spillage and over coating onto adjoining surfaces; remove stains on adjacent surfaces.

3.3 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.

3.4 SPECIAL REQUIREMENTS

.1 Location of special requirements for fire stopping and smoke seal materials at openings and penetrations in fire resistant rated assemblies are as follows:

.1 Designed for re-entry, removable at: cable trays, electrical and communication rooms.

3.5 SEQUENCES OF OPERATION

.1 Proceed with installation only when submittals have been reviewed by Departmental Representative.

.2 Install floor fire stopping before interior partition erections.

.3 Metal deck bonding: fire stopping to precede spray applied fireproofing to ensure required bonding.

.4 Mechanical pipe insulation: certified fire stop system component.

.1 Ensure pipe insulation installation precedes fire stopping.

3.6 FIELD QUALITY CONTROL

.1 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 11 - 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 Top of fire-resistance rated masonry and gypsum board partitions.

.3 Intersection of fire-resistance rated masonry and gypsum board partitions.

.4 Control and sway joints in fire-resistance rated masonry and gypsum board partitions and walls.

.5 Penetrations through fire-resistance rated floor slabs, ceilings and roofs.

.6 Openings and sleeves installed for future use through fire separations.

.7 Around mechanical and electrical assemblies penetrating fire separations.

.8 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 American Society for Testing and Materials International, (ASTM)

- .1 ASTM C919-12, Standard Practice for Use of Sealants in Acoustical Applications.
- .2 ASTM E814-13, Standard Test Method for Fire Tests of Penetration Firestop Systems.
- .3 ASTM E1966-07(2011), Standard Test Method for Fire-Resistive Joint Systems.

.2 Canadian General Standards Board (CGSB)

- .1 CAN/CGSB-19.13-M87, Sealing Compound, One-component, Elastomeric, Chemical Curing.
- .2 CAN/CGSB-19.17-M90, One-Component Acrylic Emulsion Base Sealing Compound.
- .3 CAN/CGSB-19.24-M90, Multi-component, Chemical Curing Sealing Compound.

.3 Department of Justice Canada (Jus)

- .1 Canadian Environmental Protection Act, 1999 (CEPA).

.4 Health Canada/Workplace Hazardous Materials Information System (WHMIS)

- .1 Material Safety Data Sheets (MSDS).

.5 Transport Canada (TC)

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

1.2 SUBMITTALS

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

.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 manufacturer's instructions in accordance with Section 01 33 00 - Submittal Procedures.

- .1 Instructions to include installation instructions for each product used.

1.3 QUALITY ASSURANCE/MOCK-UP

.1 Construct mock-up in accordance with Section 01 45 00 - Quality Control.

.2 Construct mock-up to show location, size, shape and depth of joints complete with back-up material, primer, caulking and sealant.

.3 Mock-up will be used:

.1 To judge workmanship, substrate preparation, operation of equipment and material application.

.4 Locate where directed.

.5 Allow 48 hours for inspection of mock-up by Departmental Representative before proceeding with sealant work.

.6 When accepted, mock-up will demonstrate minimum standard of quality required for this Work. Approved mock-up may remain as part of finished Work.

1.4 DELIVERY, STORAGE, AND HANDLING

.1 Deliver, handle, store and protect materials in accordance with Section 01 61 00 - Common Product Requirements.

.2 Deliver and store materials in original wrappings and containers with manufacturer's seals and labels, intact. Protect from freezing, moisture, water and contact with ground or floor.

1.5 WASTE MANAGEMENT AND DISPOSAL

.1 Separate waste materials for reuse and recycling in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.

.2 Remove from site and dispose of packaging materials at appropriate recycling facilities.

.3 Place materials defined as hazardous or toxic in designated containers.

.4 Handle and dispose of hazardous materials in accordance with the CEPA, TDGA, Regional and Municipal regulations.

.5 Unused sealant material must not be disposed of into sewer system, into streams, lakes, onto ground or in other location where it will pose health or environmental hazard.

.6 Divert unused joint sealing material from landfill to official hazardous material collections site approved by Departmental Representative.

.7 Empty plastic joint sealer containers are not recyclable. Do not dispose of empty containers with plastic materials destined for recycling.

1.6 PROJECT CONDITIONS

.1 Environmental Limitations:

.1 Do not proceed with installation of joint sealants under following conditions:

.1 When ambient and substrate temperature conditions are outside limits permitted by joint sealant manufacturer or are below 4.4 degrees C.

.2 When joint substrates are wet.

.2 Joint-Width Conditions:

.1 Do not proceed with installation of joint sealants where joint widths are less than those allowed by joint sealant manufacturer for applications indicated.

.3 Joint-Substrate Conditions:

.1 Do not proceed with installation of joint sealants until 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 Material Safety Data Sheets (MSDS) acceptable to Labour Canada.

.2 Conform to manufacturer's recommended temperatures, relative humidity, and substrate moisture content for application and curing of sealants including special conditions governing use.

.3 Ventilate area of by use of approved portable supply and exhaust fans approved by Departmental Representative.

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 which offgas to exterior, are contained behind air barriers, or are applied several months before occupancy to maximize offgas time.

.3 Where sealants are qualified with primers use only these primers.

2.2 SEALANT MATERIAL DESIGNATIONS

.1 Type 1 - Urethanes Two Part.

.1 Non-Sag to CAN/CGSB-19.24, Type 2, Class B, colour as selected by Departmental Representative from manufacturer’s standard range.

.2 Type 2 - Urethanes One Part.

.1 Non-Sag to CAN/CGSB-19.13, Type 2, MCG-2-25 or MCG-2-40, colour as selected by Departmental Representative from manufacturer’s standard range.

.3 Type 3 - Silicones One Part.

.1 To CAN/CGSB-19.13.

.2 Mildew resistant: for use in interior areas where water may contact sealant.

.4 Type 4 - Acrylic Latex One Part.

.1 To CAN/CGSB-19.17.

.5 Type 5 - Acoustical Sealant.

.1 To ASTM C919.

.6 Type 6 – Acoustical Sealant and Firestopping.

.1 To ASTM E-814 and ASTM E-1966.

.2 Acceptable material: Metacaulk MC-150+.

2.3 PREFORMED COMPRESSIBLE AND NON-COMPRESSIBLE BACK-UP MATERIALS.

.1 Polyethylene, Urethane, Neoprene or Vinyl Foam.

.1 Extruded closed cell foam backer rod.

.2 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 which will not bond to sealant.

2.4 SEALANT SELECTION

.1 Perimeters of exterior openings where frames meet exterior facade of building (i.e. brick, block, precast masonry): Sealant type: 1 or 2.

.2 Control and expansion joints in exterior surfaces of unit masonry and stone veneer walls: Sealant type: 1 or 2.

.3 Seal interior perimeters of exterior openings as detailed on drawings: Sealant type: 4.

.4 Control and expansion joints on the interior of exterior surfaces of unit masonry walls: Sealant type: 1 or 2.

.5 Perimeters of interior frames, as detailed and itemized: Sealant type: 4.

.6 Exposed interior control joints in drywall: Sealant type: 4

.7 Perimeter of bath fixtures (e.g. sinks, tubs, urinals, stools, water closets, basins, vanities): Sealant type: 3.

.8 Perimeter of countertop edges: Sealant type: 3 (translucent)

.9 Acoustic seal for sound rated walls: Sealant type: 5

.10 Acoustic seal and firestopping: Sealant type: 6

.11 In additional locations as noted on the drawings: confirm with Departmental Representative.

2.5 JOINT CLEANER

.1 Non-corrosive and non-staining type, compatible with joint forming materials and sealant recommended by sealant manufacturer.

.2 Primer: as recommended by manufacturer.

Part 3 Execution

3.1 PROTECTION

.1 Protect installed Work of other trades from staining or contamination.

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 which 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 sides of joints in accordance with sealant manufacturer's instructions 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 strict accordance with sealant manufacturer's instructions.

3.6 APPLICATION

.1 Sealant.

.1 Apply sealant in accordance with manufacturer's written instructions.

.2 Mask edges of joint where irregular surface or sensitive joint border exists to provide neat joint.

.3 Apply sealant in continuous beads.

.4 Apply sealant using gun with proper size nozzle.

.5 Use sufficient pressure to fill voids and joints solid.

.6 Form surface of sealant with full bead, smooth, free from ridges, wrinkles, sags, air pockets, embedded impurities.

.7 Tool exposed surfaces before skinning begins to give slightly concave shape.

.8 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 Cleanup.

.1 Clean adjacent surfaces immediately and leave Work neat and clean.

.2 Remove excess and droppings, using recommended cleaners as work progresses.

.3 Remove masking tape after initial set of sealant.

END OF SECTION

Part 1 General

1.1 REFERENCES

.1 American Society for Testing and Materials International (ASTM)

.1 ASTM A653/A653M-11, Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.

.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 International)

.1 CSA-G40.20-13/G40.21-13, General Requirements for Rolled or Welded Structural Quality Steel/Structural Quality Steel.

.2 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 Frames, 2006.

.2 CSDMA, Selection and Usage Guide for Commercial Steel Doors, 2009.

.5 National Fire Protection Association (NFPA)

.1 NFPA 80-2013, Standard for Fire Doors and Fire Windows.

.2 NFPA 252-2013, Standard Methods of Fire Tests of Door Assemblies.

.6 Underwriters' Laboratories of Canada (ULC)

.1 CAN/ULC S104-10, Standard Method for Fire Tests of Door Assemblies.

1.2 SYSTEM DESCRIPTION

.1 Design Requirements:

.1 Design exterior frame assembly to accommodate to expansion and contraction when subjected to minimum and maximum surface temperature of -35 degrees C to 35 degrees C.

.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 for ratings specified or indicated.

.3 Provide fire labelled frames for openings requiring fire protection ratings. Test products in conformance with CAN/ULC S104, ASTM E152 or NFPA 252 and listed by nationally recognized agency having factory inspection services.

1.3 SUBMITTALS

.1 Provide shop drawings: in accordance with Section 01 33 00 - Submittal Procedures.

.1 Indicate each type of door, material, steel core thicknesses, mortises, reinforcements, location of exposed fasteners, openings, glazed, louvred, arrangement of hardware and fire rating and finishes.

.2 Indicate each type frame material, core thickness, reinforcements, glazing stops, location of anchors and exposed fastenings and reinforcing, 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 Waste Management and Disposal:

.1 Separate waste materials for reuse and recycling in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.

Part 2 Products

2.1 MATERIALS

.1 Hot dipped galvanized steel sheet: to ASTM A653M, ZF75, minimum base steel thickness in accordance with CSDMA Table 1 - Thickness for Component Parts.

.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:

.1 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 Temperature rise rated (TRR): core composition to limit temperature rise on unexposed side of door. Core to be tested as part of a complete door assembly, in accordance with CAN/ULC S104, ASTM E152 or NFPA 252, covering Standard Method of Tests of Door Assemblies and listed by nationally recognized testing agency having factory inspection service.

2.3 ADHESIVES

.1 Honeycomb cores and steel components: heat resistant, spray grade, resin reinforced neoprene/rubber (polychloroprene) based, low viscosity, contact cement.

.1 Adhesive: maximum VOC content 50 g/L.

2.4 PRIMER

.1 Touch-up prime CAN/CGSB-1.181.

.1 Maximum VOC limit 50 g/L.

2.5 PAINT

.1 Field paint steel doors and frames in accordance with Sections 09 91 13 - Exterior Painting and 09 91 23 - Interior Painting. Protect weatherstrips from paint. Provide final finish free of scratches or other blemishes.

2.6 ACCESSORIES

.1 Door silencers: single stud rubber/neoprene type.

.2 Exterior and interior top and bottom caps: steel.

.3 Fabricate glazing stops as formed channel, minimum 16 mm height, accurately fitted, butted at corners and fastened to frame sections with counter-sunk oval head sheet metal screws.

.4 Metallic paste filler: to manufacturer's standard.

.5 Fire labels: metal rivited.

.6 Sealant: in accordance with Section 07 92 00 – Joint Sealants.

.1 Maximum VOC limit 250 g/L.

.7 Glazing: in accordance with Section 08 80 50 - Glazing.

.8 Make provisions for glazing as indicated and provide necessary glazing stops.

.1 Provide removable stainless steel glazing beads for use with glazing tapes and compounds and secured with countersunk stainless steel screw.

.2 Design exterior glazing stops to be tamperproof.

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 Refer to drawings for specific door frame details where flush door/frame detail is required.

.4 Exterior frames: 1.6 mm welded, thermally broken type construction using rigid polyvinylchloride extrusion conforming to CGSB 41-GP-19MA.

.5 Interior frames: 1.6 mm welded type construction.

.6 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.

.7 Protect mortised cutouts with steel guard boxes.

.8 Prepare frame for door silencers, 3 for single door, 2 at head for double door.

.9 Manufacturer's nameplates on frames and screens are not permitted.

.10 Conceal fastenings except where exposed fastenings are indicated.

.11 Provide factory-applied touch up primer at areas where zinc coating has been removed during fabrication.

.12 Insulate exterior frame components with polyurethane insulation.

.13 Prepare frames to receive electronic monitoring and security devices. Refer to Section 08 71 10 - Door Hardware and Section 08 90 10 - Door, Frame and Hardware Schedule. Coordinate frame preparation with Electrical Divisions 26 and 28.

2.8 FRAME ANCHORAGE

.1 Provide appropriate anchorage to floor and wall construction.

.2 Locate each wall anchor immediately above or below each hinge reinforcement on hinge jamb and directly opposite on strike jamb.

.3 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.

.4 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 DOOR FABRICATION GENERAL

.1 Doors: swing type, flush, with provision for glass and/or louvre openings as indicated.

.2 Refer to Drawings for specific door details where flush door/frame detail is required.

.3 Fabricate doors with longitudinal edges welded. Seams: grind welded joints to a flat plane, fill with metallic paste filler and sand to a uniform smooth finish.

.4 Blank, reinforce, drill doors and tap for mortised, templated hardware and electronic hardware.

.5 Factory prepare holes 12.7 mm diameter and larger except mounting and through-bolt holes, on site, at time of hardware installation.

.6 Reinforce doors where required, for surface mounted hardware. Provide flush steel top caps to exterior doors. Provide inverted, recessed, spot welded channels to top and bottom of interior doors.

.7 Provide factory-applied touch-up primer at areas where zinc coating has been removed during fabrication.

.8 Provide fire labelled doors for those openings requiring fire protection ratings, as scheduled. Test such products in conformance with CAN/ULC S104, ASTM E152, 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.

.9 Manufacturer's nameplates on doors are not permitted.

2.11 DOORS: HONEYCOMB CORE CONSTRUCTION

.1 Form face sheets for exterior doors from 1.6 mm sheet steel with honeycomb core laminated under pressure to face sheets.

.2 Form face sheets for interior doors from 1.6 mm sheet steel with honeycomb core laminated under pressure to face sheets.

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 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 Caulk perimeter of frames between frame and adjacent material.

.6 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, top of carpet, and thresholds: 13 mm.

.3 Adjust operable parts for correct function.

.4 Install louvres.

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 doors and frames in accordance with Section 08 80 50 - Glazing.

END OF SECTION

Part 1 General

1.1 REFERENCES

.1 Aluminum Association (AA).

.1 DAF 45-03, Designation System for Aluminum Finishes.

.2 American Architectural Manufacturers Association (AAMA).

.1 AAMA CW-10, Care And Handling of Architectural Aluminum from Shop to Site

.2 AAMA 611, Voluntary Specifications for Anodized finishes Architectural Aluminum

.3 AAMA 609-93, Voluntary Guide Specification for Cleaning and Maintenance of Architectural Anodized Aluminum.

.3 American Society for Testing and Materials International, (ASTM).

.1 ASTM B209M, Aluminum and Aluminum-Alloy sheet and Plate Metric

.2 ASTM E330-02, Standard Test Method for Structural Performance of Exterior Windows, Doors, Skylights and Curtain Walls by Uniform Static Air Pressure Difference.

1.2 SUBMITTALS

.1 Product Data:

.1 Submit catalogue details for each type of frame illustrating profiles, dimensions and methods of assembly.

.2 Shop Drawings

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

.1 Indicate materials and profiles and provide scaled details of components for each type of door and frame.

.3 Closeout Submittals

.1 Conform to Section 01 78 00 - Closeout Submittals.

1.3 DELIVERY, STORAGE, AND HANDLING

.1 Storage and Protection:

.1 Apply temporary protective coating to finished surfaces. Remove coating after erection. Do not use coatings that will become hard to remove or leave residue.

.2 Leave protective covering in place until final cleaning of building.

Part 2 Products

2.1 MATERIALS

.1 Aluminum extrusions: Aluminum Association alloy AA6063-T5 anodizing quality.

.2 Fasteners: stainless steel where exposed

.3 Isolation coating: bituminous paint.

.4 Glass: refer to Section 08 80 50 – Glazing

2.2 ALUMINUM FRAMES

.1 Interior aluminum frames:

.1 Extruded aluminum frames nominal size 114 x 45 mm, front glazed system.

.2 Thickness: 3 mm

.3 Match Kawneer Trifab 450 series section

.4 Front glazed system.

.5 Glazing at front of frame

2.3 ALUMINUM FINISHES

.1 Finish exposed surfaces of aluminum components in accordance with Aluminum Association Designation System for Aluminum Finishes.

.1 Finish: Clear anodized AA-M12C22A31, 0.7 mil thickness, Class 1.

2.4 FABRICATION

.1 Framing to be by same manufacturer.

.2 Fabricate frames to profiles and maximum face sizes as shown. Provide minimum 22 mm bite for insulating glazed units.

.3 Reinforce mechanically joined corners and components areas of aluminum framing with interior steel clips to provide strength, stiffness and rigidity in the completed installation.

.4 Fit joints tightly and secure mechanically.

.5 Conceal fastenings.

.6 Mortise, reinforce, drill and tap frames and reinforcements to receive hardware.

.7 Isolate aluminum from direct contact with dissimilar metals, concrete and masonry.

Part 3 Execution

3.1 MANUFACTURER'S INSTRUCTIONS

.1 Compliance: comply with manufacturer's written data, including product technical bulletins, product catalogue installation instructions, product carton installation instructions, and data sheets.

3.2 WINDOW INSTALLATION

.1 Install windows in accordance with manufacturer's instructions. Set frames plumb, square, level at correct elevation in alignment with adjacent work.

.2 Anchor securely.

.3 Adjust operable parts for correct function and smooth friction free operation.

.4 Make allowances for deflection of structure to ensure that structural loads are not transmitted to frames.

.5 Seal joints between window frame and other building components with clear silicone caulking.

3.3 GLAZING

.1 Glaze aluminum doors and frames in accordance with Section 08 80 50 – Glazing using butt vertical joints between glazing units.

3.4 CAULKING/SEALING

.1 Apply sealant in accordance with Section 07 92 00 - Joint Sealing. Conceal sealant within the aluminum work except where exposed use is permitted by Consultant.

3.5 CLEANING

.1 Perform cleaning of aluminum components in accordance with AAMA 609.1 - Voluntary Guide Specification for Cleaning and Maintenance of Architectural Anodized Aluminum.

.2 Clean aluminum with damp rag and approved non-abrasive cleaner.

.3 Remove traces of primer, caulking, epoxy and filler materials; clean doors and frames.

.4 Clean glass and glazing materials with approved non-abrasive cleaner.

.5 Upon completion of installation, remove surplus materials, rubbish, tools and equipment barriers.

END OF SECTION

Part 1 General

1.1 REFERENCES

.1 Architectural Woodwork Manufacturers Association of Canada (AWMAC).

.1 Quality Standards for Architectural Woodwork 2009.

.2 Canadian Standards Association (CSA International).

.1 CAN/CSA-O132.5-M1992(R1998), Stile and Rail Wood Doors.

.3 National Fire Protection Association (NFPA).

.1 NFPA 80-09, Standard for Fire Doors and Fire Windows.

.2 NFPA 252-07, Standard Method of Fire Tests of Door Assemblies.

.4 Underwriters' Laboratories of Canada (ULC).

.1 CAN4-S104M-80(R1985), Fire Tests of Door Assemblies.

.2 CAN4-S105M-09, Fire Door Frames Meeting the Performance Required by CAN4-S104.

1.2 SUBMITTALS

.1 Product Data:

.1 Submit manufacturer's printed product literature, specifications and data sheet in accordance with Section 01 33 00 - Submittal Procedures.

.2 Submit two copies of WHMIS MSDS - Material Safety Data Sheets in accordance with Section 01 33 00 - Submittal Procedures. Indicate VOC's:

.1 For caulking materials during application and curing.

.2 For door materials and adhesives.

.2 Shop Drawings:

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

.2 Indicate door types and cutouts for lights and louvres, sizes, core construction, transom panel construction and cutouts.

1.3 QUALITY ASSURANCE

.1 Regulatory Requirements:

.1 Wood fire rated doors: labelled and listed by an organization accredited by Standards Council of Canada.

.2 Test Reports: certified test reports showing compliance with specified performance characteristics and physical properties.

.3 Certificates: product certificates signed by manufacturer certifying materials comply with specified performance characteristics and criteria and physical requirements.

1.4 DELIVERY, STORAGE, AND HANDLING

.1 Storage and Protection:

.1 Protect doors from dampness. Arrange for delivery after work causing abnormal humidity has been completed.

.2 Store doors in well ventilated room, off floor, in accordance with manufacturer's recommendations.

.3 Protect doors from scratches, handling marks and other damage. Wrap doors.

.4 Store doors away from direct sunlight.

1.5 WASTE MANAGEMENT AND DISPOSAL

.1 Remove from site and dispose of packaging materials at appropriate recycling facilities.

.2 Dispose of corrugated cardboard, polystyrene and plastic packaging material in appropriate on-site bin for recycling in accordance with site waste management program.

.3 Unused or damaged glazing materials are not recyclable and must not be diverted to municipal recycling programs.

.4 Divert unused adhesive material from landfill to official hazardous material collections site approved by Departmental Representative.

.5 Do not dispose of unused paint materials into sewer systems, into lakes, streams, onto ground or in locations where it will pose health or environmental hazard.

Part 2 Products

2.1 FIRE RATED WOOD DOORS

.1 Wood doors: tested in accordance with CAN4-S104 or NFPA 252 to achieve rating as scheduled.

2.2 WOOD FLUSH DOORS

.1 Solid core: to CAN/CSA-O132.2.1.

.1 Construction:

.1 Solid particleboard core: grade LD-1 or LD-2, stile and rail frame bonded to particleboard core with wood lock blocks and top blocks, 5-ply construction, 45 mm thickness. Door core and all materials shall contain no urea formaldehyde.

.2 Face Panels:

.1 Hardwood; veneer grades: Grade I (paint grade), birch species.

.3 Adhesive: Type II (water resistant) for interior doors.

2.3 GLAZING

.1 Glass and Accessories: in accordance with Section 08 80 50 – Glazing.

2.4 FABRICATION

.1 Vertical edge strips solid hardwood compatible with face veneer. AWMAC edge type 2.

.2 Prepare doors for glazing. Provide hardwood species to match face veneer and glazing stops with mitred corners.

.3 Bevel vertical edges of single acting doors 3 mm in 50 mm on lock side and 1.5 mm in 50 mm on hinge side.

Part 3 Execution

3.1 MANUFACTURER'S INSTRUCTIONS

.1 Compliance: comply with manufacturer's written data, including product technical bulletins, product catalogue installation instructions, product carton installation instructions, and data sheets.

3.2 INSTALLATION

.1 Unwrap and protect doors in accordance with CAN/CSA-O132.2 Series, Appendix A.

.2 Install labelled fire rated doors to NFPA 80.

.3 Install doors and hardware in accordance with manufacturer's printed instructions and CAN/CSA-O132.2 Series, Appendix A.

.4 Adjust hardware for correct function.

.5 Install glazing in accordance with Section 08 80 50 - Glazing.

.6 Install stops. Stops shall be wood species to match door.

3.3 ADJUSTMENT

.1 Re-adjust doors and hardware just prior to completion of building to function freely and properly.

3.4 CLEANING

.1 Perform cleaning as soon as possible after installation to remove construction and accumulated environmental dirt.

.2 Remove traces of primer, caulking; clean doors and frames.

.3 Clean glass and glazing materials with approved non-abrasive cleaner.

.4 On completion of installation, remove surplus materials, rubbish, tools and equipment barriers.

END OF SECTION

Part 1 General

1.1 SHOP DRAWINGS

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

.2 Submit catalogue details for each type of door illustrating profiles, dimensions and methods of assembly.

1.2 CLOSEOUT SUBMITTALS

.1 Provide maintenance data for cleaning and maintenance of stainless steel finishes for incorporation into manual specified in Section 01 78 00 - Closeout Submittals.

1.3 WASTE MANAGEMENT AND DISPOSAL

.1 Separate and recycle waste materials in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal, and with the Waste Reduction Workplan.

.2 Remove from site and dispose of all packaging materials at appropriate recycling facilities.

.3 Collect and separate for disposal paper, plastic, polystyrene, and corrugated cardboard packaging material for recycling in accordance with Waste Management Plan.

1.4 DELIVERY, STORAGE AND HANDLING

.1 Deliver, store and handle materials in accordance with Section 01 61 00 - Common Product Requirements.

Part 2 Products

2.1 ACCESS DOORS

.1 Sizes: Except as indicated otherwise, to be minimum sizes as follows:

.1 For body entry: 600 x 600 mm where not noted otherwise.

.2 For hand entry: 300 x 300 mm where not noted otherwise.

.2 Construction (except as noted below): Rounded safety corners, concealed hinges, screwdriver latch, anchor straps, able to open 180^{o}.

.3 Construction (for gypsum board walls and ceilings in finished areas): concealed aluminum frame and recessed door to fit either 12.7 mm or 16 mm gypsum board (as specified in wall types) for flush installation into ceiling or wall, which will have a uniform slot/gap around perimeter. Door shall open 120 degrees minimum and be removable. Latch released by mechanism concealed in slot (Not cam latch).

.4 Materials

.1 Tiled surfaces and other special areas as noted: Stainless steel with brushed satin finish.

.2 Other areas: Prime coated steel.

.5 Materials

.1 For finished gypsum board wall and ceiling locations:

.1 Frame: 2mm (.080) aluminum extrusion. For 16mm or 12.7mm depth.

.2 Door panel: 2 mm ((.080) aluminum door for 16mm gypsum board.

.3 Mill finish.

.2 For unfinished or concealed locations:

.1 Frame: 0.55mm (26ga) galvanized steel.

.2 Door panel: 1.01mm (20ga) galvanized steel, flanged on four sides.

.3 Baked enamel, mill finish.

Part 3 Execution

3.1 INSTALLATION

.1 Installation:

.1 Flush installation for drywall surfaces.

3.2 LOCATION

.1 Locations: As required for Mechanical and Electrical equipment access. Refer to drawings for other specific locations.

.2 Ensure that equipment is within view and is accessible for operating, inspecting, adjusting and servicing without using special tools.

END OF SECTION

Part 1 General

1.1 REFERENCES

.1 American Society for Testing and Materials International (ASTM)

- .1 ASTM A653/A653M-11, Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.
- .2 ASTM E90-09 – Standard Test Method for Laboratory Measurement of Airborne Sound Transmission Loss of Building Partitions and Elements.
- .3 ASTM E413-11 – Classification for Rating Sound Insulation

.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 International)

- .1 CSA-G40.20-13/G40.21-13, General Requirements for Rolled or Welded Structural Quality Steel/Structural Quality Steel.
- .2 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 Frames, 2006.
- .2 CSDMA, Selection and Usage Guide for Commercial Steel Doors, 2009.

.5 National Fire Protection Association (NFPA)

- .1 NFPA 80-2013, Standard for Fire Doors and Fire Windows.
- .2 NFPA 252-2013, Standard Methods of Fire Tests of Door Assemblies.

.6 Underwriters' Laboratories of Canada (ULC)

- .1 CAN/ULC S104-10, Standard Method for Fire Tests of Door Assemblies.

1.2 SYSTEM DESCRIPTION

.1 Design Requirements:

- .1 Acoustic Performance: Minimum Sound Transmission Class **(STC) 50** tested to ASTM E90. Label indicating sound transmission class shall be applied to the door and door frame.
- .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 for ratings specified or indicated.
- .3 Provide fire labelled frames for openings requiring fire protection ratings. Test products in conformance with CAN/ULC S104, ASTM E152 or NFPA 252 and listed by nationally recognized agency having factory inspection services.

1.3 SUBMITTALS

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

.2 Provide product data: in accordance with Section 01 33 00 - Submittal Procedures.

.3 Provide shop drawings: in accordance with Section 01 33 00 - Submittal Procedures.

.1 Indicate each type of door, material, steel core thicknesses, mortises, reinforcements, location of exposed fasteners, openings, glazed, louvred, arrangement of hardware and fire rating and finishes.

.2 Indicate each type frame material, core thickness, reinforcements, glazing stops, location of anchors and exposed fastenings and reinforcing, fire rating, and finishes.

.3 Include schedule identifying each unit, with door marks and numbers relating to numbering on drawings and door schedule.

.4 Test Data:

.1 Submit test data indicating compliance with the Sound Transmission Class (STC) requirements. Include laboratory name, test report number, and date of test.

.2 Submit certification from test laboratory qualified under the National Voluntary Accreditation Program (NVLAP) of the U.S. Bureau of Standards.

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:

.1 Separate waste materials for reuse and recycling in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.

1.5 WARRANTY

.1 Manufacturer’s Limited Warranty: Five (5) years from date of supply, covering material and workmanship.

Part 2 Products

2.1 MATERIALS

.1 Hot dipped galvanized steel sheet: to ASTM A653M, ZF75, minimum base steel thickness in accordance with CSDMA Table 1 - Thickness for Component Parts.

.2 Reinforcement channel: to CSA G40.20/G40.21, Type 44W, coating designation to ASTM A653M, ZF75.

2.2 ACCESSORIES

.1 Hinges: Heavy weight butt type as recommended by the manufacturer.

.2 Primer: Rust inhibitive zinc chromate.

.3 Threshold: Smooth and flush, to provide a seal for door on closed position.

.4 Perimeter acoustic seals: Primary and secondary perimeter acoustic seals to provide a seal for door in closed position to meet specified STC rating.

.5 Head seal: Acoustic neoprene at header.

.6 Bottom acoustic seals: Acoustic mortised drop door bottom to provide a seal for door in closed position to meet specified STC rating.

2.3 STEEL DOORS

.1 Sheet steel faces, thickness, design, and core suitable to achieve specified STC performance.

.2 Acoustic core construction, longitudinal edges, mechanically interlocked with visible edge seams.

.3 Reinforce doors where hardware is required.

.4 Drill and tap for mortised, templated hardware.

.5 Top and Bottom Channels: Inverted, recessed, welded steel channels.

2.4 STEEL FRAMES

.1 Sheet steel, metal thickness and appropriate to maintain door STC ratings, mitred corners, fully welded seams.

.2 Factory assemble and weld frames.

.3 Affix permanent metal nameplates to frame indicating manufacture’s name, door tag, and STC rating where is shall be clearly visible.

2.5 PRIMER

.1 Touch-up prime CAN/CGSB-1.181.

.1 Maximum VOC limit 50 g/L.

2.6 PAINT

.1 Field paint steel doors and frames in accordance with Sections 09 91 13 - Interior Painting. Protect sound seals from paint. Provide final finish free of scratches or other blemishes.

2.7 FRAME ANCHORAGE

.1 Provide appropriate anchorage to floor and wall construction.

.2 Locate each wall anchor immediately above or below each hinge reinforcement on hinge jamb and directly opposite on strike jamb.

.3 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.

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 GENERAL

.1 Install doors and frames to CSDMA Installation Guide.

.2 Install components to manufacturer’s written instructions.

.3 Utilize welders certified by Canadian Welding Bureau (CWB).

3.3 FRAME INSTALLATION

.1 Set frames plumb, square, level and at correct elevation.

.2 Coordinate with masonry and gypsum board wall construction for anchor placement.

.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 Caulk perimeter of frames between frame and adjacent material.

.6 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 to allow easy operation and proper function of seals.

.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 FIELD QUALITY CONTROL

.1 Provide qualified manufacturer's representative to instruct installers on the proper installation and adjustment of door assemblies.

.2 Provide manufacturer's representative to inspect door installation, and test minimum ten (10) cycles of operation. Correct any deficient doors.

END OF SECTION

Part 1 General

1.1 SALVAGE ITEMS

.1 Work of this Section includes removal of existing hardware for salvage; items include locksets, closers, card readers, and electric strikes. Turn over to Owner for first right of refusal.

1.2 REFERENCES

.1 Canadian Steel Door and Frame Manufacturers' Association (CSDFMA).

.1 CSDFMA Canadian Metric Guide for Steel Doors and Frames (Modular Construction): standard hardware location dimensions.

.2 Canadian General Standards Board (CGSB).

.1 CAN/CGSB-69.18-M90/ANSI/BHMA A156.1-1981, Butts and Hinges.

.2 CAN/CGSB-69.19-93/ANSI/BHMA A156.3-1989, Exit Devices.

.3 CAN/CGSB-69.20-M90/ANSI/BHMA A156.4-1986, Door Controls (Closers).

.4 CAN/CGSB-69.21-M90/ANSI/BHMA A156.5-1984, Auxiliary Locks and Associated Products.

.5 CAN/CGSB-69.22-M90/ANSI/BHMA A156.6-1986, Architectural Door Trim.

.6 CAN/CGSB-69.24-M90/ANSI/BHMA A156.8-1982, Door Controls - Overhead Holders.

.7 CAN/CGSB-69.26-96/ANSI/BHMA A156.10-1991, Power-operated Pedestrian Doors.

.8 CAN/CGSB-69.28-M90/ANSI/BHMA A156.12-1986, Interconnected Locks and Latches.

.9 CAN/CGSB-69.29-93/ANSI/BHMA A156.13-1987, Mortise Locks and Latches.

.10 CAN/CGSB-69.32-M90/ANSI/BHMA A156.16-1981, Auxiliary Hardware.

.11 CAN/CGSB-69.35-M89/ANSI/BHMA A156.19-1984, Power Assist and Low Energy Power Operated Doors.

1.3 SUBMITTALS

.1 Product Data:

.1 Submit manufacturer's printed product literature, specifications and data sheet in accordance with Section 01 33 00 - Submittal Procedures.

.2 Hardware List:

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

.2 Indicate specified hardware, including make, model, material, function, size, finish and other pertinent information.

.3 Manufacturer's Instructions:

.1 Submit manufacturer's installation instructions.

.4 Closeout Submittals

.1 Provide operation and maintenance data for door closers, locksets, door holders electrified hardware and fire exit hardware for incorporation into manual specified in Section 01 78 00 - Closeout Submittals.

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.

.2 Test Reports: certified test reports showing compliance with specified performance characteristics and physical properties.

.3 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 Packing, Shipping, Handling and Unloading:

.1 Deliver, store, handle and protect materials in accordance with Section 01 61 00 - Common Product Requirements.

.2 Package each item of hardware including fastenings, separately or in like groups of hardware, label each package as to item definition and location.

.2 Storage and Protection:

.1 Store finishing hardware in locked, clean and dry area.

1.6 WASTE DISPOSAL AND MANAGEMENT

.1 Separate and recycle waste materials in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.

.2 Remove from site and dispose of packaging materials at appropriate recycling facilities.

.3 Dispose of corrugated cardboard, polystyrene, plastic, and packaging material in appropriate on-site bin for recycling in accordance with site waste management program.

1.7 MAINTENANCE

.1 Extra Materials:

.1 Provide maintenance materials in accordance with Section 01 78 00 - Closeout Submittals.

.2 Supply two sets of wrenches for door closers, locksets, and fire exit hardware.

Part 2 Products

2.1 HARDWARE ITEMS

.1 For new hardware use one manufacturer's products only for similar items.

.2 Existing locksets and specialty items as noted on demolition plans and as listed below shall be removed and salvaged for re-use on this project by the Hardware Contractor. Salvage items noted below:

.1 Mortised locksets:

.1 Sargent, confirm functions available.

.2 Yale, new Sargent cylinders to be provided by Contractor.

.2 Closers: site verify quantities.

.3 Turn over all locksets and hardware to the Owner for first right of refusal.

2.2 DOOR HARDWARE

.1 Locks and latches:

.1 Interconnected locks and latches: to CAN/CGSB-69.28, series 5000 interconnected lock, grade 1, designed for function and keyed as stated in Hardware Schedule.

.2 Mortise locks and latches: to CAN/CGSB-69.29, series 1000 mortise lock, grade 1, designed for function as stated in Hardware Schedule.

.3 Lever handles: Sargent ‘J’ design

.4 Escutcheons : Sargent ‘LE1.’

.5 Normal strikes: box type, lip projection not beyond jamb.

.6 Cylinders: Sargent 6 pin, LA keyway, 0 bitted; keying by Owner.

.7 Finish: 26D.

.8 Acceptable manufacturer: Sargent.

.9 List of locksets:

a) ANSI F01; Sargent Model 8215-LE1J-26D (Passage)

b) ANSI F05; Sargent Model 8237-LE1J-26D (Classroom)

c) ANSI F07; Sargent Model 8204-LE1J-26D (Storeroom)

d) ANSI F13; Sargent Model 8225-LE1J-26D (Exit)

e) ANSI F15; Sargent Model 8251 (Hotel/Motel)

f) ANSI F22; Sargent Model 8265-LE1J-26D (Privacy)

.2 Butts and hinges:

.1 Butts and hinges: to CAN/CGSB-69.18, listed in Hardware Schedule.

.2 List of hinges:

a) FBB 168 114 x 114.

b) FBB 168 114 x 144 NRP.

.3 Acceptable manufacturers: Stanley, Hager, Monthard, McKimmey or approved alternate.

.3 Exit devices: to CAN/CGSB-69.19, type and function as noted, grade 1, finished to 630.

.1 Exit devices in fire-rated doors shall be ULC listed.

.2 List of exit devices:

a) Rim type: ETL exterior trim, cylinder lock, non-doggable.

.1 Acceptable manufacturer: Sargent 12-8888-ETL.

b) Deadbolt-style latch, with positive deadlocking by auxiliary bolt, exterior cylinder lock, FLL exterior trim.

.4 Door Closers and Accessories:

.1 Door controls (closers): to CAN/CGSB-69.20, size in accordance with CAN/CGSB-69.20, table A1, finished to 630.

.1 Grade 1, heavy duty, adjustable hydraulic back check, separate regulation of closing speed and latching speed, rack and pinion action.

.2 List of closers:

.1 LCN 4040 with delayed action function.

.3 Acceptable manufacturers: LCN, Sargent, Norton, Rixson or approved alternate.

.2 Door controls (overhead hold open/door stop): to ANSI A156.8, as listed in Hardware Schedule, finished to 652.

.1 Heavy duty hold open-stop, grade 1, heavy duty shock spring, surface mounted, 110° opening, arm, shoe and slider cam assembly.

.2 Acceptable manufacturers: Rixson 9-336 or approved alternate.

.5 Architectural door trim: to CAN/CGSB-69.22, as listed in Hardware Schedule, finish as noted

.1 Door protection plates: kick plate type, 1.27 mm thick stainless steel, bevelled edges, 300 mm high by 25 mm less than door width, 32D finish.

.2 Push plates: 1.27 mm thick stainless steel, bevelled edges, 125 mm wide by 400 mm high, finished to 32D.

.3 Pulls: 19 mm diameter “D” style, projecting 35 mm from door, height 300 mm, without rose.

.6 Auxiliary hardware: to CAN/CGSB-69.32, as listed in Hardware Schedule and as listed below.

.1 Wall stop: concave wall stop with concealed mounting, 62 mm diameter, 30 mm projection, cast brass with rubber bumper, 26D finish.

.1 Acceptable products: Hager 234 or Richelieu 2205.

.2 Floor stop: to ANSI A156.16, low dome stop, 45 mm diameter, 3.2 mm thick base, cast brass, 26D finish.

.1 Acceptable products: Hager 241, or Richelieu 218.

.7 Thresholds:

a) 127 mm wide x full width of door opening, 12.7mm height, 3.8 mm wall. stainless steel mill finish, plain surface.

.8 Weatherstripping:

.1 Head and jamb seal:

.1 Extruded aluminum frame and solid closed cell neoprene insert, clear anodized finish.

.2 Door bottom seal:

.1 Heavy duty, extruded aluminum frame and closed cell neoprene weather seal, surface mounted, closed ends, adjustable, clear anodized finish.

.9 Sound Seals

.1 Head and jamb seal:

.1 Self-adhesive silicone perimeter gasketing.

.2 Acceptable Manufacturer: Pemko S773; DraftSeal DS340CS or approved alternate.

.2 Door bottom drop seal:

.1 Auto door bottom drop seal: heavy duty, door seal of extruded aluminum frame and solid closed cell neoprene seal, surface mounted, closed ends, automatic retract mechanism when door is open, clear anodized finish.

.2 Acceptable manufacturer: Pemko 4131CPKL or approved alternate.

.10 Electric strike: To ANSI/BHMA A156.5, Grade 1. To accept lockset or exit device scheduled. Heavy duty, stainless steel construction, dual voltage, fail secure operation unless noted otherwise, 630 finish. ULC listed for fire rated doors.

a) Acceptable product: HES 9500-12/24-630 fail secure.

b) Acceptable product: SDC Uni-Flex 55-ABCD-630

c) Acceptable product: SDC Uni-flex 55-DU-630, complete with dead bolt keeper, installed.

d) Acceptable product: HES 1006CDB-12/24D-630 (Door 153B)

If door frame design is not compatible with the SDC 55 Series strikes, Folger Adam 310-3-1-24D 630 may be used but will require alignment, cutting and welding of tabs. Proper alignment, installation and operation is responsibility of the Contractor.

.11 Card reader: provided by Owner.

.12 Door Viewer

.1 Mount 1.57m above floor level.

.2 Finish: anodized aluminum. Colour ‘Black’

.3 60mm (2 3/8”) viewing diameter; glass optical lenses

.4 Acceptable manufacturer:

.1 ASD Door Scope Model DS238

.13 Transfer Cable: Frame to Door

.1 Acceptable product: Abloy A281

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 All locks to be ordered with zero bitted Sarent LA cylinders. Cylinders to be installed by the Contractor and locks tested for proper operation.

.2 All final keying by Departmental Representative.

Part 3 Execution

3.1 MANUFACTURER'S INSTRUCTIONS

.1 Compliance: comply with manufacturer's written data, including product technical bulletins, product catalogue installation instructions, product carton installation instructions, and data sheets.

.2 Furnish metal door and frame manufacturers with complete instructions and templates for preparation of their work to receive hardware.

.3 Furnish manufacturers' instructions for proper installation of each hardware component.

3.2 INSTALLATION

.1 Install hardware to standard hardware location dimensions in accordance with Canadian Metric Guide for Steel Doors and Frames (Modular Construction) prepared by Canadian Steel Door and Frame Manufacturers' Association.

.2 Where door stop contacts door pulls, mount stop to strike bottom of pull.

.3 Use only manufacturer's supplied fasteners. Failure to comply may void manufacturer's warranties and applicable licensed labels. Use of "quick" type fasteners, unless specifically supplied by manufacturer, is unacceptable.

3.3 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 provide tight fit at contact points with frames.

3.4 TESTING

.1 All locks must be tested by the Contractor with the installed construction cores for proper installation. All doors and locks not installed and operating correctly will be rejected.

3.5 CLEANING

.1 Perform cleaning after installation to remove construction and accumulated environmental dirt.

.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 Upon completion of installation, remove surplus materials, rubbish, tools and equipment barriers.

3.6 DEMONSTRATION

.1 Maintenance Staff Briefing:

.1 Brief maintenance staff regarding:

.1 Proper care, cleaning, and general maintenance of projects complete hardware.

.2 Use, application and storage of wrenches for door closers, locksets, and fire exit hardware.

.2 Demonstrate operation, operating components, adjustment features, and lubrication requirements.

3.7 SCHEDULE

FIRST FLOOR	
Door 146A	**Door 146B**
Existing OHD	1 Lockset F15 3 butts 1 closer 1 threshold 1 electric strike 1 set weatherstripping 1 bottom sweep
Door 146C	**Door 147**
Existing double door 1 lockset F15 (replace existing Yale) Retain existing strike. Re-align strike with new lockset.	Existing double door 1 Lockset F15 1 electric strike – Folger Adam 310-3-1-24D 630 - wire through existing inactive door 1 electric hinge

Door 148	**Door 149A**
Existing Door (salvage existing electric strike to Departmental Representative – leave existing wiring within door frames for future use) 1 Lockset: ANSI F01 1 Closer 1 Set Soundstripping 1 Bottom drop seal	Existing Door (salvage existing electric strike to Departmental Representative – leave existing wiring within door frames for future use) 1 Lockset: ANSI F01 1 Closer
Door 149B	**Door 150**
1 lockset: ANSI F15 1 closer 1 door viewer (view from 146) 1 bottom drop seal 1 threshold 1 electric strike 1 wall stop	Existing Door 1 lockset: ANSI F15 1 door closer 1 electric strike
Door 152	**Door 153A**
1 lockset: ANSI F01 3 butts 1 closer 1 set weather stripping 1 bottom drop seal 1 wall stop	1 lockset: ANSI F15 3 butts 1 closer 1 electric strike
Door 153B	**Door 154**
Existing Double Door 1 lockset: ANSI F15 6 butts NRP 1 closer 1 floor stop 1 transfer EA281 1 electric strike	1 lockset: ANSI F15 3 butts 1 closer 1 wall stop 1 electric strike
Door 155A	**Door 155B**
1 lockset: ANSI F13 3 butts NRP 1 closer 1 kick stop 1 wall stop	Door hardware by freezer supplier 1 wall stop

Door 156	**Door 158A**
1 lockset: ANSI F15 3 butts 1 closer 1 wall stop	1 lockset: ANSI F15 3 butts NRP 1 closer 1 wall stop
Door 158B	**Door 159**
1 lockset: ANSI F15 (remove existing Yale) 3 butts NRP 1 closer 1 threshold 1 wall stop	1 lockset: (existing F15) 1 viewer 1 electric strike (existing)
SECOND FLOOR	
Door 205	**Door 206**
1 lockset: ANSI F15 3 butts 1 closer 1 wall stop 1 electric strike 1 door viewer	1 lockset: ANSI F15 3 butts 1 door closer 1 wall stop
Door 207	
1 lockset: ANSI F07 3 butts 1 wall stop	
Door 211	**Door 212**
1 lockset: ANSI F15 with special lock and cylinder due to door thickness (replace existing Yale lockset) 1 closer 1 electric strike (existing to be re-aligned with new lockset) 1 door viewer	1 lockset: ANSI F15 3 butts 1 closer 1 set sound seal 1 bottom drop seal 1 electric strike 1 wall stop
Door 213	**Door 214**
1 lockset: ANSI No.: F15 3 butts 1 closer 1 wall stop	1 locket: ANSI F15 3 butts 1 closer Electric strike

Door 215	**Door 216**
1 lockset: ANSI F15 3 butts 1 closer 1 wall stop	1 lockset: ANSI F15 3 butts 1 door closer 1 wall stop
Note 1: Prepare frame for installation of electric strike. Ensure deadbolt keepers are installed and aligned in door frame where there are locksets with deadbolts.	

END OF SECTION

Part 1 General

1.1 REFERENCES

.1 American National Standards Institute (ANSI).

.1 ANSI/ASTM E330-02(2010), Standard Test Method for Structural Performance of Exterior Windows, Doors, Skylights and Curtain Walls by Uniform Static Air Pressure Difference.

.2 American Society for Testing and Materials International, (ASTM).

.1 ASTM C542-05(2011), Standard Specification for Lock-Strip Gaskets.

.2 ASTM D790-10, Standard Test Methods for Flexural Properties of Unreinforced and Reinforced Plastics and Electrical Insulating Materials.

.3 ASTM D1003-13, Standard Test Method for Haze and Luminous Transmittance of Transparent Plastics.

.4 ASTM D1929-13a, Standard Test Method for Determining Ignition Temperature of Plastics.

.5 ASTM D2240-05(2010), Standard Test Method for Rubber Property - Durometer Hardness.

.6 ASTM E84-13a, Standard Test Method for Surface Burning Characteristics of Building Materials.

.7 ASTM F1233-08(2013), Standard Test Method for Security Glazing Materials and Systems.

.3 Canadian General Standards Board (CGSB).

.1 CAN/CGSB-12.1-M90, Tempered or Laminated Safety Glass.

.2 CAN/CGSB-12.3-M91, Flat, Clear Float Glass.

.3 CAN/CGSB-12.5-M86, Mirrors, Silvered.

.4 CAN/CGSB-12.11-M90, Wired Safety Glass.

.4 Flat Glass Manufacturers Association (FGMA).

.1 FGMA Glazing Manual.

.5 Laminators Safety Glass Association (LSGA).

.1 LSGA Laminated Glass Design Guide.

1.2 SYSTEM DESCRIPTION

.1 Butt Joint Glazed Openings:

.1 10mm tempered glass in aluminum frames at head and sill.

.2 Butt vertical joints between glass to be sealed using clear silicone sealant; for interior application.

.3 Maximize size of glass.

1.3 SUBMITTALS

.1 Product Data:

.1 Submit manufacturer's printed product literature, specifications and data sheet in accordance with Section 01 33 00 - Submittal Procedures.

.2 Submit two copies of WHMIS MSDS - Material Safety Data Sheets in accordance with Section 01 33 00 - Submittal Procedures. Indicate VOC's:

.1 For glazing materials during application and curing.

.2 Shop Drawings:

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

.3 Manufacturer's Instructions:

.1 Submit manufacturer's installation instructions.

.4 Closeout Submittals:

.1 Provide maintenance data including cleaning instructions for incorporation into manual specified in Section 01 78 00 - Closeout Submittals.

1.4 QUALITY ASSURANCE

.1 Mock-ups:

.1 Construct mock-ups in accordance with Section 01 45 00 - Quality Control.

.2 Construct mock-up of butt-joint glazing.

.3 Mock-up will be used:

.1 To judge workmanship, substrate preparation, operation of equipment and material application.

.4 Locate where directed.

.5 Allow 48 hours for inspection of mock-up before proceeding with work.

.6 When accepted, mock-up will demonstrate minimum standard of quality required for this work. Approved mock-up may remain as part of finished work.

1.5 SITE CONDITIONS

.1 Environmental Requirements:

.1 Install glazing when ambient temperature is 10 degrees 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.

1.6 WASTE MANAGEMENT AND DISPOSAL

.1 Separate and recycle waste materials in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.

.2 Divert uninstalled materials for reuse at nearest used building materials facility or similar type facility.

.3 Divert unused caulking and sealant materials from landfill through disposal at special wastes depot.

.4 Unused or damaged glazing materials are not recyclable and must not be diverted to municipal recycling programs.

.5 Remove form site and dispose of packaging materials at appropriate recycling facilities.

.6 Dispose of corrugated cardboard, polystyrene, plastic, and packaging material in appropriate on-site bin for recycling in accordance with site waste management program.

Part 2 Products

2.1 MATERIALS: FLAT GLASS

.1 Float glass: to CAN/CGSB-12.3.

.2 Safety glass: to CAN/CGSB-12.1, transparent, 6 mm (typical) and 10 mm (for butt glazing) thick as indicated on schedules or drawings.

.1 Type 2-tempered. (use 6mm low-iron glass for glazed panel beside door 210)

.2 Class B-float.

.3 Category 1.

.3 Wired glass: to CAN/CGSB-12.11, 6 mm thick.

.1 Type 1-Polished both sides (transparent).

.2 Wire mesh styles 3-Square.

2.2 MATERIALS

.1 Plastic Film: in accordance with Section 08 87 33 - Decorative Films

.2 Sealant: as recommended by manufacturer.

.3 Back-paint: proprietary bonding opaque paint. Apply using controlled spray equipment in multiple layers. Cure in controlled environment – baked finish to provide a durable finish for handling and further fabrication requirements. Apply on low-iron tempered glass. Colour to be selected by Departmental Representative. (Panel adjacent to door 210)

2.3 ACCESSORIES

.1 Stand-offs: Brushed stainless steel finish. Low profile button cap on exposed surface. Stand-off from wall 12mm. (Panel adjacent to door 210). Ensure solid wood blocking in wall for installation.

.2 Setting blocks: Neoprene, 80-90 Shore A durometer hardness to ASTM D2240, to suit glazing method, glass light weight and area.

.3 Spacer shims: Neoprene, 50-60 Shore A durometer hardness to ASTM D2240, 75 mm long x one half height of glazing stop x thickness to suit application. Self-adhesive on one face.

.4 Glazing tape:

.1 Preformed butyl compound with integral resilient tube spacing device, 10-15 Shore A durometer hardness to ASTM D2240; coiled on release paper; black colour.

.5 Glazing splines: resilient polyvinyl chloride, extruded shape to suit glazing channel retaining slot, colour as selected.

.6 Glazing clips: manufacturer's standard type.

.7 Lock-strip gaskets: to ASTM C542.

Part 3 Execution

3.1 MANUFACTURER'S INSTRUCTIONS

.1 Compliance: Comply with manufacturer's written data, including product technical bulletins, product catalogue installation instructions, product carton installation instructions, and data sheets.

3.2 EXAMINATION

.1 Verify that openings for glazing are correctly sized and within tolerance.

.2 Verify that surfaces of glazing channels or recesses are clean, free of obstructions, and ready to receive glazing.

3.3 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.

3.4 INSTALLATION: INTERIOR - DRY METHOD (TAPE AND TAPE)

.1 Perform work in accordance with FGMA Glazing Manual, IGMAC, and Laminators Safety Glass Association - Standards Manual for glazing installation methods.

.2 Cut glazing tape to length and set against permanent stops, projecting 1.6 mm above sight line.

.3 Place setting blocks at 1/4 points, with edge block maximum 150 mm from corners.

.4 Rest glazing on setting blocks and push against tape for full contact at perimeter of light or unit.

.5 Place glazing tape on free perimeter of glazing in same manner described.

.6 Install removable stop without displacement of tape. Exert pressure on tape for full continuous contact.

.7 Knife trim protruding tape.

3.5 INSTALLATION: BUTT JOINT GLAZING

.1 Perform work in accordance with FGMA Glazing Manual, IGMAC, and Laminators Safety Glass Association - Standards Manual for glazing installation methods.

.2 Install glazing in aluminum head and sill frame sections using glazing spline system in accordance with manufacturer’s instructions.

.3 Install butt joints using silicone sealant. Install to full depth of glass. Tool smooth.

.4 Clean glass.

3.6 INSTALLATION: PLASTIC FILM

.1 Install plastic film in accordance with Section 08 87 33 – Decorative Films

.2 Install decorative films prior to installation in frame.

3.7 CLEANING

.1 Perform cleaning after installation to remove construction and accumulated environmental dirt.

.2 Remove traces of primer, caulking.

.3 Remove glazing materials from finish surfaces.

.4 Remove labels after work is complete.

.5 Clean glass and mirrors using approved non-abrasive cleaner in accordance with manufacturer's instructions.

.6 Upon completion of installation, remove surplus materials, rubbish, tools and equipment barriers.

3.8 PROTECTION OF FINISHED WORK

.1 After installation, mark light with an "X" by using removable plastic tape or paste. Do not mark heat absorbing or reflective glass units.

3.9 SCHEDULE

.1 Refer to drawings.

END OF SECTION

Part 1 General

1.1 REFERENCES

.1 American National Standards Institute (ANSI)

.1 ANSI Z97.1-2009, Glazing Materials Used in Buildings, Safety Performance Specifications and Methods of Test.

.2 International Window Film Association (IWFA)

.1 IWFA Visual Quality Standard for Applied Window Film 1999.

.3 Government of Canada

.1 Canada Labour Code, WHMIS datasheets.

1.2 SUBMITTALS

.1 Submittals in accordance with Section 01 33 00 – Submittal Procedures.

.2 Product Data: submit WHMIS MSDS - Material Data Sheets.

.3 Submit shop drawings and product data in accordance with Section 01 33 00 – Submittal Procedures.

.4 Submit samples in accordance with Section 01 33 00 – Submittal Procedures.

.1 Submit one 500 x 500mm sample of film installed on 7mm thick clear plate glass.

.5 Submit Closeout Submittals in accordance with Section 01 78 00 - Closeout Submittals.

.1 Provide operation and maintenance data for window film for incorporation into manual.

.2 Follow manufacturers written instructions for care and maintenance of security and safety film.

.3 Use only cleaning solution recommended by manufacturer for regularly scheduled cleaning of security film.

1.3 QUALITY ASSURANCE

.1 Health and Safety:

.1 Comply with requirements of WHMIS regarding use, handling, storage, and disposal of hazardous materials; and regarding labelling and provision of material safety data sheets acceptable to Canada Labour Code.

1.4 DELIVERY, STORAGE AND HANDLING

.1 Deliver, store and handle materials in accordance with Section 01 61 00 – Common Product Requirements.

.2 Remove from storage, in quantities required for same day use.

.3 Store materials in accordance with manufacturers written instructions.

.4 Waste Management and Disposal:

.1 Separate and recycle waste materials in accordance with Section 01 74 21 – Construction/Demolition Waste Management and Disposal

1.5 WARRANTY

.1 Contractor hereby warrants that Security and Safety Film will stay in place without delaminating, peeling or blistering for 10 years.

.2 Ensure warranty includes items as follows:

.1 Maintaining adhesion properties without blistering, bubbling or delaminating from glass surface.

.2 Maintaining appearance without discolouration.

.3 Removing, replace and reapply defective materials.

.4 In event of product failure under warranty terms, remove and re-apply film without glass replacement at no cost to Owner.

Part 2 Products

2.1 MATERIALS

.1 Polyester

.2 Abrasion resistant coating.

.3 Release liner.

.4 Acrylic pressure sensitive adhesive

.5 Film thickness: 2.76 mil

.6 Film: pattern – Fasara, “Stripe – line” to simulate ripple glass (install in vertical orientation). Confirm pattern prior to ordering. Provide samples of similar material for selection by Departmental Representative.

Part 3 Execution

3.1 PREPARATION

.1 See drawings and specifications for locations of privacy film.

.2 Clean surface of glazing before beginning installation using neutral cleaning solution. Ensure no deleterious material adheres to glass.

.3 Ensure dust, grease, and chemical residue are removed from surface of glazing before installation of film. Examine under natural daylight and identify cracks, blisters, bubbles, discolouration, edge defects or other anomalies that may cause film to delaminate or cause vision transparency or distortion problems. Report findings to Departmental Representative. Correct deficiencies as required to acceptance of Departmental Representative.

.4 Before beginning Work, place absorbent material on windowsill or at sash frame to absorb moisture accumulation generated by film application.

3.2 INSTALLATION

.1 Field Installation of Film to glazing:

.1 Remove window stops prior to installation of film.

.2 Install film to glazing ensuring no blisters, bubbles, scratches or distortions.

.2 Cut film edges straight and square within 3mm of edge of glazing sheet.

.3 Ensure film is installed behind window stops.

.4 Cut edges in accordance with manufacturer’s written instructions.

.5 Apply and attach film to glazing in accordance with manufacturer's written instructions.

.6 Remove left over material form work area and return work area to original condition.

3.3 INSTALLER'S INSPECTION

.1 Visual Inspection: in accordance with IWFA - Visual Quality Standard for Applied Window Film.

.2 Remove and replace without glazing replacement, film that continues to show blisters, bubbles, tears, scratches, edge defects or vision distortion in film when viewed under natural daylight from 1.0 m minimum after 30 day period.

3.4 FINAL CLEANING

.1 Wash interior and exterior of each glazing panel and film using cleaning solution recommended by film manufacturer.

END OF SECTION

General notes:

.1 This schedule is to be read in conjunction with the Drawings and applicable Specification Sections**.**

.2 Refer to Section 08 71 10, Door Hardware for hardware groups.

.3 Refer to Drawings for door and frame types

.4 Refer to Electrical for Card reader rough-ins, door contacts, power operators and associated power. Hardware manufacturer/installer shall be responsible for making all low voltage connections to hardware devices.

.5 Refer to Drawing for "Secure Door" details.

.6 Verify all door and frame sizes prior to ordering.

Door No.	Door				Frame			Rating (Min.)	Glass	Additional Requirements
	Size	Type	Mat'l	Fin.	Type	Mat'l	Fin.			
Main Floor – Refer to Drawing A1.1										
146A	EXIST.	-	-	-	-	-	-	-	-	Overhead Door
146B	900 x 2150	A	HM	PT-	F1	PS	PT-	-	-	
146C	EXIST. PAIR	-	-	PT-	F3	PS	PT-	90 MIN	-	Add horizontal mullion and fixed transom.
147	EXIST. PAIR	-	-	PT-	-	-	PT-	-	-	
148	EXIST.	-	-	PT-	-	-	PT-	-		
149A	EXIST.	-	-	PT-	-	-	PT-	-	-	
149B	900 x 2150	A	HM	PT-	F1	PS	PT-	90 MIN	-	
150	EXIST.	-	-	PT-		-	PT-	-	-	
152	900 x 2150	A	HM	PT-	F1	PS	PT-	-	-	
153A	900 x 2150	A	HM	PT-	F1	PS	PT-	-	-	
153B	EXIST. PAIR	-	-	PT-	F3	PS	PT-	45 MIN	-	Add horizontal mullion and fixed transom.
154	1000 x 2150	A	HM	PT-	F1	PS	PT-	-	-	Secure frame
155A	1000 x 2150	A	HM	PT-	F1	PS	PT-	-	-	Secure frame
155B	1000 x 2150	-	-	PT-	-	PS	PT-	-	-	FREEZER DOOR
156	1000 x 2150	A	HM	PT-	F1	PS	PT-	-	-	Secure frame
158A	1000 x 2150	A	HM	PT-	F1	PS	PT-	45 MIN	-	Secure frame
158B	EXIST			PT-			PT-			
Second Floor – Refer to Drawing A1.2										
205	900 x 2150	A	HM	PT-	F1	PS	PT-	-	-	Secure frame
206	900 x 2150	A	HM	PT-	F1	PS	PT-	45 MIN	-	Secure frame
207	900 x 2150	A	HM	PT-	F1	PS	PT-	-	-	

Door No.	Door				Frame			Rating (Min.)	Glass	Additional Requirements
	Size	Type	Mat'l	Fin.	Type	Mat'l	Fin.			
211	EXIST.	-	-	PT-	-	-	PT-	-	-	
212	900 x 2150	A	ASD	PT-	F2	PS	PT-	-	-	**STC 50** (Section 08 34 74); Secure frame
213	900 x 2150	A	HM	PT-	F1	PS	PT-	45 MIN	-	Secure frame
214	900 x 2150	A	HM	PT-	F1	PS	PT-	-	-	Secure frame
215	900 x 2150	A	HM	PT-	F1	PS	PT-	-	-	Secure frame
216	900 x 2150	A	HM	PT-	F1	PS	PT-	45 MIN	-	Secure frame

Abbreviations:
HM – Hollow Metal Door
AN – Anodized Aluminum
ASD – Acoustic Steel Door (08 34 74)
IMD – Insulated Metal Door
PT# – Paint (# Denotes Colour)
PS – Pressed Steel Frame (welded) (08 11 00 & 08 34 74)
SCW – Solid Core Wood
TG – Tempered Glass

This schedule is to be read in conjunction with the Drawings and Specification Sections.

Room No.	Floor	Base	Walls				Ceiling	Notes:
			N	S	E	W		
Main Floor								
146	EXIST.	-	PT-1	-	PT-1	-	EXP	
147	CONC P	-	PT-1	PT-1	PT-1	PT-1	EXP	
148	CPT / CPT-1	CPT	PT-1	PT-1	PT-1	PT-1	DCP3	
149	CPT	CPT	PT-1	PT-1	PT-1	PT-1	MTL	
150	EXIST.	-	-	-	-	-	EXIST.	
151	VSF	RB	PT-1	PT-1	PT-1	PT-1	EXP	
152	VSF	RB	PT-2	PT-2	PT-2	PT-2	EXP	
153	CPT	CPT	PT-1	PT-3	PT-1	PT-1	ATC / DCP-1	
154	CONC P	RB	PT-1	PT-1	PT-1	PT-1	EXP	
155 Vestibule	CONC P	RB	PT-1	PT-1	PT-1	PT-1	EXP	
155	CHPL	-	-	-	-	-	FREEZER	
156	CONC P	RB	PT-1	PT-1	PT-1	PT-1	EXIST.	
157	CONC P	RB	PT-1	PT-1	PT-1	PT-1	ATC / EXP	
158	CONC P / VSF	-	PT-1	PT-1	PT-1	PT-1	GB	VSF AT MOBILE FILE AREA
159	-	RB	PT-1	PT-1	PT-1	PT-1	EXP	
Second Floor								
204	EXIST / CPT	EXIST / CPT	-	PT-1	PT-1	PT-1	-	Repair carpet tile and base where affected by renovations
205	CPT	CPT	PT-1	PT-1 / PT-3	PT-1	PT-1 / PT-3	ATC / GP / DCP-2	
206	SDT	RB	PT-1	PT-1	PT-1	PT-1	EXP	
207	EXIST / CPT	EXIST / CPT	PT-1	PT-1	PT-1	PT-1	MTL	
210	CPT	CPT	PT-1	PT-1	PT-1	PT-1	DCP-3	
211	CPT	CPT	PT-1	PT-1	PT-1	PT-1	MTL	
212	CPT / CPT-1	CPT	PT-1	PT-1	PT-1	PT-1	DCP-1	
213	SDT	RB	PT-1	PT-1	PT-1	PT-1	EXP	
214	CPT	CPT	PT-1	PT-1	PT-1	PT-1 / PT-3	ATC / DCP-1 / DCP-2	
215	CPT	CPT	PT-1	PT-1	PT-1	PT-1	EXP	
216	SDT	RB	PT-1	PT-1	PT-1	PT-1	EXP	

List of Abbreviations:

FLOORING		
CONC	CONCRETE	
CONC P	POLISHED CONCRETE	03 35 43
CHPL	CHECKER PLATE	
CPT	CARPET TILE	
CPT-1	CARPET TILE ACCENT	
RB	RUBBER BASE	09 65 16
CB	CARPET BASE	
RSSF	RESILIENT SHEET SAFETY FLOORING	09 65 16
SDT	STATIC DISSIPATIVE VINYL TILE	09 65 16
VSF	HOMOGENEOUS SHEET VINYL	09 65 16
CEILING		
DCP- 1	DECORATIVE PANEL TYPE 1 – CAPZ	09 51 13
DCP- 2	DECORATIVE PANEL TYPE 2 - WOOD	09 51 13
DCP- 3	DECORATIVE PANEL TYPE 3 – OPEN CELL WOOD	09 51 13
ATC	ACOUSTIC TILE CEILING	09 51 13
EXP	EXPOSED	
LMC	LINEAR METAL CEILING	
GB	GYPSUM BOARD (PAINTED)	
WALL		
PT- 1	COLOR 1	
PT- 2	COLOR 2	
PT- 3	COLOR 3	
AWP	ACOUSTIC WALL PANEL	
DP	DECORATIVE PANEL	

EXIST.	EXISTING MATERIAL TO REMAIN	

Part 1 General

1.1 REFERENCES

.1 American Society for Testing and Materials International, (ASTM)

- .1 ASTM C36/C36M-03e1, Specification for Gypsum Wallboard.
- .2 ASTM C475-12, Specification for Joint Compound and Joint Tape for Finishing Gypsum Board.
- .3 ASTM C840-11, Specification for Application and Finishing of Gypsum Board.
- .4 ASTM C841-03(2008), Standard Specification for Installation of Interior Lathing and Furring.
- .5 ASTM C1002-07, Specification for Steel Self-Piercing Tapping Screws for the Application of Gypsum Panel Products or Metal Plaster Bases to Wood Studs or Steel Studs.
- .6 ASTM C1047-10a, Specification for Accessories for Gypsum Wallboard and Gypsum Veneer Base.
- .7 ASTM C1178/C1178M-11, Specification for Glass Mat Water-Resistant Gypsum Backing Board.
- .8 ASTM C1396/C1396M-11, Standard Specification for Gypsum Board.
- .9 ASTM C1629/C1629M-06(2011), Standard Classification for Abuse-Resistant Nondecorated Interior Gypsum Panel Products and Fiber-Reinforced Cement Panels

.2 Association of the Wall and Ceilings Industries International (AWEI)

.3 Canadian General Standards Board (CGSB)

- .1 CAN/CGSB-51.34-M86(R1988), Vapour Barrier, Polyethylene Sheet for Use in Building Construction.

.4 Underwriters' Laboratories of Canada (ULC)

- .1 CAN/ULC-S102-2007, Surface Burning Characteristics of Building Materials and Assemblies.

1.2 DELIVERY, STORAGE AND HANDLING

.1 Deliver materials in original packages, containers or bundles bearing manufacturers brand name and identification.

.2 Store materials inside, level, under cover. Keep dry. Protect from weather, other elements and damage from construction operations and other causes.

.3 Handle gypsum boards to prevent damage to edges, ends or surfaces. Protect metal accessories and trim from being bent or damaged.

1.3 SITE ENVIRONMENTAL REQUIREMENTS

.1 Maintain temperature minimum 10 degrees C, maximum 21 degrees C for 48 hours prior to and during application of gypsum boards and joint treatment, and for at least 48 hours after completion of joint treatment.

.2 Apply board and joint treatment to dry, frost free surfaces.

.3 Ventilation: Ventilate building spaces as required to remove excess moisture that would prevent drying of joint treatment material immediately after its application.

1.4 WASTE MANAGEMENT AND DISPOSAL

.1 Separate and recycle waste materials in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.

.2 Divert unused metal materials from landfill to metal recycling facility.

.3 Do not dispose of unused paint and caulking materials into sewer systems, into lakes, streams, onto ground or in other locations where it will pose health or environmental hazard.

Part 2 Products

2.1 MATERIALS

.1 Standard board: to ASTM C36/C36M, Type X, 16 mm thick, 1200 mm wide x maximum practical length, ends square cut, edges bevelled.

.2 Glass mat water-resistant gypsum backing board: to ASTM C1178/C1178M, 16 mm thick, 1200 mm wide x maximum practical length.

.3 Abuse-resistant gypsum board: to ASTM C1396 and ASTM C1629, 12.7 mm thick, 1200 mm wide x maximum practical length, ends square cut, edges bevelled.

.4 Metal furring runners, hangers, tie wires, inserts, and anchors required for installation to ASTM C841.

.5 Drywall furring channels: 0.5 mm core thickness galvanized steel channels for screw attachment of gypsum board.

.6 Resilient drywall furring: 0.5 mm base steel thickness galvanized steel for resilient attachment of gypsum board.

.7 Metal channel stiffener: 19 x 1.4 mm thick cold rolled steel, coated with rust inhibitive coating.

.8 Steel drill screws: to ASTM C1002.

.9 Casing beads, corner beads, control joints and edge trim: to ASTM C1047, metal, zinc-coated by electrolytic process, 0.5 mm base thickness, perforated flanges, one piece length per location.

.10 Sealants: in accordance with Section 07 92 00 - Joint Sealants.

.11 Acoustic sealant: in accordance with Section 07 92 00 - Joint Sealants.

.12 Polyethylene: to CAN/CGSB-51.34, Type 2.

.13 Insulating strip: rubberized, moisture resistant, 3 mm thick closed cell neoprene strip, 12 mm wide, with self-sticking permanent adhesive on one face, lengths as required.

.14 Joint compound: to ASTM C475, asbestos-free.

Part 3 Execution

3.1 ERECTION

.1 Do application and finishing of gypsum board in accordance with ASTM C840 except where specified otherwise.

.2 Erect hangers and runner channels for suspended gypsum board ceilings in accordance with ASTM C840 except where specified otherwise.

.3 Support light fixtures by providing additional ceiling suspension hangers within 150 mm of each corner and at maximum 600 mm around perimeter of fixture.

.4 Install work level to tolerance of 1:1200.

.5 Frame with furring channels, perimeter of openings for access panels, light fixtures, diffusers, and grilles.

.6 Furr for gypsum board faced vertical bulkheads within and at termination of ceilings.

.7 Furr above suspended ceilings for gypsum board fire and sound stops and to form plenum areas as indicated.

.8 Install wall furring for gypsum board wall finishes in accordance with ASTM C840, except where specified otherwise.

.9 Furr openings and around built-in equipment, cabinets, access panels, on four sides. Extend furring into reveals. Check clearances with equipment suppliers.

.10 Furr duct shafts, beams, columns, pipes and exposed services where indicated.

.11 Erect drywall resilient furring transversely across studs, spaced maximum 600 mm on centre and not more than 150 mm from ceiling/wall juncture. Secure to each support with 25 mm drywall screw.

3.2 APPLICATION

.1 Do not apply gypsum board until bucks, anchors, blocking, sound attenuation, electrical and mechanical work are approved.

.2 Apply single and double layer gypsum board (as indicated on drawings) to metal furring or framing using screw. Maximum spacing of screws, 300 mm on centre.

.1 Single-Layer Application:

.1 Apply gypsum board on ceilings prior to application of walls in accordance with ASTM C840.

.2 Apply gypsum board vertically or horizontally, providing sheet lengths that will minimize end joints.

.2 Double-Layer Application:

.1 Install gypsum board for base layer and exposed gypsum board for face layer.

.2 Apply base layer to ceilings prior to base layer application on walls; apply face layers in same sequence. Offset joints between layers at least 250 mm.

.3 Apply base layers at right angles to supports unless otherwise indicated.

.4 Apply base layer on walls and face layers vertically with joints of base layer over supports and face layer joints offset at least 250 mm with base layer joints.

.3 Apply water-resistant gypsum board where wall tiles to be applied. 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.

.4 Install ceiling boards in direction that will minimize number of end-butt joints. Stagger end joints at least 250 mm.

.5 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.

.6 Install gypsum board with face side out.

.7 Do not install damaged or damp boards.

.8 Locate edge or end joints over supports. Stagger vertical joints over different studs on opposite sides of wall.

3.3 INSTALLATION

.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. Secure at 150 mm on centre.

.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.

.4 Install closed cell foam neoprene gasket where partitions abut window mullions, to provide sound seal gasket.

.5 Construct control joints of preformed units set in gypsum board facing and supported independently on both sides of joint.

.6 Provide continuous polyethylene dust barrier behind and across control joints.

.7 Apply 12 mm diameter bead of acoustic sealant continuously around perimeter of first layer of multiple layers of gypsum board to seal gypsum board/structure junction where partitions abut fixed building components. Seal full perimeter of cut-outs around electrical boxes, ducts, and penetrations, in partitions where perimeter sealed with acoustic sealant.

.8 Install access doors to electrical and mechanical fixtures specified in respective sections.

.1 Rigidly secure frames to furring or framing systems.

.9 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.

.10 Gypsum Board Finish: finish gypsum board walls and ceilings to following levels in accordance with Association of the Wall and Ceiling Industries (AWCI) International Recommended Specification on Levels of Gypsum Board Finish:

.1 Levels of finish:

.1 Level 0: No tapping, finishing or accessories required.

.2 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.

.3 Level 2: Embed tape for joints and interior angles in joint compound and apply one separate coat of joint compound over joints, angles, fastener heads and accessories; surfaces free of excess joint compound; tool marks and ridges are acceptable.

.4 Level 3: Embed tape for joints and interior angles in joint compound and apply two separate coats of joint compound over joints, angles, fastener heads and accessories; surfaces smooth and free of tool marks and ridges.

.5 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.

.6 Level 5: 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; apply a thin skim coat of joint compound to entire surface; surfaces smooth and free of tool marks and ridges.

.11 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.

.12 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.

.13 Sand lightly to remove burred edges and other imperfections. Avoid sanding adjacent surface of board.

.14 Completed installation to be smooth, level or plumb, free from waves and other defects and ready for surface finish.

.15 Mix joint compound slightly thinner than for joint taping.

.16 Apply thin coat to entire surface using trowel or drywall broadknife to fill surface texture differences, variations or tool marks.

.17 Allow skim coat to dry completely.

.18 Remove ridges by light sanding or wiping with damp cloth.

.19 Provide protection that ensures gypsum drywall work will remain without damage or deterioration at time of substantial completion.

3.4 CONTROL JOINTS

.1 Provide control joints at not greater than 9 m spacing on continuous gypsum board walls in a single plane and at not greater than 9 m spacing on ceilings and bulkheads except where indicated otherwise in the drawings.

.1 Confirm location of control joints with the Consultant prior to installation of gypsum board

.2 Provide control joints of preformed units set in gypsum board facing and supported independently on both sides of joint. Interrupt top and bottom tracks at location of control joint.

.3 Install control joints straight and true. Finish control joints as required with two coats of joint compound and one coat of taping compound, feathered out onto panel faces.

3.5 SCHEDULES

.1 Levels of finish: Interior partitions;

.1 Level 1:

.1 Plenums above suspended ceilings, inside of duct shafts and other gypsum board wall areas not exposed to view.

.2 Level 5:

.1 Vertical surfaces exposed to view.

.2 Ceilings and underside of bulkheads exposed to view.

END OF SECTION

Part 1 General

1.1 REFERENCES

.1 American Society for Testing and Materials International, (ASTM).

.1 ASTM A627-03: Standard Test Methods for Tool-Resisting Steel Bars, Flats, and Shapes for Detention and Correctional facilities.

.2 ASTM C645-11a, Specification for Nonstructural Steel Framing Members.

.3 ASTM C754-11, Specification for Installation of Steel Framing Members to Receive Screw-Attached Gypsum Panel Products.

.4 ASTM F2367-07: Standard Specification for Metal Expanded Steel

.2 Canadian Standards Association (CSA International)

.1 CSA W59-03(R2008),Welded Steel Construction (Metal Arc Welding).

.3 Expanded Metal Manufacturers Association (EMMA)

.1 EMMA 557-99 Standard for Expanded Metal

1.2 QUALITY ASSURANCE

.1 Test Reports: certified test reports showing compliance with specified performance characteristics and physical properties.

.2 Certificates: product certificates signed by manufacturer certifying materials comply with specified performance characteristics and criteria and physical requirements.

1.3 WASTE MANAGEMENT AND DISPOSAL

.1 Separate and recycle waste materials in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.

.2 Divert unused metal materials from landfill to metal recycling facility.

Part 2 Products

2.1 MATERIALS

.1 Non-load bearing channel stud framing: to ASTM C645, stud size as noted on drawings and Partition Schedule, roll formed from 0.478 mm steel (25ga) and from 1.146 steel (18ga) as noted on drawings and Partition Schedule for Secure Demising Wall (SDW); hot dipped galvanized steel sheet, for screw attachment of gypsum board. Knock-out service holes at 460 mm centres.

.2 Floor and ceiling tracks: to ASTM C645, in widths to suit stud sizes, 32 mm flange height. Thickness as noted for studs in Partition Schedule.

.3 Metal channel stiffener: cold rolled steel, coated with rust inhibitive coating.

.4 Expanded Mesh: To EMMA 557-99. Style 19mm-9F. 19mm #9/10 roll-flattened steel mesh. Nominal strand thickness of 3mm. Diamond opening of 14mm x 43mm.

.5 Acoustical sealant: in accordance with Section 07 92 00 – Joint Sealants.

.6 Insulating strip: rubberized, moisture resistant 3 mm thick closed cell neoprene strip, 12 mm wide, with self sticking permanent adhesive on one face, lengths as required.

.7 Welding materials: to CSA W59.

Part 3 Execution

3.1 ERECTION

.1 Align partition tracks at floor and ceiling and secure at 400 mm on centre maximum for normal partitions.

.2 For Secure Demising Wall (SDW) partitions: secure top and bottom tracks at 300mm on centre using expanding (preferably double expanding) mechanical fastener. Non-expanding (e.g. Tapcon") screws are NOT acceptable.

.3 Install damp proof course under stud shoe tracks of partitions on slabs on grade.

.4 For normal partitions: place studs vertically at 600 mm on centre (refer to drawings) and not more than 50 mm from abutting walls, and at each side of openings and corners. Position studs in tracks at floor and ceiling. Cross brace steel studs as required to provide rigid installation to manufacturer's instructions. Attach studs to bottom track using screws.

.5 For SDW partitions: place studs vertically at 300mm on centre (refer to drawings) and secure to top and bottom tracks with welds or rivets (not screws). Install double studs at door frame openings. Install door frame as per HMMA 840-07 part 3 A,B,C,D, and E except that screws shall be replaced with steel rivets. Install anti-spread bracing approximately 1200mm on centre vertically from the bottom of the wall between the door jamb and adjacent stud on both sides of the frame. Construct corners with double studs.

.6 Erect metal studding to tolerance of 1:1000.

.7 For SDW partitions: Install expanded mesh on "attack" side of partition. Support all edges using anti-spread bracing or studs. Align edges to centre of supports. Secure to studs by welding or use of rivets. Fillet (3mm) weld at 200mm on centre along strand to stud or rivet to studs (preferred) using 1.9mm (3/16") steel pop rivet with 38mm outside diameter/ 1.9mm inside diameter fender washer at 200mm on centre. Do not overlap mesh at supports. Fasten each sheet separately.

.8 Co-ordinate simultaneous erection of studs with installation of service lines. When erecting studs ensure web openings are aligned.

.9 Co-ordinate erection of studs with installation of door/window frames and special supports or anchorage for work specified in other Sections.

.10 Provide two studs extending from floor to ceiling at each side of openings wider than stud centres specified. Weld studs together, placed alongside frame anchor clips.

.11 For SDW partitions: Install 16 ga steel sheet to face of studs for 1200mm each side of door jamb and 1200mm above head of door on inside of room. This is in addition to the expanded mesh on the “attack” exterior side of the partition. Attach as per rivet requirements for mesh.

.12 Do welding work in accordance with CSA W59 unless specified otherwise

.13 Erect track at head of door/window openings and sills of sidelight/window openings to accommodate intermediate studs. Secure track to studs at each end, in accordance with manufacturer's instructions. Install intermediate studs above and below openings in same manner and spacing as wall studs.

.14 Frame openings and around built-in equipment, cabinets, access panels, on four sides. Extend framing into reveals. Check clearances with equipment suppliers.

.15 Install steel studs or furring channel between studs for attaching electrical and other boxes.

.16 Extend partitions to ceiling height except where noted otherwise on drawings.

.17 Maintain clearance under beams and structural slabs to avoid transmission of structural loads to studs. Use double track slip joint.

.18 Install continuous insulating strips to isolate studs from uninsulated surfaces.

.19 Install two continuous insulating strips between ceiling track and floor slab and around perimeter of sound control partitions.

.20 Install purpose made foam gasket between top of track and fluted metal deck at sound control partitions.

.21 Install proprietary fire stop material between top of track and fluted metal deck at fire rated partitions.

3.2 CLEANING

.1 Upon completion of installation, remove surplus materials, rubbish, tools and equipment barriers.

END OF SECTION

Part 1 General

1.1 REFERENCES

.1 American Society for Testing and Materials International (ASTM)

.1 ASTM E 413-87(1999) Standard Classification for Rating Sound Insulation

.2 ASTM E1264-08e1, Standard Classification for Acoustical Ceiling Products.

.3 ASTM E1477-98a(2013), Standard Test Method for Luminous Reflectance Factor of Acoustical Materials by Use of Integrating-Sphere Reflectometers.

.4 ASTM E 1414-00a Standard test method for Airborne Sound Attenuation Between Rooms sharing a Common Ceiling Plenum

.2 Canadian General Standards Board (CGSB)

.1 CAN/CGSB-92.1-M89, Sound Absorptive Prefabricated Acoustical Units.

.3 Canadian Standards Association (CSA International)

.1 CSA B111-1974(R2003), Wire Nails, Spikes and Staples.

.4 Health Canada/Workplace Hazardous Materials Information System (WHMIS)

.1 Material Safety Data Sheets (MSDS).

.5 Underwriter's Laboratories of Canada (ULC)

.1 CAN/ULC-S102-10, Surface Burning Characteristics of Building Materials and Assemblies.

1.2 SUBMITTALS

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

.2 Product Data: submit WHMIS MSDS in accordance with Section 02 81 01 - Hazardous Materials.

1.3 QUALITY ASSURANCE

.1 Health and Safety:

.1 Do construction occupational health and safety in accordance with Section 01 35 29.06 - Health and Safety Requirements.

1.4 PRE-INSTALLATION MEETING

.1 Convene pre-installation meeting two weeks prior to beginning work of this Section, with contractor's representative, Departmental Representative, and Consultants in accordance with Section 01 32 16.07 - 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.

1.5 DELIVERY, STORAGE AND HANDLING

.1 Protect on site stored or installed absorptive material from moisture damage.

.2 Store extra materials required for maintenance, where directed by Departmental Representative.

.3 Waste Management and Disposal:

.1 Separate waste materials for reuse and recycling in accordance with Section 01 74 21 - Construction /Demolition Waste Management and Disposal.

.2 Remove from site and dispose of packaging materials at appropriate recycling facilities.

.3 Collect and separate for disposal paper, plastic, polystyrene, corrugated cardboard, and packaging material for recycling in accordance with Waste Management Plan (WMP).

1.6 ENVIRONMENTAL REQUIREMENTS

.1 Permit wet work to dry before beginning to install.

.2 Maintain uniform minimum temperature of 15 degrees C and humidity of 20-40% before and during installation.

.3 Store materials in work area 48 hours prior to installation.

1.7 EXTRA MATERIALS

.1 Provide extra materials of acoustic units in accordance with Section 01 78 00 - Closeout Submittals.

.2 Provide acoustical units amounting to 5% of gross ceiling area for each pattern and type of acoustic lay in tiles required for project.

.3 Ensure extra materials are from same production run as installed materials.

.4 Clearly identify each type of acoustic unit, including colour and texture.

.5 Deliver to Departmental Representative, upon completion of the work of this section.

Part 2 Products

2.1 MATERIALS

.1 Acoustic units for suspended ceiling system: to CAN/CGSB-92.1 and ASTM E1264, designated by “ATC” in Room Finish Schedule.

.1 Type XII, Form 2, Pattern E (match surface of Armstrong Optima Tegular Lay-in)

.2 Class A.

.3 Fibreglass with minimum 70% recycled content.

.4 Pattern: No pattern.

.5 Textures: fine.

.6 Flame spread rating of 25 or less in accordance with CAN/ULC-S102.

.7 Smoke developed 50 or less in accordance with CAN/ULC-S102.

.8 Noise Reduction Coefficient (NRC) designation of 0.95.

.9 Ceiling Attenuation Class (CAC) rating 26, in accordance with ASTM E1264

.10 Light Reflectance (LR) range of 0.90 to ASTM E1477.

.11 Edge type: tegular.

.12 Colour: “white”.

.13 Size: 610 x 610 x 25 mm thick.

.14 Humidity resistant: proprietary coating.

.15 Surface coverings: low VOC paint.

.16 Perimeter trim: On all exposed ends of ceilings provide 150mm high extruded aluminum trim (flat profile). Finish “white” to match grid.

.17 Acceptable manufacturers:

.1 Armstrong, CGC, CertainTeed, Celotex, or approved alternate.

.2 Decorative Panel Type 1: Designated as “DCP-1” in Room Finish Schedule

.1 Fibreglass (> 50% recycled content) with acoustically transparent scrim with factory applied latex paint – colour white

.2 Size: 1220mm x 2135mm

.3 Fire Class A to ASTM E1264

.4 Light Reflectance (LR) range of 0.90 to ASTM E1477

.5 Noise Reduction Coefficient (NRC) designation of 0.95

.6 Flame spread rating of 25 or less in accordance with CAN/ULC-S102.

.7 Smoke developed 50 or less in accordance with CAN/ULC-S102.

.8 No pattern

.9 Texture: fine

.10 Suspended installation: concealed 15/16” suspension system with purpose made suspension rods to coincide with suspension points of panels. Support point covers shall be white textured cap at underside (exposed) of panel. Support at sufficient spacing to prevent deflection of panels to less than 3mm.

.11 Provide panel stiffeners as required by size of panels

.12 10 year manufacturer’s warranty on panels

.3 Decorative Panel Type 2: Designated as “DCP-2” in Room Finish Schedule

.1 FSC-certified fire retardant particle board with face-cut veneers

.2 Real wood veneer: species to be selected by Departmental Representative from manufacturer’s range

.3 Panels to be perforated with round openings in straight lines (pattern to match Armstrong W4)

.4 Tinted semi-gloss coating on face of panels: colour to be selected from manufacture’s range

.5 Size 610mm x 1220mm with 6mm reveal between panels

.6 Flame spread rating of 25 or less in accordance with CAN/ULC-S102.

.7 Smoke developed 50 or less in accordance with CAN/ULC-S102.

.8 Fire Class A ASTM E1264

.9 Suspended installation: concealed 15/16" suspension system with purpose made concealed clips to fasten to T bar

.10 Perimeter Trim: extruded aluminum with matching wood veneer. 150mm height

.4 Decorative Panel Type 3: Designated as "DCP-3" in Room Finish Schedule

.1 Solid Poplar wood cell ceiling

.2 All material to be Class A intumescent treated

.3 Tinted semi-gloss coating on face of panels: colour to be selected from manufacture's range

.4 Panel size 610mm x 610mm x 60mm; 305 x 305 cells; with 6mm reveal between panels

.5 Flame spread rating of 25 or less in accordance with CAN/ULC-S102.

.6 Smoke developed 50 or less in accordance with CAN/ULC-S102.

.7 Fire Class A ASTM E1264

.8 Suspended installation: concealed 15/16" suspension system. Colour "black"

.9 Perimeter Trim: extruded aluminum 150mm height. Colour "black"

.5 Staples, nails and screws: to CSA B111 non-corrosive finish as recommended by acoustic unit manufacturer.

Part 3 Execution

3.1 EXAMINATION

.1 Do not install acoustical panels and tiles until work above ceiling has been inspected by Departmental Representative.

3.2 INSTALLATION

.1 Follow manufacturer's written instructions for installation.

.2 Install acoustical panels and tiles in ceiling suspension system.

.3 Install decorative panel ceilings onto suspension system.

.4 Install extruded aluminum trim to Decorative Panels Types 2 and 3.

3.3 APPLICATION

.1 Install all ceiling panels parallel to building lines with edge unit not less than 50% of unit width. Refer to reflected ceiling plan.

.2 Scribe acoustic units to fit adjacent work. Butt joints tight, terminate edges with moulding.

3.4 INTERFACE WITH OTHER WORK

.1 Attend Pre-Installation Meeting to coordinate work of ceilings, mechanical and electrical systems.

.2 Co-ordinate ceiling work to accommodate components of other sections, such as light fixtures, diffusers, speakers, sprinkler heads, to be built into acoustical ceiling components.

.3 Co-ordinate ceiling components to accommodate components associated with operation and maintenance of Mechanical equipment installed above suspended ceiling.

END OF SECTION

Part 1 General

1.1 REFERENCES

.1 American Society for Testing and Materials International (ASTM)

.1 ASTM C635-12, Standard Specifications for the Manufacture, Performance and Testing of Metal Suspension Systems for Acoustical Tile and Lay-In Panel Ceilings.

.2 ASTM C636/C636M-08, Standard Practice for Installation of Metal Ceiling Suspension Systems for Acoustical Tile and Lay-In Panels.

.2 Health Canada/Workplace Hazardous Materials Information System (WHMIS)

.1 Material Safety Data Sheets (MSDS).

1.2 DESIGN REQUIREMENTS

.1 Maximum deflection: 1/360th of span to ASTM C635 deflection test.

1.3 SUBMITTALS

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

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:

.1 Separate waste materials for reuse and recycling in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.

1.5 SEQUENCING

.1 Layout ceiling grid to ensure main tees do not interfere with access to mechanical units installed above the suspended ceiling. Cross tees to be removable at access points to mechanical units installed above the suspended ceiling.

1.6 PRE-INSTALLATION MEETING

.1 Convene pre-installation meeting at request of Departmental Representative, with contractor's representative, Departmental Representative, and Consultants in accordance with Section 01 32 16.07 - Construction Progress Schedule - Bar (GANTT) Chart to:

.1 Verify project requirements.

.2 Review installation and substrate conditions.

.3 Co-ordination with Mechanical and Electrical above ceiling systems.

Part 2 Products

2.1 MATERIALS

.1 Heavy duty system to ASTM C635.

.2 Basic materials for suspension system: commercial quality cold rolled steel.

.3 Suspension system: non fire rated, made up as follows:

.1 Two directional exposed tee bar grid.

.2 Perimeter specialty grids.

.3 Recycled Content: 53% post-consumer content, 61% total content.

.4 Exposed tee bar grid components for ATC: shop painted satin sheen. Components die cut. Hot-dipped galvanized steel. Main tee with double web, rectangular bulb and 24 mm rolled cap on exposed face. Cross tee with rectangular bulb; web extended to form positive interlock with main tee webs; lower flange extended and offset to provide flush intersection. Wall moulding: L-shaped, hemmed edges, 43mm leg height, 24 mm reveal, shop painted satin sheen.

.1 Colour: White

.2 Acceptable material:

.1 Armstrong Prelude XL;

.2 Donn DX/DXL;

.3 Approved alternate.

.5 Concealed tee bar grid components for DCP 1 acoustic panel ceilings: shop painted satin sheen. Components die cut. Hot-dipped galvanized steel. Main tee with double web, rectangular bulb and 24 mm rolled cap on exposed face. Cross tee with rectangular bulb; web extended to form positive interlock with main tee webs; lower flange extended and offset to provide flush intersection. Wall moulding: L-shaped, hemmed edges, 43mm leg height, 24 mm reveal, shop painted satin sheen.

.1 Colours: ‘black’

.2 Acceptable material:

.1 Armstrong Prelude XL;

.2 Donn DX/DXL;

.3 Approved alternate.

.6 Concealed tee system for DCP 2 wood panel ceilings: shop painted satin sheen. Components die cut. Hot-dipped galvanized steel. Heavy duty main tee with double web, rectangular bulb and 24 mm rolled cap on exposed face. 43mm high cross tee with rectangular bulb; web extended to form positive interlock with main tee webs; lower flange extended and offset to provide flush intersection. Wall moulding: L-shaped, hemmed edges, 43mm leg height, 24 mm reveal, shop painted satin sheen. Provide all snap bars, hangers, clips and accessories for a complete system.

.1 Colour: an all exposed surfaces: ‘black’

.2 Acceptable material:

.1 Armstrong Prelude XL;

.2 Donn Fineline DXF;

.3 Approved alternate.

.7 Concealed tee system for DCP 3 wood cell ceilings: shop painted satin sheen. Components die cut. Hot-dipped galvanized steel. Heavy duty main tee with double web, rectangular bulb and 24 mm rolled cap on exposed face. 43mm high cross tee with rectangular bulb; web extended to form positive interlock with main tee webs; lower flange extended and offset to provide flush intersection. Wall moulding: L-shaped, hemmed edges, 43mm leg height, 24 mm reveal, shop painted satin sheen. Provide all snap bars, hangers, clips and accessories for a complete system.

.1 Colour: an all exposed surfaces: ‘black’

.2 Acceptable material:

.1 Armstrong Prelude XL;

.2 Donn Fineline DXF;

.3 Approved alternate.

.8 Hanger wire: galvanized soft annealed steel wire:

.1 3.6 mm minimum diameter for access tile ceilings. Increase sizes as required for ceiling loads.

.2 Colour “black”.

.9 Hanger inserts: purpose made.

.10 Accessories: splices, clips, wire ties, snap bars, carrying channels, retainers and wall moulding, to complement suspension system components, as recommended by system manufacturer.

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 Installation: in accordance with ASTM C636 except where specified otherwise.

.2 Install suspension system to manufacturer's instructions.

.3 Do not erect ceiling suspension system until work above ceiling has been reviewed by Departmental Representative.

.4 Secure hangers to overhead structure using attachment methods as indicated and acceptable to Departmental Representative.

.5 Install hangers spaced at maximum 1200 mm centres and within 150 mm from ends of main tees.

.6 Lay out centre line of ceiling both ways, to provide balanced borders at room perimeter, with border units not less than 50% of standard unit width. Conform to general layout indicated on reflected ceiling plan.

.7 Ensure suspension system is co-ordinated with location of related components.

.8 Install wall moulding to provide correct ceiling height.

.9 Completed suspension system to support super-imposed loads, such as lighting fixtures, diffusers, grilles and speakers.

.10 Support at light fixtures and diffusers with additional ceiling suspension hangers within 150 mm of each corner and at maximum 600 mm around perimeter of fixture.

.11 Interlock cross member to main runner to provide rigid assembly.

.12 Frame at openings for light fixtures, air diffusers, speakers and at changes in ceiling heights.

.13 Finished ceiling system to be square with adjoining walls and level within 1:1000.

3.3 CLEANING

.1 Proceed in accordance with Section 01 74 11 - Cleaning.

.2 Touch up scratches, abrasions, voids and other defects in painted surfaces.

END OF SECTION

Part 1 General

1.1 REFERENCES

.1 American Society for Testing and Materials International (ASTM)

.1 ASTM A 641 Standard Specification for Zinc-Coated (Galvanized) Carbon Steel Wire.

.2 ASTM B 209 Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate.

1.2 DESIGN REQUIREMENTS

.1 Maximum deflection: 1/360th of span to ASTM C635 deflection test.

1.3 SUBMITTALS

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

.2 Product Data

.1 Submit manufacturer's technical data for each type of ceiling unit and suspension system required.

.3 Installation Instructions

.1 Submit manufacturer's installation instructions.

1.4 DELIVERY, STORAGE AND HANDLING

.1 Deliver, store and handle materials in accordance with Section 01 61 00 – Common Product Requirements.

Part 2 Products

2.1 MATERIALS

.1 Linear Metal Ceiling (Interior)

.1 Material: Aluminum.

.2 Finish: Post-production, powder-coat painted.

.3 Thickness: 0.7 mm (nominal) (0.025 inch).

.4 Size: Nominal 80 mm wide panels with 20 mm reveal (leave open), 25 mm high x length to suit.

.5 Edge Details: Square.

.6 Color: selected from manufacturers standard range of colours.

.7 Unperforated.

.8 Texture: Smooth.

2.2 SUPSPENSION

.1 Universal hat shaped 1mm (.038 inch) roll-formed aluminum section with hook shaped tabs spaced to receive ceiling panels at 50mm on centre. Support holes spaced 100mm on centre. Factory applied “black” enamel.

.2 Hanger Wire: Minimum 12 gauge pre-stretched galvanized steel wire.

.3 Hanger Clip: Provide carrier steel clip to connect carriers to hanger wires.

.4 Accessories: Provide accessories including panel splices, panel end caps, and trim molding as required to suit installation. Finish to match ceiling panels. Refer to electrical and mechanical for devices in ceilings.

Part 3 Execution

3.1 INSTALLATION

.1 Comply with manufacturer's written recommendations or specifications, including product technical bulletins, handling, storage and installation instructions, and datasheets.

.2 Comply with applicable industry standards and local regulations in effect including requirements for wind uplift performance.

.3 Secure hangers to overhead structure using industry approved attachment methods.

.4 Ensure suspension system is co-ordinated with location of related components.

.5 Install wall moulding to provide correct ceiling height.

.6 Completed suspension system to support super-imposed loads, such as lighting fixtures.

.7 Frame at openings for penetrations through metal ceiling such as light fixtures.

.8 Adjust ceiling components to provide a consistent finish and appearance in conformity.

.9 Finished linear metal ceiling system to be square with adjoining walls and level within 1:1000.

3.2 CLEANING

.1 Proceed in accordance with Section 01 74 11 – Cleaning.

.2 Touch up scratches, abrasions, voids and other defects in painted surfaces.

END OF SECTION

Part 1 General

1.1 REFERENCES

.1 American Society for Testing and Materials International (ASTM)

.1 ASTM F1913, Standard Specification for Homogeneous Sheet Vinyl Floor Covering.

.2 Health Canada/Workplace Hazardous Materials Information System (WHMIS)

.1 Material Safety Data Sheets (MSDS).

1.2 SUBMITTALS

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

.2 Provide product data in accordance with Section 01 33 00 - Submittal Procedures.

.3 Provide samples in accordance with Section 01 33 00 - Submittal Procedures.

.1 Submit duplicate 300 x 300 mm sample pieces of sheet material, 300 mm long base and edge strips.

.4 Closeout Submittals:

.1 Provide maintenance data for resilient flooring for incorporation into manual specified in Section 01 78 00 - Closeout Submittals.

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:

.1 Separate waste materials for reuse and recycling in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.

1.4 AMBIENT CONDITIONS

.1 Maintain air temperature and structural base temperature at flooring installation area above 20 degrees for 48 hours before, during and 48 hours after installation.

1.5 MAINTENANCE

.1 Extra Materials:

.1 Provide extra materials of resilient sheet flooring and adhesives in accordance with Section 01 78 00 - Closeout Submittals.

.2 Provide 7 m^2 of each colour, pattern and type flooring material required for project for maintenance use.

.3 Extra materials one piece and from same production run as installed materials.

.4 Identify each roll of sheet flooring and each container of adhesive.

.5 Deliver to Departmental Representative, upon completion of the work of this section.

.6 Store where directed by Departmental Representative.

Part 2 Products

2.1 MATERIALS

.1 Resilient Safety Flooring: To ASTM F1913. Designated as "RSSF" on Room Finish Schedule.

.1 Homogeneous slip-resistant vinyl sheet

.2 Static coefficient of slip resistance in excess of 0.6 when tested to ASTM D2047, and R10 when tested to DIN 51130

.3 Pattern: match Tarkett "Granit Safe-T" .

.4 Thickness: 2.0 mm.

.5 Colour: as selected by Departmental Representative.

.6 Roll width: 2.0 m (nominal)

.7 Heat welding rod: colour-matched to suit selected material.

.2 Static dissipative vinyl tile: to ASTM F1066, designated as "SDT" on Room Finish Schedule. Refer to Electrical for grounding for copper strips.

.1 Pattern: marbelized.

.2 Thickness: 3.0 mm.

.3 Size: 305 mm x 305 mm tile.

.4 1.0 x 10 (to 6^{th}) ohms resistance.

.5 Colour: selected by Departmental Representative.

.6 51 wide x 610 long copper grounding connection strips for under tile.

.7 Acceptable manufacturers:

.1 Armstrong SDT

.2 Johnsonite Granit SD

.3 Or approved alternate.

.3 Homogeneous vinyl sheet flooring: to ASTM F1913 and ASTM F1700 designated as "VSF" on Room Finish Schedule.

.1 Pattern: multi-flake decoration with pearl tone flex

.2 Thickness: 2.0 mm.

.3 Size: 2.0 metre wide roll.

.4 Lifetime polish free surface.

.5 VOC emissions: GBCA compliant (Green Tag Approval) or Floorscore certified.

.6 25% recycled material (100% recyclable)

.7 Chemical resistance to EN 423 – "good" rating

.8 Indentation Residual to ASTM F970 750 psi

.9 Colour: selected by Departmental Representative.

.10 Acceptable manufacturers:

.1 Polyflor Pearlatzzo Pur

.2 Johnsonite Tarkett Aria 2.0

.3 Or approved alternate.

.4 Resilient base: continuous, top set, complete with premoulded end stops and external corners:

.1 Type: rubber.

.2 Style: cove.

.3 Thickness: 2.03 mm.

.4 Height: 101.6 mm.

.5 Lengths: cut lengths minimum 2400 mm.

.6 Colour: selected by Departmental Representative.

.5 Primers and adhesives: of types recommended by resilient flooring manufacturer for specific material on applicable substrate, above, on or below grade.

.1 Rubber floor adhesives: maximum VOC limit 50 g/l.

.2 Resilient base adhesives: maximum VOC limit 50 g/l.

.6 Sub-floor filler and leveller: white premix latex requiring water only to produce cementitious paste as recommended by flooring manufacturer for use with their product.

.7 Metal edge strips:

.1 Aluminum extruded, smooth, mill finish stainless steel with lip to extend under floor finish, shoulder flush with top of adjacent floor finish.

.8 External corner protectors: stainless steel, type recommended by flooring manufacturer.

.9 Edging to floor penetrations: stainless steel, type recommended by flooring manufacturer.

.10 Sealer and wax: Seal and wax flooring when recommended by manufacturer. Product to be acceptable to both manufacturer and Departmental Representative.

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 SITE VERIFICATION OF CONDITIONS

.1 Ensure concrete floors are clean and dry by using test methods recommended by flooring manufacturer.

3.3 PREPARATION

.1 Remove existing resilient flooring.

.2 Remove or treat old adhesives to prevent residual, old flooring adhesives from bleeding through to new flooring and/or interfering with the bonding of new adhesives.

.3 Clean floor and apply filler; trowel and float to leave smooth, flat hard surface. Prohibit traffic until filler cured and dry.

.4 Remove sub-floor ridges and bumps. Fill low spots, cracks, joints, holes and other defects with sub-floor filler.

.5 Prime and seal concrete slab to resilient flooring manufacturer's printed instructions.

3.4 APPLICATION: FLOORING

.1 Provide high ventilation rate, with maximum outside air, during installation, and for 48 to 72 hours after installation. If possible, vent directly to outside. Do not let contaminated air recirculate through district or whole building air distribution system. Maintain extra ventilation for at least one month following building occupation.

.2 Apply adhesive uniformly using recommended trowel. Do not spread more adhesive than can be covered by flooring before initial set takes place. Install application for “heavy duty” traffic; follow manufacturer’s directions.

.3 Lay flooring with seams parallel to exterior wall building lines to produce a minimum number of seams. Border widths minimum 1/3 width of full material.

.4 Heat weld seams of sheet flooring in accordance with manufacturer's printed instructions.

.5 As installation progresses and after installation roll flooring with 45 kg minimum roller to ensure full adhesion.

.6 Cut flooring around fixed objects.

.7 Install feature strips and floor markings where indicated. Fit joints tightly.

.8 Continue flooring over areas which will be under built-in furniture.

.9 Continue flooring through areas to receive movable type partitions without interrupting floor pattern.

.10 Terminate flooring at centreline of door in openings where adjacent floor finish or colour is dissimilar.

.11 Install metal edge strips at unprotected or exposed edges where flooring terminates.

.12 Install two (2) 50mm wide, 600mm copper grounding strips using purpose made adhesive. Place 450mm of the copper strip onto the dry-to-touch adhesive and carry 150mm of the copper strip up the wall (concealed behind gypsum board finish). Install additional adhesive on top of copper strip for installation of static dissipative floor tile. Coordinate installation of copper grounding strips with Electrical requirements.

3.5 APPLICATION: BASE

.1 Lay out base to keep number of joints at minimum.

.2 Clean substrate and prime with one coat of adhesive.

.3 Apply adhesive to back of base.

.4 Set base against wall and floor surfaces tightly by using 3 kg hand roller.

.5 Install straight and level to variation of 1:1000.

.6 Scribe and fit to door frames and other obstructions. Use premoulded end pieces at flush door frames.

.7 Cope internal corners. Use premoulded corner units for right angle external corners. Use formed straight base material for external corners of other angles.

3.6 FIELD QUALITY CONTROL

.1 Manufacturer's Field Services:

.1 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.

3.7 CLEANING

.1 Proceed in accordance with Section 01 74 11 - Cleaning.

.2 Remove excess adhesive from floor, base and wall surfaces without damage.

.3 Clean, floor and base surface to flooring manufacturer's printed instructions.

3.8 WAXING

.1 Seal and wax to be applied to flooring where wax coating is recommended by manufacturer.

.2 Seal and wax in accordance with manufacture’s written instructions using product acceptable to manufacturer and to Departmental Representative. Confirm all products to be used prior to use.

3.9 PROTECTION

.1 Protect new floors from time of final set of adhesive until final inspection.

.2 Prohibit traffic on floor for 48 hours after installation.

END OF SECTION

Part 1 General

1.1 REFERENCES

.1 American Association of Textile Chemists and Colorists (AATCC)

.1 AATCC 23-2010, Color Fastness to Burnt Gas Fumes.

.2 AATCC 129-2011, Colour Fastness to Ozone in the Atmosphere Under High Humidities.

.2 American Society for Testing and Materials (ASTM International)

.1 ASTM D1667-05(2011), Standard Specification for Flexible Cellular Materials-Poly (Vinyl Chloride) Foam (Closed-Cell).

.2 ASTM D5252-11, Standard Practice for the Operation of the Hexapod Drum Tester.

.3 ASTM D5417-11, Standard Practice for Operation of the Vettermann Drum Tester.

.3 Canadian General Standards Board (CGSB)

.1 CAN/CGSB-4.2 No.77.1-94/ISO 4919:1978(R2012), Textile Test Methods - Carpets - Determination of Tuft Withdrawal Force.

.2 CAN/CGSB-4.129-93(R1997), Carpets for Commercial Use.

.3 CAN/CGSB-25.20-95, Surface Sealer Floors.

.4 Carpet and Rug Institute (CRI)

.1 CRI-104-2011, Standard Installation of Commercial Carpet.

.2 IAQ Carpet Testing Program.

.5 Underwriters' Laboratories of Canada (ULC)

.1 CAN/ULC-S102-10, Surface Burning Characteristics of Building Materials and Assemblies.

1.2 SUBMITTALS

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

.2 Submit verification to demonstrate compliance with CAN/ULCS102 and CAN/ULCS102.2.

.3 Submit proof that carpet has been tested and passed the Indoor Air Quality (IAQ) Carpet Testing Program requirements of the Carpet and Rug Institute (CRI) and the Canadian Carpet Institute (CCI).

.4 Submit report verifying that tuft bind meets requirements of CAN/CGSB-4.129 when tested to CAN/CGSB-4.2 No.77.1.

.5 Submit report outlining proposed dust control measures.

.6 Submit carpet manufacturer's installation instructions: Indicate special procedures and perimeter conditions requiring special attention.

1.3 PRODUCT DATA

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

.2 Submit product data sheet for each carpet, adhesive, carpet protection and subfloor patching compound.

.3 Submit WHMIS MSDS - Material Safety Data Sheets acceptable to Labour Canada and Health Canada for carpet adhesive and seam adhesive. Indicate VOC content.

.4 Submit data on specified products, describing physical and performance characteristics, sizes, patterns, colours, and methods of installation.

1.4 SAMPLES

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

.2 Submit duplicate 600 x 600 mm pieces of each carpet specified, duplicate pieces for each colour selected, 150 mm lengths of base and divider strips.

1.5 CLOSEOUT SUBMITTALS

.1 Submit operation and maintenance data for incorporation into manual specified in Section 01 78 00 - Closeout Submittals.

.2 Submit maintenance data: Include maintenance procedures, recommendations for maintenance materials and equipment, and suggested schedule for cleaning.

1.6 QUALIFICATIONS

.1 Installer Qualifications:

.1 Flooring contractor requirements.

.1 Specialty contractor normally engaged in this type of work, with prior experience in installation of these types of materials.

.2 Certified by carpet manufacturer prior to tender submission.

.3 Must not sub-contract labour without written approval of Departmental Representative.

.2 Be responsible for proper product installation, including floor testing and preparation as specified and in accordance with carpet manufacturers written instructions.

1.7 REGULATORY REQUIREMENTS

.1 Indoor Air Quality: compliance with CRI/CCI Green Label Indoor Air Quality Program, CRI/CCI-IAQ requirements for maximum total volatile chemicals released into air. Label each carpet product with CRI/CCI-IAQ label.

1.8 DELIVERY, STORAGE AND HANDLING

.1 Label packaged materials. For carpet tile products indicate nominal dimensions of tile and indicate installation direction.

.2 Store packaged materials in original containers or wrapping with manufacturer's seals and labels intact.

.3 Store carpeting and accessories in location as directed by Departmental Representative. Store carpet and adhesive at minimum temperature of 18°C and relative humidity of maximum 65% for minimum of 48 hours before installation.

.4 Prevent damage to materials during handling and storage. Keep materials under cover and free from dampness.

.5 Store materials in area of installation for minimum period of 48 hours prior to installation.

.6 Modular carpet: store on pallet form as supplied by Manufacturer. Do not stack pallets.

1.9 WASTE MANAGEMENT AND DISPOSAL

.1 Separate and recycle waste materials in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal, and with Waste Reduction Workplan.

.2 Remove from site and dispose of packaging materials at appropriate recycling facilities.

.3 Collect and separate for disposal paper, plastic, and corrugated cardboard packaging material for recycling in accordance with Waste Management Plan.

1.10 ENVIRONMENTAL REQUIREMENTS

.1 Moisture: Ensure substrate is within moisture limits and alkalinity limits prescribed by manufacturer. Prepare moisture testing and provide report to Departmental Representative.

.2 Temperature: Maintain ambient temperature of not less than 18 °C from 48 hours before installation to at least 48 hours after completion of work.

.3 Relative humidity: Maintain relative humidity between 10 and 65% RH for 48 hours before, during and 48 hours after installation.

.4 Safety: Comply with requirements of Workplace Hazardous Materials Information System (WHMIS) regarding use, handling, storage, and disposal of hazardous materials.

.5 Ventilation:

.1 Ventilate area of work as directed by Departmental Representative by use of approved portable supply and exhaust fans.]

.2 Ventilate enclosed spaces in accordance with Section 01 51 00 - Temporary Utilities. Provide fans with HEPA filters.

.3 Provide continuous ventilation during and after carpet application. Run ventilation system 24 hours per day during installation; provide continuous ventilation for 7 days after completion of carpet installation.

.6 Test existing floor levelling compound for presence of asbestos contamination. Notify Departmental Representative for additional instructions where asbestos is discovered.

.7 Do not install carpet until space is enclosed and weatherproof, wet-work in space is completed and nominally dry, work above ceilings is complete.

1.11 EXTRA MATERIALS

.1 Provide extra materials of carpet, carpet base, and adhesives in accordance with Section 01 78 00 - Closeout Submittals.

.2 Provide 2% of each colour, pattern and type of carpeting tile for maintenance material.

.3 Extra materials to be from same production run as installed materials.

.4 Identify each package of carpet and each container of adhesive.

.5 Deliver to Departmental Representative and store where directed by Departmental Representative.

Part 2 Products

2.1 MANUFACTURERS

.1 Certified to Carpet and Rug Institute's and the Canadian Carpet Institute IAQ requirements.

2.2 MODULAR CARPET

.1 Acceptable material: (to match existing in building plus additional accent colour)

.1 Salvage carpet in good condition for reuse on this project. Full tiles only.

.2 Tandus, Grid Overlay II, colour: ‘Total Elcipse”. (to match existing in building)

.3 Accent colour: by same manufacturer as base building carpet. Colour to be selected from complete range by Departmental Representative.

.2 Carpet Tile Dimensions: 610 x 610 mm.

.3 Carpet: to CAN/CGSB-4.129 and as follows:

.1 Certified for flammability to Health Canada regulations under "Hazardous Products (Carpet) Regulations", Part II of the Schedule.

.2 Maximum flame spread rating 300, maximum smoke developed classification 500, when tested to CAN/ULC-S102.

.3 Certified to Carpet and Rug Institute's and the Canadian Carpet Institute's IAQ requirements.

.4 Performance rating: to ASTM D5252 or ASTM D5417.

.5 Construction: Stratatec patterned loop.

.6 Pile Surface Appearance:

.1 Multi-level loop.

.7 Pile fibre: to CAN/CGSB-4.129.

.1 Nylon: BCF.

.1 Type: Nylon 6.

.8 Yarn Ply: 2- ply minimum.

.9 Gauge: 50 rows per 10cm.

.10 Stitch Rate: 35. per 10cm.

.11 Tuft Density: 610 g/m².

.12 Pile Height: 4.8mm.

.13 Kilotex Rating: 11.66 kilotex.

.14 Yarn Dye Method: solution dyed.

.15 Colourization: patterned.

.16 Colourfastness to light: to CAN/CGSB-4.2No.18.3.

.17 Colour Fastness to Atmospheric Fading: to AATCC 129 and AATCC 23.

.18 Primary Backing: non-woven synthetic.

.19 Secondary Backing: thermoplastic polyolefin compound.

.1 Recycled content: 100%.

.2 Density: as per ASTM D1667.

.3 Backing thickness: 2.4mm.

.4 Total weight: 2543g/m².

.20 Adhesive: mill applied releasable dry adhesive.

2.3 ACCESSORIES

.1 Base:

.1 Carpet base: 100mm high. Broadloom to match carpeting. Bound top edge. Colour ‘black’.

.2 Adhesive:

.1 Pressure sensitive type: recommended by carpet manufacturer for direct glue down installation of modular carpet or speciality backed carpets.

.3 Carpet protection: non-staining heavy duty kraft paper.

.4 Concrete floor sealer: to CAN/CGSB-25.20, Type 1.

.5 Subfloor patching compound: white premix latex requiring water only to produce cementitious paste as recommended by flooring manufacturer for use with their product..

Part 3 Execution

3.1 DEMOLITION

.1 Remove and divert unusable carpet for recycling in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal, and with Waste Reduction Workplan. Coordinate with Departmental Representative.

3.2 SUB-FLOOR TREATMENT

.1 Concrete shall be inspected to determine special care required to make it a suitable foundation for carpet. Cracks 3 mm wide or protrusions over 0.8 mm will be filled and levelled with appropriate and compatible latex patching compound.

.2 Do not exceed manufacturer's recommendations for patch thickness.

.3 Large patch areas are to be primed with a compatible primer.

.4 Concrete substrates shall be cured, clean and dry.

.5 Concrete substrates shall be free of paint, dirt, grease, oil, curing or parting agents, and other contaminates, including sealers, that may interfere with the bonding of the adhesive.

.6 Wherever a powdery or porous concrete surface is encountered, a primer compatible with the adhesive shall be used to provide a suitable surface for glue-down installation.

3.3 PREPARATION

.1 Prepare floor surfaces in accordance with CRI 104 Standard for Installation of Commercial Carpet.

.2 Pre-condition carpeting following manufacturer's printed instructions.

3.4 INSTALLATION

.1 Install carpeting using minimum of pieces.

.2 Install in accordance with manufacturer's printed instructions and in accordance with Carpet and Rug Institute Standard for Installation of Commercial Carpet, CRI 104.

.3 Install carpet after finishing work is completed but before demountable office partitions and telephone and electrical pedestal outlets are installed.

.4 Finish installation to present smooth wearing surface free from conspicuous seams, burring and other faults.

.5 Use material from same dye lot. Ensure colour, pattern and texture match within any one visual area. Maintain constant pile direction.

.6 Adhesive seams and cross-joints. Seam edges must be sealed.

.7 Fit neatly around architectural, mechanical, electrical and telephone outlets, and furniture fitments, around perimeter of rooms into recesses, and around projections.

.8 Install carpeting to underfloor duct system and to access covers.

.9 Extend carpet into toe spaces, door reveals, closets, open-bottomed obstructions, removable flanges, alcoves, and similar openings.

.10 Install carpet smooth and free of bubbles, puckers, and other defects.

3.5 BINDER BARS

.1 Install binder bars at exposed carpet edges and centre under doors in door openings.

3.6 MODULAR CARPET

.1 Apply acrylic release type adhesive and install modular carpet in accordance with manufacturer's written instructions.

.2 Lay modular carpet with butt seams.

.3 Roll modular carpet with appropriate roller for complete contact of carpet with mill-applied adhesive to sub-floor.

3.7 SEAMS

.1 Seal edges of cut-outs as recommended by manufacturer.

.2 Carpet visibility of seams and joints to acceptable industry standards.

3.8 BASE INSTALLATION

.1 Install resilient base in accordance with Section 09 65 19.

3.9 PROTECTION OF FINISHED WORK

.1 Vacuum carpets clean immediately after completion of installation. Protect traffic areas.

.2 Prohibit traffic on carpet for a period of 24 hours until adhesive is cured.

.3 Install carpet protection to satisfaction of Departmental Representative.

END OF SECTION

Part 1 General

1.1 REFERENCES

.1 American Society for Testing and Materials (ASTM International)

.1 ASTM C423-01, Test Method for Sound Absorption and Sound Absorption Coefficients by the Reverberation Room Method.

.2 ASTM E84 – Standard Test Methodfor Surface Burning Characteristics of Building Materials.

.2 Underwriter Laboratories of Canada (ULC)

.1 CAN/ULC-S702-97, Thermal Insulation, Mineral Fibre, for Buildings.

.2 CAN/ULC – S102 Test for Surface Burning Characteristics of Building Materials and Assemblies.

1.2 ACTION AND INFORMATIONAL SUBMITTALS

.1 Product Data

.1 Submit manufacturer's printed product literature, specifications and data sheets.

.2 Shop Drawings

.1 Submit shop drawings indicating panel sizes and configuration.

1.3 DELIVERY, STORAGE AND HANDLING

.1 Deliver, store and handle materials in accordance with Section 01 61 00 - Common Product Requirements.

Part 2 Products

2.1 MATERIALS

.1 Acoustical construction products must:

.1 Not require being labelled as poisonous, corrosive, flammable or explosive under the Consumer Chemical and Container Regulations of the Hazardous Products Act.

.2 Be accompanied by detailed instructions for proper handling and installation so as to minimize health concerns.

2.2 ACOUSTIC WALL PANELS

.1 Acoustic core material: to CAN/CGSB-92.1.

.1 NRC designation of 0.80 or greater.

.2 Panel core: resin edge hardened fibreglass core with 96 – 112 kg/m^3 (6-7 lbs/ft^2) density. Resin hardened at clip locations.

.3 Thickness: 25 mm.

.4 Edges: standard square edge with integral concealed edge reinforcing if required by panel sizes.

.5 Panels and visible edges to be wrapped with fire retardant fabric material.

.1 Flame spread class of 25 or less to CAN/ULC S102.

.6 Fabric: polyester woven fabric, minimum 10.0±0.5 Oz./lineal year. All fabric from same dye lot.

.1 Colour and pattern to match Victor "Wisper" Xpress line.

.2 Fabric wear: to ASTM D-4157; 100,000 double rub.

.3 Acceptable Manufacturer: Victor Fabric, Guilford of Maine, or approved equivalent.

.4 Colour selected from manufacturer's standard range of colours.

.7 Metal support clips: galvanized steel Z-clips to suit acoustic panel requirements.

.8 Dimensions: refer to drawings for sizes and locations.

.9 Acceptable manufacturers:

.1 Armstrong "Soundsoak"

.2 Decoustics

.3 Conwed

.4 Avanti

.5 Approved equivalent.

Part 3 Execution

3.1 INSTALLATION

.1 Ensure substrate surface is straight to tolerance of plus or minus 3 mm over 3000 mm.

.2 Install according to manufacturer's written instructions.

.3 Install acoustic units to clean, dry and firm gypsum board substrate using concealed clips.

.4 Install acoustic units plumb and aligned. Arrange units as indicated.

.5 Cut panels to suit electrical and mechanical items mounted to walls and ceilings.

.6 Cut panels around openings in wall.

.7 Wrap fabric back to panels wherever panels are cut, cover exposed panel edges.

3.2 CLEANING

.1 Keep acoustic installation and all components clean. Remove blemishes immediately.

3.3 PROTECTION

.1 Use polyethylene to protect finished acoustical treatment from damage.

.2 Remove prior to substantial completion.

3.4 SCHEDULES

.1 Install as noted on walls in Room 148 and Room 210.

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 Environmental Protection Agency (EPA)

.1 EPA Test Method for Measuring Total Volatile Organic Compound Content of Consumer Products, Method 24 - 1995, (for Surface Coatings).

.3 Health Canada / Workplace Hazardous Materials Information System (WHMIS)

.1 Material Safety Data Sheets (MSDS).

.4 Master Painters Institute (MPI)

.1 MPI Architectural Painting Specifications Manual, 2004.

.5 National Fire Code of Canada - 2010

.6 Society for Protective Coatings (SSPC)

.1 SSPC Painting Manual, Volume Two, 8th Edition, Systems and Specifications Manual.

1.2 QUALITY ASSURANCE

.1 Qualifications:

.1 Contractor: minimum of five years proven satisfactory experience. Provide list of last three comparable jobs including, job name and location, specifying authority, and project manager.

.2 Journeymen: qualified journeymen who have "Tradesman Qualification Certificate of Proficiency" engaged in painting work.

.3 Apprentices: working under direct supervision of qualified trades person in accordance with trade regulations.

.2 Mock-Ups:

.1 Construct mock-ups in accordance with Section 01 45 00 - Quality Control.

.1 Prepare and paint designated surface, area, room or item (in each colour scheme) to specified requirements, with specified paint or coating showing selected colours, gloss/sheen, textures.

.2 Mock-up will be used:

.1 To judge workmanship, substrate preparation, operation of equipment and material application and workmanship to MPI Architectural Painting Specification Manual standards.

.3 Locate where directed.

.4 Allow 48 hours for inspection of mock-up before proceeding with work.

.5 When accepted, mock-up will demonstrate minimum standard of quality required for this work. Approved mock-up may not remain as part of finished work.

.3 Health and Safety:

.1 Do construction occupational health and safety in accordance with Section 01 35 29.06 - Health and Safety Requirements.

1.3 SCHEDULING

.1 Submit work schedule for various stages of painting to Departmental Representative for review. Submit schedule minimum of 48 hours in advance of proposed operations.

.2 Obtain written authorization from Departmental Representative for changes in work schedule.

.3 Schedule painting operations to prevent disruption of occupants.

1.4 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 two copies of Workplace Hazardous Materials Information System (WHMIS) Material Safety Data Sheets (MSDS) in accordance with Section 01 33 00 - Submittal Procedures. Indicate VOCs during application and curing.

.3 Samples:

.1 Submit full range colour sample chips to indicate where colour availability is restricted.

.2 Submit duplicate 200 x 300 mm sample panels of each paint, stain, clear coating, and special 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:

.3 Retain reviewed samples on-site to demonstrate acceptable standard of quality for appropriate on-site surface.

.4 Test reports: submit certified test reports for paint from approved independent testing laboratories, indicating compliance with specifications for specified performance characteristics and physical properties.

.1 Lead, cadmium and chromium: presence of and amounts.

.2 Mercury: presence of and amounts.

.3 Organochlorines and PCBs: presence of and amounts.

.5 Certificates: submit certificates signed by manufacturer certifying that materials comply with specified performance characteristics and physical properties.

.6 Manufacturer's Instructions:

.1 Submit manufacturer's installation and application instructions.

.7 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.

.4 MPI Environmentally Friendly classification system rating.

1.5 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 - four litre can of each type and colour of primer, stain, 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.

1.6 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 with temperature range 7 degrees C to 30 degrees 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 Type ABC 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 Separate waste materials for reuse and recycling in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.

.2 Remove from site and dispose of packaging materials at appropriate recycling facilities.

.3 Collect and separate for disposal paper, plastic, polystyrene, corrugated cardboard, and packaging material for recycling in accordance with Waste Management Plan (WMP).

.4 Place materials defined as hazardous or toxic in designated containers.

.5 Handle and dispose of hazardous materials in accordance with CEPA, TDGA, Regional and Municipal, regulations.

.6 Ensure emptied containers are sealed and stored safely.

.7 Unused paint and coating materials must be disposed of at official hazardous material collections site as approved by Departmental Representative.

.8 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.

.9 Material which cannot be reused must be treated as hazardous waste and disposed of in an appropriate manner.

.10 Place materials defined as hazardous or toxic waste, including used sealant and adhesive tubes and containers, in containers or areas designated for hazardous waste.

.11 To reduce the amount 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).

.12 Where paint recycling is available, collect waste paint by type and provide for delivery to recycling or collection facility.

1.7 SITE CONDITIONS

.1 Heating, Ventilation and Lighting:

.1 Ventilate enclosed spaces in accordance with Section 01 56 00 - Temporary Barriers and Enclosures.

.2 Provide heating facilities to maintain ambient air and substrate temperatures above 10 degrees 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 written approval by Specifying body and product manufacturer, perform no painting when:

.1 Ambient air and substrate temperatures are below 10 degrees C.

.2 Substrate temperature is above 32 degrees 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 degrees C variance between the air/surface temperature. Paint should not be applied if the dew point is less than 3 degrees C below the ambient or surface temperature. Use sling psychrometer to establish the relative humidity before beginning paint work.

.5 Rain or snow is 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 15% for wood.

.3 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 Only qualified products with E3 "Environmentally Friendly" rating are acceptable for use on this project. Do not exceed VOC limits of Green Seal Standard GS-11 “Paints” 1993 and latest revision.

.4 Conform to latest MPI requirements for interior painting work including preparation and priming.

.5 Materials (primers, paints, coatings, varnishes, stains, lacquers, fillers, thinners, solvents, etc.) in accordance with MPI Architectural Painting Specification Manual "Approved Product" listing.

.6 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.

.7 Provide paint products meeting MPI "Environmentally Friendly" E3 ratings based on VOC (EPA Method 24) content levels.

.8 Use MPI listed materials having minimum E3 rating where indoor air quality (odour) requirements exist.

.9 Paints, coatings, adhesives, solvents, cleaners, lubricants, and other fluids:

.1 Water-based.

.2 Non-flammable.

.3 Manufactured without compounds which contribute to ozone depletion in the upper atmosphere.

.4 Manufactured without compounds which contribute to smog in the lower atmosphere.

.5 Do not contain methylene chloride, chlorinated hydrocarbons, andtoxic metal pigments.

.10 Formulate and manufacture water-borne surface coatings with no aromatic solvents, formaldehyde, halogenated solvents, mercury, lead, cadmium, hexavalent chromium or their compounds.

.11 Flash point: 61.0 degrees C or greater for water-borne surface coatings and recycled water-borne surface coatings.

.12 Ensure manufacture and process of both water-borne surface coatings and recycled water-borne surface coatings does not release:

.1 Matter in undiluted production plant effluent generating 'Biochemical Oxygen Demand' (BOD) in excess of 15 mg/L to natural watercourse or sewage treatment facility lacking secondary treatment.

.2 Total Suspended Solids (TSS) in undiluted production plant effluent in excess of 15 mg/L to natural watercourse or a sewage treatment facility lacking secondary treatment.

.13 Water-borne paints and stains, recycled water-borne surface coatings and water borne varnishes to meet minimum "Environmentally Friendly" E3 rating.

.14 Recycled water-borne surface coatings to contain 50 % post-consumer material by volume.

.15 Recycled water-borne surface coatings must not contain:

.1 Lead in excess of 600.0 ppm weight/weight total solids.

.2 Mercury in excess of 50.0 ppm weight/weight total product.

.3 Cadmium in excess of 1.0 ppm weight/weight total product.

.4 Hexavelant chromium in excess of 3.0 ppm weight/weight total product.

.5 Organochlorines or polychlorinated biphenyls (PCBS) in excess of 1.0 ppm weight/weight total product.

2.2 COLOURS

.1 Departmental Representative will provide Colour Schedule after Contract award.

.2 Selection of colours from manufacturer’s full range of colours.

.3 Where specific products are available in restricted range of colours, selection based on limited range.

.4 Each coat in multi coat system to be tinted slightly lighter colour than top coat to show visible difference between coats.

2.3 MIXING AND TINTING

.1 Perform colour tinting operations prior to delivery of paint to site.

.2 Where thinner is required, use and add thinner in accordance with paint manufacturer's recommendations. Do not use kerosene or similar organic solvents to thin water-based paints.

.3 Thin paint for spraying in accordance with paint manufacturer's instructions.

.4 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 herein and as noted on Finish Schedule.

2.5 INTERIOR PAINTING SYSTEMS

.1 Concrete masonry units: smooth and split face block and brick:

.1 INT 4.2D – High Performance Architectural Latex, G3, low VOC, premium finish.

.2 Galvanized metal: doors, frames, railings, misc. steel, pipes

.1 INT 5.3M – High-performance architectural latex, low odour/low VOC, G5 premium finish, over one coat of surface tolerant primer.

.2 For repainting doors use INT 5.3M top coat products. Spot prime as necessary.

.3 Dressed lumber: including doors, door and window frames, casings, mouldings:

.1 INT 6.3A - High performance architectural latex, G5 premium finish.

.4 Plaster and gypsum board: gypsum wallboard, drywall, "sheet rock type material", and textured finishes:

.1 INT 9.2B – High Performance Architectural Latex, low VOC, G3, premium finish.

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 data sheet.

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 Investigate existing substrates for problems related to proper and complete preparation of surfaces to be painted. Report to Departmental Representative damages, defects, unsatisfactory or unfavourable conditions before proceeding with 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 Maximum moisture content as follows:

.1 Stucco, plaster and gypsum board: 12%.

.2 Concrete: 12%.

.3 Clay and Concrete Block/Brick: 12%.

.4 Wood: 15%.

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 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 approval of Departmental Representative.

.3 Clean and prepare surfaces in accordance with MPI Architectural Painting Specification Manual requirements. Refer to MPI Manual in regard to specific requirements and as follows:

.1 Remove dust, dirt, and other surface debris by vacuuming, or wiping with dry, clean cloths.

.2 Wash surfaces with a biodegradable detergent and clean warm water using a 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 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 pretreatment as soon as possible after cleaning and before deterioration occurs.

.5 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.

.6 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.

.7 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.

.8 Touch up of shop primers with primer as specified.

.9 Do not apply paint until prepared surfaces have been accepted by Departmental Representative.

3.5 APPLICATION

.1 Apply paint by brush and roller. 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 period 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 Finish closets and alcoves as specified for adjoining rooms.

.9 Finish top, bottom, edges and cutouts of doors after fitting as specified for door surfaces.

3.6 MECHANICAL/ELECTRICAL EQUIPMENT

.1 Finished areas: Unless noted otherwise, paint all exposed conduits, piping (unless protected by metal clad pipe insulation, hangers (unless prefinished), and other mechanical and electrical equipment with colour and finish as selected by Departmental Representative.

.2 Do not paint exposed ductwork in finished areas unless noted.

.3 Boiler room, mechanical and electrical rooms: paint exposed conduits, piping, hangers, ductwork and other mechanical and electrical equipment.

.4 Other unfinished areas: leave exposed conduits, piping, hangers, ductwork and other mechanical and electrical equipment in original finish and touch up scratches and marks.

.5 Touch up scratches and marks on factory painted finishes and equipment with paint as supplied by manufacturer of equipment.

.6 Do not paint over nameplates.

.7 Keep sprinkler heads free of paint.

.8 Paint inside of ductwork where visible behind grilles, registers and diffusers with primer and one coat of matt black paint.

.9 Paint fire protection piping red.

.10 Paint disconnect switches for fire alarm system and exit light systems in red enamel.

.11 Paint natural gas piping yellow.

.12 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.

.13 Do not paint interior transformers and substation equipment.

3.7 FIELD QUALITY CONTROL

.1 Standard of Acceptance:

.1 Walls: no defects visible from a distance of 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 personnel 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 REFERENCES

.1 Health Canada/Workplace Hazardous Materials Information System (WHMIS)

.1 Material Safety Data Sheets (MSDS).

1.2 ACTION SUBMITTALS

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

.2 Shop Drawings:

.1 Submit shop drawings, catalogue sheets and full size templates.

.2 Indicate materials, thicknesses, sizes, finishes, colours, construction details, removable and interchangeable components, mounting methods, schedule of signs.

.3 Submit full size templates for individually fabricated or incised lettering indicating word and letter spacing.

.3 Samples:

.1 Submit duplicate representative sample of each type of sign, sign image and mounting method including, but not limited to: graphics, cast letters, sign box installation method, channel letters, and wall plates fixed mounting installation method.

1.3 INFORMATIONAL SUBMITTALS

.1 Product Data:

.1 Submit manufacturer's printed product literature panel signage or components, specifications and datasheet and include product characteristics, performance criteria, physical size, finish and limitations.

.2 Manufacturer's Instructions: submit manufacturer's installation instructions and special handling criteria, installation sequence, and cleaning procedures.

1.4 CLOSEOUT SUBMITTALS

.1 Provide operation and maintenance data for illuminated signs for incorporation into manual specified in Section 01 78 00 - Closeout Submittals.

1.5 DELIVERY, STORAGE AND HANDLING

.1 Deliver, store and handle materials in accordance with Section 01 61 00 - Common Product Requirements.

Part 2 Products

2.1 MATERIALS

.1 Door Signage (for each door in renovated area)

- .1 Self-adhesive vinyl film. Colour to match existing.
- .2 Locate door numbers on each room side of each door within renovated area.
- .3 Remove existing door numbers prior to painting of existing frames.
- .4 Install new signage minimum of one week following painting of frames.

.2 Room in Use Signage:

- .1 Aluminum slider plate with engraved lamacoid, complete with stops.
- .2 Clear anodized frame.
- .3 Size 75mm x 200 mm.
- .4 Colour of lamacoid to be selected from standard range.
- .5 Provide sliding sign “In Use/Vacant” in French and English.

2.2 FABRICATION

.1 Fabricate signs in accordance with details, specifications and shop drawings.

.2 Build units square, true, accurate to size, free from visual or performance defects.

Part 3 Execution

3.1 INSTALLATION

.1 Manufacturer's Instructions: compliance: comply with manufacturer's written recommendations or specifications, including product technical bulletins, handling, storage and installation instructions, and data sheets.

.2 Erect and secure signs plumb and level at elevations as directed by Departmental Representative.

.3 Comply with sign manufacturer's installation instructions and approved shop drawings.

3.2 CLEANING

.1 Proceed in accordance with Section 01 74 11 - Cleaning.

- .1 On completion and verification of performance of installation, remove surplus materials, excess materials, rubbish, tools and equipment.
- .2 Leave signs clean.
- .3 Remove debris from interior of sign boxes.
- .4 Touch up damaged finishes.

.2 Waste Management: separate waste materials for reuse and recycling in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.

3.3 SCHEDULE

.1 Install door number signage above door on all door frames within renovation areas. Provide signage on both sides of the door frame.

.2 Install Room In Use signage outside of rooms 152 and 210.

END OF SECTION

Part 1 General

1.1 REFERENCES

.1 CSA Group

.1 CSA G40.20/G40.21-13, General Requirements for Rolled or Welded Structural Quality Steel/Structural Quality Steel.

.2 CSA W59-13, Welded Steel Construction (Metal Arc Welding).

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 wire mesh partitions and include product characteristics, performance criteria, physical size, finish and limitations.

.3 Shop Drawings:

.1 Submit drawings stamped and signed by professional engineer registered or licensed in Saskatchewan.

.2 Indicate partition panel modules and types, materials, gauges, finishes, door and other openings, hardware, fastening methods to adjacent structure, ceiling details, and assembly methods.

.4 Samples:

.1 Submit duplicate 300 x 300 mm samples of mesh fabric.

1.3 QUALITY ASSURANCE

.1 Mock-ups:

.1 Construct mock-ups in accordance with Section 01 45 00 - Quality Control.

.2 When accepted, mock-up will demonstrate minimum standard for this work.

.3 Mock-up may not remain as part of finished work.

1.4 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 materials in dry location indoors and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.

.2 Store and protect from nicks, scratches, and blemishes.

.3 Replace defective or damaged materials with new.

Part 2 Products

2.1 MATERIALS

.1 Partition mesh: painted.

.1 Welded steel wire fabric: 5mm steel wire with opening size 50 x 50 mm, provide in flat sheets.

.2 Steel sections and plates: to CSA G40.20/G40.21, type 44W.

.1 Posts: hollow steel tubing, painted welded square 102 x 102 mm, construction, designed to fasten to ceiling, and floors minimum wall thickness 4 mm.

.2 Angle frame: 38 x 38 x 4.8 mm.

.3 Welding materials: to CSA W59.

.4 Bolts, fasteners and fastening hardware: manufacturer's standard to suit design and application.

2.2 FABRICATION

.1 Panels:

.1 Fabricate panels to suit sizes as dimensioned on drawings.

.2 Swing doors: standard doors:

.1 Sizes as indicated.

.2 Weld pressed steel door frame to HSS posts.

.3 Coordinate with door and frame Sections.

2.3 FINISHES

.1 After fabrication, clean and paint components with primer and finish coats as specified in Section 09 91 23 Interior Painting.

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 wire mesh partitions 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.

3.2 ERECTION

.1 Install mesh enclosures and doors in accordance with manufacturer's printed instructions.

.2 Erect enclosures plumb, level, straight, rigidly supported, and securely fastened to abutting surfaces, free from superimposed loads.

.3 Fix to concrete using lag bolts and shields; to hollow walls using bolts and toggle type anchors; to steel supports with bolts in threaded holes or spot welds.

.1 Locate fasteners on interior side where possible for maximum security.

3.3 CLEANING

.1 Progress Cleaning: clean in accordance with Section 01 74 11 - Cleaning.

.1 Leave Work area clean at end of each day.

.2 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment in accordance with Section 01 74 11 - Cleaning.

.3 Waste Management: separate waste materials for recycling in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.

.1 Remove recycling containers and bins from site and dispose of materials at appropriate facility.

3.4 SCHEDULE

.1 Install between Rooms 206 and 216.

END OF SECTION

1 General

1.1 REFERENCES

.1 American National Standards Institute (ANSI)

.1 ANSI/NFPA 10-2002, Portable Fire Extinguishers.

.2 Underwriters' Laboratories of Canada (ULC)

.1 CAN/ULC-S508-M90(R1995), Rating and Fire Testing of Fire Extinguishers and Class "D" Extinguishing Media.

1.2 SHOP DRAWINGS AND PRODUCT DATA

.1 Submit shop drawings and product data in accordance with Section 01 33 00 - Submittal Procedures.

1.3 CLOSEOUT SUBMITTALS

.1 Provide maintenance data for incorporation into manual specified in Section 01 78 00 - Closeout Submittals.

2 Products

2.1 MULTI-PURPOSE DRY CHEMICAL EXTINGUISHERS

.1 Stored pressure rechargeable type with hose and shut-off nozzle, ULC labelled for A, B and C Class protection, as indicated in equipment schedule.

.2 Sizes: Wall hung - 4.5 kg (10 lb) and Cabinets - 2.2 kg (5 lb).

2.2 EXTINGUISHER BRACKETS

.1 Type recommended by extinguisher manufacturer.

2.3 CABINETS

.1 Semi-recessed type as indicated, constructed of 1.6 mm thick steel, 180^{o} opening door of 2.5 mm thick steel with latching device.

.2 Cabinet to maintain fire resistive rating of construction in which they occur.

.3 Cabinet door: with 5 mm full glass panel.

.4 Finish:

.1 Tub: prime coated.

.2 Door and frame: No.4 satin finish stainless steel.

2.4 IDENTIFICATION

.1 Identify extinguishers in accordance with recommendations of ANSI/NFPA 10 and CAN/ULC-S508.

.2 Attach tag or label to extinguishers, indicating month and year of installation. Provide space for service dates.

3 Execution

3.1 INSTALLATION

.1 Install or mount extinguishers in cabinets or on brackets as indicated on drawings.

.2 Providing backing as required for installing recessed or semi-recessed cabinets into walls with less than the required depth.

END OF SECTION

Part 1 General

1.1 SECTION INCLUDES

.1 Section includes metal shelving, steel storage cabinets and mechanically assisted movable shelf storage racks.

1.2 REFERENCES

.1 American Society for Testing and Materials (ASTM): ASTM A1008 - Steel, Sheet, Cold-Rolled, Carbon, Structural, High Strength Low-Alloy and High-Strength Low-Alloy with Improved Formability.

.2 ASTM A1011 - Steel Sheet and Strip, Hot-Rolled, Carbon, Structural, High Strength Low-Alloy and High-Strength Low-Alloy with Improved Formability.

.3 ASTM B221 - Aluminum-Alloy Extruded Bar, Rod, Wire, Shape, and Tube.

1.3 DESIGN REQUIREMENTS

.1 Layout: Refer to Drawings for configuration and quantities.

.2 Mobile Storage system shall be designed to adequately support live loads from Owner's stated storage requirements and specific Project conditions.

.1 Stored material design live load: To be determined at design stage. Storage material will be in Bankers Boxes typically (with some specialized inserts for long gun storage) and will consist of clothing or light-weight materials.

.3 Mobile storage system shall be designed to manually move fully loaded carriage with appropriate gear selections to create an aisle with minimum number of hand cranks. Gear ratios shall move 1,360 to 4,082 kg force with 454 grams.

1.4 SHOP DRAWINGS

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

.2 Schedule of shelving units to be installed on carriages indicating types, materials, quantities, sizes, and finishes.

.3 Design data to determining loads, gear ratio, and anti-tip restraints.

.4 Shop drawings showing layout plans, elevations, dimensions, required tolerances, clearances, spacing of tracks, and details for fabrication, installation, connections, anchors, accessories, and interface with other elements and systems.

.5 Shelving details indicating configuration.

1.5 SAMPLES

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

.2 Minimum 75 mm square sample of each colour and texture to be exposed after installation.

.3 Finish color samples for selection by Departmental Representative.

1.6 QUALITY ASSURANCE

.1 Installer qualifications: Experienced in installation of mobile storage systems and employee of manufacturer or certified by manufacturer for installation of specified system.

1.7 WARRANTY

.1 Provide under provisions of Section 01780 - Closeout Submittals the following warranties:

.1 5 years warranty to cover mobile storage system parts and materials against defects.

.2 2 years warranty to cover workmanship.

Part 2 Products

2.1 MATERIALS

.1 Steel sheet:

.1 Cold rolled steel sheet complying with ASTM A1008.

.2 Hot rolled, pickled steel sheet complying with ASTM A1011.

.2 Steel rail: SAE 1045.

.3 Cast steel wheels: SAE 1144.

.4 Extruded aluminum: ASTM B221, alloy 6063 Temper T-5.

2.2 MOBILE STORAGE SYSTEM

.1 Type: Manually operated, mechanically assisted, high density, mobile storage system consisting of track assembly and wheeled carriages which provide maneuverable platforms for storage units. Grouted track assembly over existing concrete floor slab. System to include ramp and built-up floor system between rails. Finish underlay suitable for installation of new sheet vinyl flooring in Room 158 and insulated floor assembly in Walk-in Freezer Rm 155.

.2 Track: Straight section consisting of aluminum housing and steel rail. Number and spacing as determined by manufacturer to accommodate loads and performance requirements.

.3 Housing: Extruded aluminum section with recess for rail, 95 mm minimum base for load distribution, and holes for attachment.

.1 Equip housing with leveling screws capable of adjustment.

.2 Where required to meet design requirements provide aluminum anti-tip track housing to engage anti-tip bracket and roller guide attached to carriage bottom.

.3 Housing shall protect steel rail from rust and corrosion and allow rail to be removed and replaced without removing complete track assembly.

.4 Rail: 16 mm square cold rolled steel bar. Rail material shall match carriage wheel steel to minimize friction and ensure smooth movement. Use low profile rail to minimize height requirement of raised floor at tracks and headroom in space.

.5 Joints: Tongue and groove connection such that rail joints do not coincide with housing joints thus ensuring horizontal and vertical continuity.

.6 Stops: Where required by layout, provide stops to prevent carriages from running off track.

.7 Mobile carriages: wheeled, rigid, steel frame supporting storage units.

.1 Framework: Fabricate from 2.75 mm, cold rolled steel side and cross channels with all welded joints.

.8 Joints: Fabricate carriages in single or maximum possible lengths. When required, carriage splices shall be bolted type designed to maintain alignment and rigidity.

.9 Wheels: precision ground solid steel wheel. Steel material shall match rail steel to minimize friction and ensure smooth movement.

.1 Guide wheels: Provide 4 minimum dual flange wheels per carriage.

.2 Drive wheels: Fit wheels on drive shaft with two permanently sealed bearings housed in self-aligning flanged pillow blocks.

.10 Drive shaft: solid steel rod connected to all drive wheels with positive keyway coupling that will not loosen.

.11 Bumpers: Equip carriages with resilient bumpers to provide safety gap between end panels in closed position. Provide 100mm gap between mobile shelving units.

.12 Fixed carriages: Where indicated on Drawings or required by storage layout, provide fixed carriages of same height and construction as movable carriages. Permanently anchor carriages to floor such that storage unit heights are uniform.

.13 Drive system: Manually operated, mechanically assisted, geared reduction, internal drive assembly with handwheel.

.1 Operation: Movement accomplished by chain and sprocket drive system. There shall be no play in drive handle and carriage shall stop without drifting when handle operation ceases.

.2 Housing: Drive mechanism including all chains and sprockets shall be concealed with steel sheet housing mounted on carriage end. Housing shall be designed to allow access to drive mechanism for maintenance. All chain tension adjustment plates to be concealed and tamper proof.

.14 End and back closure panels: Provide carriages with end panels which conceal all chains and sprockets of drive mechanism. End panels shall be designed to allow access to drive

mechanism for maintenance. Provide solid closure panels between double-sided shelf units.

.1 Size: Full height and depth of storage unit.

.2 Construction: 1.00 mm steel sheet with prefinished coating.

.15 Handwheel: 3 spoke, ergonomic design with rotating knobs allowing direct pull up or down from any possible starting position to initiate carriage movement.

.16 Hand wheel safety lock: Provide push/pull knob, two pin lock mechanism for handwheel to prevent movement of carriage. Fluorescent orange visual indicator shall alert user to locked status.

.17 Hand wheel mounting: Handle to be installed to a steel chain guard housing independently from the end panel.

.18 Accessories:

.1 Provide fasteners, anchors, other attachment hardware, lateral braces, and other accessories as indicated on approved shop drawings and as required for complete, rigid, functional installation.

.2 Ramp assembly at transition to floor area below mobile shelving.

.19 Built up deck.

.1 Build up floor between tracks flush to base of track.

.2 Provide suitable substrate for floor finish specified Room Finish Schedule.

.20 Finish:

.1 Thoroughly clean steel parts in multi-stage washer followed by application of phosphate coating.

.2 Electrostatically apply commercial enamel.

.3 Color: As selected by Departmental representative from manufacturer's standard range.

2.3 METAL SHELVING/STORAGE UNIT

.1 Shelf:

.1 Cold-rolled furniture-grade steel, 1.27 mm (18 ga.) . Double formed on all four sides. Corners are closed with double thickness steel forming a no-slip notch for the shelf clip.

.2 Clip: 12-gauge compression type; cadmium plated.

.3 Reinforcement: 25 mm x 12 GA. bent angle of steel, installed in the front and rear flange of the shelf to provide additional shelf capacity.

.4 Number of shelves per unit as indicated in drawings.

.2 Inserts: Long gun storage inserts to be provided for a total of 2740mm length of shelving.

.3 T-Posts

.1 38 mm x 50 mm x 3.17 mm double-formed steel in a "T" style with a smooth, unperforated face.

.4 Closed End Panel Assembly

.1 Two "T" posts welded to a cold-rolled steel side panel to form a single unit providing greater strength and easier handling.

.2 Provide closed end panel between adjacent shelving units.

.5 Back Panel

.1 Cold-rolled steel panel attached to uprights with cadmium-plated back clips.

.6 Base Plates

.1 Formed top and bottom to provide support for the bottom shelf in addition to closing the space under the shelf.

.7 Finish

.1 Prepared components for painting by being cleaned, iron phosphatized and rinsed. Electrostatically apply high-grade alkyd enamel. Bake to provide a hard, long lasting, furniture-grade finish.

.8 Minimum Shelf Capacity

.1 Shelf dimensions: 914mm wide by 760 deep: minimum load capacity 181 kg (400 pounds).

Part 3 Execution

3.1 PREPARATION

.1 Verify dimensions and Project conditions prior to fabrication.

.2 Coordinate provision of mobile storage system with casting of concrete floor slab specified in Section 03300 - Cast-in-Place Concrete to ensure accurate location of recesses for track installation.

.1 Layout of floor panel grid is compatible with position of mobile storage floor track.

.2 Adequate support is provided by pedestals for storage system and for anchoring of tracks. Ensure that track pedestals are height which allows installation of tubular steel support.

.3 Verify floor substrate is level and ready to receive mobile storage system.

3.2 INSTALLATION MOBILE STORAGE SYSTEM

.1 Install mobile storage system in accordance with manufacturer's installation instructions and approved shop drawings.

.2 Accurately layout storage system and location of tracks. Use manufacturer provided spacers to ensure tracks are correctly positioned and parallel. Ensure that manufacturer recommended wall clearances are maintained.

.3 Embedded track installation:

.1 Anchor track in concrete recess with expansion anchors of type, size, and spacing recommended by manufacturer. Use leveling screws to adjust tracks such that top is flush with final floor finish. Leave grout space below track housing.

.2 Tightly pack grout under track housing. Allow to cure.

.3 Coordinate installation by others of concrete specified in Section 03300 - Cast-in-Place Concrete in remainder of recess. Ensure track alignment and spacing is not disturbed.

3.3 INSTALLATION METAL SHELVING

.1 Assemble and install cabinets in accordance with manufacturer's written instructions.

.2 Install storage cabinets in numbers and configurations shown in drawings.

.3 Ensure shelving units are installed square and plumb.

.4 Align shelving units adjacent to each other when they are installed end to end.

.5 Install shelving units parallel and perpendicular to walls according to the layout.

3.4 CLEANING

.1 Remove protective wrappings.

.2 Clean metal surfaces using clean water and mild detergent. Do not use abrasive agent, steel wool, or harsh chemicals. Rinse with clean water.

3.5 DEMONSTRATION

.1 Demonstrate to Owner's designated representatives, complete operation and required maintenance for mobile storage system.

END OF SECTION

Part 1 General

1.1 REFERENCES

.1 American National Standards Institute/National Fire Protection Association (ANSI/NFPA)

.1 ANSI/NFPA 255-2006, Standard Method of Test of Surface Burning Characteristics of Building Materials.

.2 ASTM International

.1 ASTM A653/A653M-10, Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.

.2 ASTM E84-11a, Standard Test Method for Surface Burning Characteristics of Building Materials.

.3 ASTM E162-11a, Standard Test Method for Surface Flammability of Materials Using a Radiant Heat Energy Source.

.3 Canadian General Standards Board (CGSB)

.1 CAN/CGSB-19.13-M87, Sealing Compound, One-Component, Elastomeric, Chemical Curing.

.4 Underwriters' Laboratories of Canada

.1 CAN/ULC-S705.1-2001, Thermal Insulation - Spray Applied Rigid Polyurethane Foam, Medium Density, Material Specification.

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 walk-in freezers and include product characteristics, performance criteria, physical size, finish and limitations.

.3 Shop Drawings:

.1 Indicate on drawings:

.1 Construction details of equipment by drawings and manufacturers' literature.

.2 Roughing-in requirements for mechanical and electrical services.

.3 Installation details.

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 walk-in freezers for incorporation into manual.

1.4 DELIVERY, STORAGE AND HANDLING

.1 Deliver, store and handle materials in accordance with Section 01 61 00 - Common Product Requirements 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 accordance with manufacturer's recommendations in clean, dry, well-ventilated area.

.2 Store and protect walk-in freezers from nicks, scratches, and blemishes.

.3 Replace defective or damaged materials with new.

.4 Packaging Waste Management: remove for reuse as specified in 01 74 21 - Construction/Demolition Waste Management and Disposal.

Part 2 Products

2.1 MATERIALS

.1 Galvalume: 0.8 mm core steel sheet with aluminum zinc alloy coating with baked on polyester finish.

.2 Sealant: to CAN/CGSB-19.13, colour to match panel.

.3 Isolating coating: to manufacturer's recommendations.

.4 Insulation for panels and screeds: to CAN/ULC-S705.1, Class 3, poured type foamed-in-place polyurethane (urethane), 150 mm thick.

.5 Insulation for built-in insulated floors: to CAN/ULC-S704, board extruded polystyrene, 275 kPa, 2-50 mm thick layers. R 5 per 25mm thickness.

2.2 FABRICATION

.1 Overall dimensions: as indicated on drawings

.2 Panel sections: precision die formed metal pans accurately spaced and insulated. Panel edges and corners to have tongue and grooves, formed-in-place, to assure airtight, vapour proof joints using gaskets or sealants.

.3 Wall, ceiling and floor panels: nominal 300, 600 and 1200 mm widths.

.4 Corner panels: 300 x 300 mm wide externally.

.5 Door panels: insulated and finished as per exterior and interior panels with 900 x 2050 mm nominal clear door opening, reinforced to prevent door panels from twisting, racking or warping. Ensure that doors will close and seal opening. Equip each door panel with.

.1 One, in fitting flush mounted type, door (swing as indicated) to fit door opening, insulated and finished same as panels, having 1220 high x 1.6 mm thick stainless steel push/kick-plates on both exterior and interior and having soft thermoplastic gasket with magnetic steel core at top and both sides, adjustable rubber wiper gasket at bottom.

.1 Gaskets to be oil, fat, water and sunlight resistant and be replaceable.

.2 Hinges, spring loaded, self-closing type, with stainless steel pin and nylon cam-type bearing, of satin finished aluminum.

.3 One latch, to match hinges, for opening door by breaking force of trigger-action door closer and magnetic gasket.

.1 Latch to have cylinder type lock, and have inside safety release handle capable of opening door from within regardless of whether door is locked or not.

.4 One foot treadle to match hinges and latch, for opening door without use of hands.

.5 One trigger-action positive door closer, located on interior, to assist in positive closing of door.

.6 Built-in thermostatically controlled heater cables inside perimeter of door and beneath sill plate and jambs of door opening. Heaters to have fused protection within panels.

.7 Threshold plates: 2.0 mm stainless steel and removable.

.8 One 50 mm diameter flush-face dial-type thermometer to provide temperature readings from -51 degrees C to 27 degrees C and mounted on hinge side of panel approximately 1525 mm from floor.

.1 Cover sensing bulb with protective stainless steel moulding.

.6 Ceiling panels: reinforced internally or externally as required. Where external reinforcement is needed and through fasteners are used, fasteners to be of low heat conducting material such as teflon.

.1 Insert fasteners in teflon sleeves to prevent compressing of insulation.

.7 Screeds: same construction materials and finish as wall panels. Length and configuration to match wall and corner panels.

.1 Reinforce screeds internally at 584 mm minimum centres to accommodate fastening to building.

.8 Interior floor panels: 6mm checkerplate galvanized steel. Refer to drawings.

.9 Panel colour: white.

.10 Locking devices: panel sections to have cam-action locking devices, spaced at maximum 950 mm vertically, 600 mm horizontally. Male and female lock pockets.

.11 Provide eight (8) surface mounted LED luminaires (4 x 2 rows), spaced 1800mm apart, within walk-in freezer. Luminaires shall be as follows:

.1 One (1) piece molded fiberglass reinforced polyester body, polycarbonate lens, suitable for wet locations, rated for -30 degrees Celsius.

.2 Lamp: 38 watts, 4300 lumens LED module with remote phosphor technology, 4000K, minimum 80 CRI, 50,000 hours at 70% lumen maintenance,

.3 Driver: over-voltage, over-current and short-circuit protected, 120 volt, < 20% THD.

.4 Fixtures shall be surface mounted on freezer ceiling and be electrically connected and terminated to factory pre-wired vapour-tight junction boxes.

.5 Provide a junction box connected to lighting circuitry located outside of freezer enclosure to allow for a 120 Volt single point power connection by electrical contractor.

.6 Fixtures shall be connected and operated from a SPST toggle switch c/w pilot light, mounted 1375mm from the freezer floor on exterior of panel, adjacent to latch.

.7 Manufacturer: Philips 'Day-Brite CFI' VAPORLUME LED DW series Or approved equal.

.12 Two-way pressure relief port: in freezer wall panel away from direct air stream flowing from coil.

.1 Embed anti-sweat heater cables in frame of port so intake and exhaust ports will not freeze.

.2 Terminate wiring in junction box on interior panel over top of port.

.13 Temperature alarm system: self-contained with visual and audible alarm. Include following:

.1 Power source failure alarm with adjustable set point for temperature.

.2 Jack for remote alarm telephone dialer and enunciator panel.

.3 Digital thermometer with minus 15 degrees C to plus 30 degrees C range.

.4 Built-in battery and charger.

2.3 REFRIGERATION SYSTEM

.1 Refrigeration system: Refer to Mechanical.

.2 Seal all penetrations of insulated wall panels. Provide escutcheon cover at all penetrations.

2.4 DRAIN LINES AND HEATER CABLES

.1 Provide necessary drain lines to funnel drains and heater cables as required.

2.5 SOURCE QUALITY CONTROL

.1 Ensure equipment is manufactured and installed by company having personnel skilled in manufacturing and installing of prefabricated walk-in freezers and coolers and has continuous proven experience within last five years.

Part 3 Execution

3.1 EXAMINATION

.1 Verification of Conditions: verify that conditions of substrate are acceptable for walk-in freezers and coolers installation in accordance with manufacturer's written instructions.

.1 Visually inspect substrate.

.2 Inform Departmental Representative of unacceptable conditions immediately upon discovery.

.3 Proceed with installation only after unacceptable conditions have been remedied .

3.2 INSTALLATION

.1 Supply appropriate protection apparatus.

.2 Install in accordance with manufacturer's written recommendations.

.3 Erect work true-to-line, plumb, square and level with joints aligned. Fit joints and intersecting members accurately and in true planes adequately fastened.

.4 Insulate to prevent electrolysis between metal and concrete by applying coating of asphaltic paint to metal surface, applied in accordance with manufacturer's instructions.

.1 Insulation to be dry before assembling floor panels in place.

.5 Unless otherwise indicated, install units within 25 mm of building walls, with 25 mm minimum clearance between top of unit and room ceiling.

.1 Fasten screeds to building and/or wearing floor in accordance with manufacturer's instructions.

.6 Caulk around perimeter of floor panels after installation.

.7 Fill space between perimeter of floor panels and edge of floor depression with concrete or non-shrink grout and trowel flush with floor slab.

.8 Cut or drill holes in panels, as required, to accommodate electrical and mechanical services, runs or connections.

.1 Insert teflon sleeves into holes and seal.

.2 After installation of services, fill remaining space with insulation.

.9 Cap wrench access holes with an in-fitting, flush, stainless steel removable plug.

.10 Install removable closure panels, cover strips, and angles.

.11 Supervise installation of thresholds, heaters and urethane insulation for floors.

3.3 ADJUSTING

.1 Remove protective coverings and test and adjust operating equipment.

3.4 CLEANING

.1 Progress Cleaning: clean in accordance with Section 01 74 11 - Cleaning.

.1 Leave Work area clean at end of each day.

.2 Clean equipment and apparatus in accordance with Section 01 45 00 - Quality Control.

.3 Re-finish damaged coatings and finishes.

.2 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment in accordance with Section 01 74 11 - Cleaning.

.3 Waste Management: separate waste materials for recycling in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.

3.5 PROTECTION

.1 Protect installed products and components from damage during construction.

.2 Repair damage to adjacent materials caused by walk-in freezer and cooler installation.

END OF SECTION

1 General

1.1 REFERENCES

.1 American National Standards Institute/National Fire Prevention Association (ANSI/NFPA)
- .1 ANSI/NFPA 13- 2013, Installation of Sprinkler Systems.

.2 Underwriters Laboratories of Canada (ULC)
- .1 ULC S543- 1984, Internal Lug Quick Connect Couplings for Fire Hose.

1.2 SHOP DRAWINGS AND PRODUCT DATA

.1 Submit shop drawings and product data in accordance with Section 01 33 00 - Submittal Procedures and in accordance with ANSI/NFPA 13, working plans and design requirements.

.2 Sprinklers shall be referred to on drawings, submittals and other documentation, by the sprinkler identification or model number as specifically published in the appropriate agency listing or approval. Trade names or other abbreviated designations shall not be allowed.

1.3 ENGINEERING DESIGN CRITERIA

.1 Design system in accordance with ANSI/NFPA 13, using following parameters:
- .1 Hazard:
  - .1 To suit occupancy as indicated.
- .2 Pipe size and layout:
  - .1 Hydraulic design.
  - .2 Sprinkler head layout: to ANSI/NFPA 13.
- .3 Water supply:
  - .1 Conduct flow and pressure test of water supply in vicinity of project to obtain criteria for bases of design in accordance with ANSI/NFPA 13.Zoning:
  - .1 System zoning as indicated.

1.4 CLOSEOUT SUBMITTALS

.1 Provide maintenance data for incorporation into manual specified in Section 01 78 00 - Closeout Submittals.

1.5 EXTRA MATERIALS

.1 Provide maintenance materials in accordance with Section 01 78 00 - Closeout Submittals.

.2 Provide spare sprinklers and tools as required by ANSI/NFPA 13.

2 Products

2.1 PIPE, FITTINGS AND VALVES

.1 Pipe:
- .1 Ferrous: to ANSI/NFPA 13.
- .2 Copper tube: to ANSI/NFPA 13.

.2 Fittings and joints to ANSI/NFPA 13:
- .1 Ferrous: screwed, welded, flanged or roll grooved.
  - .1 Grooved joints shall consist of two ductile iron housing segments, pressure responsive gasket, and zinc-electroplated steel bolts and nuts.
    - .1 Rigid Type: Housings shall be cast with offsetting angle-pattern bolt pads to provide rigidity. Couplings shall be fully installed at visual pad-to-pad offset contact. (Tongue and recess type couplings, or any coupling that requires exact gapping of bolt pads on each side of the coupling at specified torque ratings, are not allowed.) Victaulic Style 009-EZ, 005, and 07.
    - .2 Flexible Type: For use in locations where vibration attenuation and stress relief are required, and for seismic applications. Victaulic Style 77.
- .2 Copper tube: screwed, soldered, brazed, or roll grooved.
  - .1 Grooved joints shall be manufactured to copper-tube dimensions, with housings cast with offsetting angle-pattern bolt pads. Victaulic Style 606.

.3 Valves:
- .1 ULC listed for fire protection service.
- .2 Up to NPS 2: bronze, screwed or grooved ends, OS & Y; gate or indicating ball valve. Victaulic Style 728.
- .3 NPS 2 1/2 and over: cast ductile iron, flanged or roll grooved ends, indicating butterfly valve. Victaulic Style 705W.
- .4 Swing or spring-actuated check valves. Victaulic Series 717.
- .5 Ball drip.

.4 Pipe hangers:
- .1 ULC listed for fire protection services.

2.2 SPRINKLER HEADS

.1 General: to ANSI/NFPA 13 and ULC listed for fire services.

.2 New sprinkler heads to match equivalent existing types. Confirm on site.

.3 Temperature rating on fusible links shall suit specific hazard area with minimum of safety 10 deg.C.

.4 Sprinklers shall be listed with and bear certification marking of nationally recognized testing agency.

.5 Sprinklers with O-rings are not allowed.

.6 Provide minimum 12 mm (1/2") nominal diameter discharge orifice, except when approved by authorities having jurisdiction.

.7 Provide chrome plated finish for sprinklers in all areas: except mechanical rooms where bronze finish is acceptable.

.8 All pendant type heads to be semi-recessed where possible.

.9 All sprinkler heads located in Mechanical Rooms and other areas susceptible to damage to be complete with wire guards.

.10 Sprinkler heads shall be located in the centre half or quarter point of ceiling tiles.

.11 Provide quick response heads in all light hazard areas.

.12 Sprinkler body shall be integrally cast with hex-shaped wrench boss to reduce the risk of damage during installations.

.1 Wrenches shall be provided by the sprinkler manufacturer that directly engage the hex-shaped wrench boss integrally cast in the sprinkler body.

2.3 PENDANT SPRINKLER HEAD

.1 Provide semi-recessed polished chrome glass bulb type in areas indicated on drawings or specified.

2.4 UPRIGHT SPRINKLER HEAD

.1 Provide polished chrome glass bulb type in areas indicated on drawings or specified. Bronze in mechanical rooms, chrome elsewhere.

2.5 SIDE WALL SPRINKLER HEAD

.1 Provide polished chrome glass bulb type in areas indicated on drawings or specified.

.2 Provide extended coverage where specified or required.

2.6 CONCEALED SPRINKLER HEAD

.1 Provide brass glass bulb type concealed sprinkler head with stainless steel deflector pins in areas indicated on drawings or specified.

.2 Unit to be complete with pre-assembled threaded adaptor that provides a minimum of ½" vertical adjustment with a matched low profile cover assembly.

.3 Cover plate finish to be selected by Architect for each ceiling type based on the following: Polished Chrome, Brushed Chrome, Bright Brass, Antique Brass, Brushed Brass, Brushed Copper, Painted White, Painted Ivory, or Painted Black.

2.7 DRY PENDANT SPRINKLER HEAD

.1 Provide polished chrome glass bulb type in areas indicated as preaction or non-freeze. For preaction systems utilized semi-recessed and for freezers utilize non-recessed with escutcheon.

2.8 DRY SIDEWALL SPRINKLER HEAD

.1 Provide polished chrome glass bulb type in areas indicated as preaction or non-freeze.

2.9 DOUBLE INTERLOCK PREACTION VALVE STATION

.1 Provide integrated fire protection system consisting of a preaction system trim totally pre-assembled, pre-wired and factory tested.

.2 All electrical and mechanical components of the system shall be contained in one single unit, rated for the intended application, and shall be complete with the standard trim including deluge valve, releasing control panel, releasing circuit disable switch, water supply control valve, preaction riser check valve, solenoid valve, pneumatic actuator, alarm pressure switch, low air supervisory switch, and options as noted within.

.3 Electric/pneumatic controlled, double interlock preaction systems to be complete with a pneumatic actuator, normally held closed by supervisory pressure maintained in the sprinkler system, a normally closed electric solenoid valve controlled by an approved system releasing control panel with compatible detection system.

.4 Both the electric detection system and supervisory pressure must be relieved from the sprinkler system before the deluge valve will open and fill the sprinkler system with water.

.5 Activation of a releasing device alone or operation of a sprinkler alone will sound an alarm but will NOT cause the system to fill with water.

.6 All the valves and trim shall be rated up to a maximum of 250 psi WWP (1724 kPa) max.

.7 cULus Listed & FM Approved as an assembled unit.

.8 Factory assembled and tested under ISO-9001 standards

.9 Prewired to an appropriate releasing control panel.

.10 Unit to be complete with the following galvanized trim piping, base mounting rail/platform, air connection coordinated with on site plant air, inlet & outlet hydrostatic test ports, and gauges to indicate air, water supply pressure and priming water pressure.

.11 Sequence of operation shall be: In a fire condition, when the detection system operates, system releasing control panel energizes solenoid valve open. Alarms activate, but the deluge valve will NOT open until a sprinkler opens relieving supervisory pressure from the sprinkler system. When a sprinkler opens, supervisory pressure in the sprinkler piping is reduced causing the pneumatic actuator to open. Pressure is released from the priming chamber of the deluge valve to the open drain manifold faster than it is supplied through the restricted orifice. The deluge valve clapper opens to allow water to flow into the

system piping and alarm devices, causing the alarm pressure switch and optional water motor alarm to activate. Water will flow from any open sprinklers and/or other opening in the sprinkler piping. When the deluge valve operates, the sensing end of the PORV is pressurized, causing the PORV to open. When the PORV opens, it drains the priming water pressure to the priming chamber, preventing the deluge valve from resetting, even if the open releasing devices close. The deluge valve can only be reset after the system is taken out of service, and the outlet chamber of the deluge valve and associated trim piping is depressurized and drained.

.12 Unit to be complete with shut-off valve and sight glass to permit testing without filling dry pipe to critical areas.

.13 Unit to be complete with an anti-column device to prevent an unwanted water column from establishing within the system riser

.14 Design is based on FireFlex Systems Inc. TotalPac 3 with Viking Trim including Viking VFR-400 releasing panel and due to space constraints without cabinet.

2.10 SIGNS

.1 Signs for control drain and test valves: to ANSI/NFPA 13.

2.11 SPARE PARTS CABINET

.1 Reuse existing cabinet.

.2 For storage of maintenance materials, spare sprinkler heads and special tools.

3 Execution

3.1 INSTALLATION

.1 Install, inspect and test to acceptance in accordance with ANSI/NFPA 13.

.2 Testing to be witnessed by Fire Commissioner of Canada and authority having jurisdiction.

.3 Install packaged preaction systems for areas indicated and connect to required services. Connect supervisory air to existing plant compressed air located in basement mechanical room.

3.2 INSPECTION

.1 Do not recess, paint or conceal piping accessories or work prior to inspection and approval by authorities having jurisdiction or authorized representative.

3.3 FIELD QUALITY CONTROL

.1 Subject systems and equipment to operational test.

.2 Hydrostatically test water supply connections and fire department connections at 345 mm in excess of normal working pressure but not less than 1400 kPa for 2 hours without loss under supervision.

.3 Upon complete installation of piping and apparatus for sprinkler systems, test joints for tightness and good condition of piping. When testing with water, install pressure gauge at highest point of installation. If impossible to test whole installation in single operation, subdivide into several zones and test each zone in manner described.

.4 During tests, stop any leaks and remove and repair any defective part. Perform test over again until satisfactory results are obtained.

.5 Provide hydraulic pump, temporary connections and labour required for tests.

3.4 ADJUSTMENT

.1 Adjust equipment to satisfaction of authorities having jurisdiction.

3.5 PROTECTION OF COMPLETE WORK

.1 Paint exposed steel pipe and fittings, except special finishes, in accordance with Division 9.

.2 Assume responsibility for protecting sprinkler heads during painting. Replace damaged and painted components.

.3 Provide red wire guards for sprinkler heads in mechanical and electrical rooms and around ventilation equipment, and all other areas required by Code or intended usage.

.4 Provide stainless steel guards for sprinkler heads in freezers.

END OF SECTION

1 General

1.1 SECTION INCLUDES

.1 Materials and installation for copper domestic water service used in the following:
  .1 Copper incoming domestic water service, up to NPS 2 1/2.
  .2 Hard drawn copper domestic hot and cold water services inside building.
  .3 Soft copper tubing inside building.
.2 Sustainable requirements for construction, verification and operation.

1.2 REFERENCES

.1 American National Standards Institute (ANSI)/American Society of Mechanical Engineers International (ASME).
  .1 ANSI/ASME B16.15-02, Cast Bronze Threaded Fittings, Classes 125 and 250.
  .2 ANSI/ASME B16.18-01, Cast Copper Alloy Solder Joint Pressure Fittings.
  .3 ANSI/ASME B16.22-01, Wrought Copper and Copper Alloy Solder Joint Pressure Fittings.
  .4 ANSI/ASME B16.24-01, Cast Copper Alloy Pipe Flanges and Flanged Fittings, Class 150, 300, 400, 600, 900, 1500 and 2500.

.2 American Society for Testing and Materials International, (ASTM).
  .1 ASTM A307-03, Standard Specification for Carbon Steel Bolts and Studs, 60,000 PSI Tensile Strength.
  .2 ASTM B88M-03, Standard Specification for Seamless Copper Water Tube (Metric).
  .3 ASTM F492-95, Standard Specification for Propylene and Polypropylene (PP) Plastic-Lined Ferrous Metal Pipe and Fittings.

.3 American Water Works Association (AWWA).
  .1 AWWA C111-00, Rubber-Gasket Joints for Ductile-Iron Pressure Pipe and Fittings.

.4 Canadian Standards Association (CSA International).
  .1 CSA B242-M1980(R1998), Groove and Shoulder Type Mechanical Pipe Couplings.

.5 Department of Justice Canada (Jus).
  .1 Canadian Environmental Protection Act, 1999, c. 33 (CEPA).

.6 Health Canada/Workplace Hazardous Materials Information System (WHMIS).
  .1 Material Safety Data Sheets (MSDS).

.7 Manufacturer's Standardization Society of the Valve and Fittings Industry (MSS).
  .1 MSS-SP-67-02, Butterfly Valves.
  .2 MSS-SP-70-98, Cast Iron Gate Valves, Flanged and Threaded Ends.
  .3 MSS-SP-71-97, Cast Iron Swing Check Valves, Flanged and Threaded Ends.
  .4 MSS-SP-80-03, Bronze Gate, Globe, Angle and Check Valves.

.8 National Research Council (NRC)/Institute for Research in Construction.
  .1 NRCC 38728, National Plumbing Code of Canada (NPC) - 1995.

.9 Transport Canada (TC).
  .1 Transportation of Dangerous Goods Act, 1992, c. 34 (TDGA).

2 Products

2.1 PIPING

.1 Domestic hot, cold and recirculation systems, within building.
- .1 Above ground: copper tube, hard drawn, type L to ASTM B88M.
- .2 Buried or embedded: copper tube, soft annealed, type K: to ASTM B88M, in long lengths and with no buried joints.

2.2 FITTINGS

.1 Bronze pipe flanges and flanged fittings, Class 150: to ANSI/ASME B16.24.

.2 Cast bronze threaded fittings, Class 125: to ANSI/ASME B16.15.

.3 Cast copper, solder type: to ANSI/ASME B16.18.

.4 Wrought copper and copper alloy, solder type: to ANSI/ASME B16.22.

.5 NPS 2 and larger: roll grooved to CSA B242.

2.3 JOINTS

.1 Rubber gaskets, 1.6 mm thick: to AWWA C111.

.2 Bolts, nuts, hex head and washers: to ASTM A307, heavy series.

.3 Solder: 95/5 (no lead).

.4 Teflon tape: for threaded joints.

.5 Grooved couplings: designed with angle bolt pads to provide rigid joint, complete with EPDM flush seal gasket.

.6 Dielectric connections between dissimilar metals: dielectric fitting to ASTM F492, complete with thermoplastic liner.

2.4 GATE VALVES

.1 NPS 2 and under, soldered:
- .1 Rising stem: to MSS-SP-80, Class 125, 860 kPa, bronze body, screw-in bonnet, solid wedge disc as specified Section 23 05 22 - Valves - Bronze.

.2 NPS 2 and under, screwed:
- .1 Rising stem: to MSS-SP-80, Class 125, 860 kPa, bronze body, screw-in bonnet, solid wedge disc as specified Section 23 05 22 - Valves - Bronze.

2.5 SWING CHECK VALVES

.1 NPS 2 and under, soldered:
- .1 To MSS-SP-80, Class 125, 860 kPa, bronze body, bronze swing disc, screw in cap, regrindable seat as specified Section 23 05 22 - Valves - Bronze.

.2 NPS 2 and under, screwed:
.1 To MSS-SP-80, Class 125, 860 kPa, bronze body, bronze swing disc, screw in cap, regrindable seat as specified Section 23 05 22 - Valves - Bronze.

2.6 BALL VALVES

.1 NPS 2 and under, screwed:
.1 Class 150.
.2 Bronze body, chrome plated brass ball, PTFE adjustable packing, brass gland and PTFE or BunaN seat, steel lever handle as specified Section 23 05 22 - Valves - Bronze.

.2 NPS 2 and under, soldered:
.1 To ANSI/ASME B16.18, Class 150.
.2 Bronze body, chrome plated brass ball, PTFE adjustable packing, brass gland and PTFE or BunaN seat, steel lever handle, with NPT to copper adaptors as specified Section 23 05 22 - Valves - Bronze.

3 Execution

3.1 INSTALLATION

.1 Install in accordance with Province Plumbing Code and local authority having jurisdiction.

.2 Install pipe work in accordance with Section 23 05 05 - Installation of Pipework, supplemented as specified herein.

.3 Assemble piping using fittings manufactured to ANSI standards.

.4 Install cold piping below and away from all hot piping so as to maintain temperature of cold water as low as possible.

.5 Connect to fixtures and equipment in accordance with manufacturer's written instructions unless otherwise indicated.

3.2 VALVES

.1 Isolate equipment, fixtures and branches with ball valves.

3.3 PRESSURE TESTS

.1 Conform to requirements of Section 23 05 02 - General Mechanical Provisions.

.2 Test pressure: greater of 1 times maximum system operating pressure or 860 kPa.

3.4 FLUSHING AND CLEANING

.1 Disinfect and rinse entire system to requirements of authority having jurisdiction and RCMP site standards.

.2 Flush entire system for 8 h. Ensure outlets flushed for 2 h. Let stand for 24 h, then draw one sample off longest run. Let system flush for an additional 2 hours, then draw a second sample (from same location). Submit to testing laboratory to verify system is clean to Federal potable water guidelines.

.3 Upon completion, provide laboratory test reports on water quality for Departmental Representative's approval. Include one copy of approved test reports in Operation and Maintenance Manual.

3.5 START-UP

.1 Timing: Start up after:
- .1 Pressure tests have been completed.

.2 Provide continuous supervision during start-up.

.3 Start-up procedures:
- .1 Establish circulation and ensure that air is eliminated.
- .2 Check pressurization to ensure proper operation and to prevent water hammer, flashing and/or cavitation.
- .3 Monitor piping domestic hot piping systems for freedom of movement, pipe expansion as designed.
- .4 Check control, limit, safety devices for normal and safe operation.

.4 Rectify start-up deficiencies.

3.6 PERFORMANCE VERIFICATION

.1 Timing:
- .1 After pressure and leakage tests and disinfection completed, and certificate of completion has been issued by authority having jurisdiction.

.2 Procedures:
- .1 Verify that flow rate and pressure meet Design Criteria.
- .2 TAB in accordance with Section 23 05 93 - Testing, Adjusting and Balancing for HVAC.
- .3 Adjust pressure regulating valves while withdrawal is maximum and inlet pressure is minimum.
- .4 Sterlize domestic hot water systems for Legionella control.
- .5 Verify performance of temperature controls.
- .6 Verify compliance with safety and health requirements.
- .7 Check for proper operation of water hammer arrestors. Run one outlet for 10 seconds, then shut of water immediately. If water hammer occurs, replace water hammer arrestor or re-charge air chambers. Repeat for outlets and flush valves.
- .8 Confirm water quality consistent with supply standards, verifying that no residuals remain as a result of flushing and/or cleaning.

END OF SECTION

1 General

1.1 SUMMARY

.1 Section Includes:
- .1 The installation of drainage waste and vent piping. Sustainable requirements for construction and verification.

1.2 REFERENCES

.1 American Society for Testing and Materials International, (ASTM).
- .1 ASTM B32-03, Specification for Solder Metal.
- .2 ASTM B306-02, Specification for Copper Drainage Tube (DWV).
- .3 ASTM C564-03a, Specification for Rubber Gaskets for Cast Iron Soil Pipe and Fittings.

.2 Canadian Standards Association (CSA International).
- .1 CSA B67-1972(R1996), Lead Service Pipe, Waste Pipe, Traps, Bends and Accessories.
- .2 CAN/CSA-B70-02, Cast Iron Soil Pipe, Fittings and Means of Joining.
- .3 CAN/CSA-B125-01, Plumbing Fittings.

2 Products

2.1 COPPER TUBE AND FITTINGS

.1 Above ground sanitary, storm and vent Type DWV to: ASTM B306.
- .1 Fittings.
  - .1 Cast brass: to CAN/CSA-B125.
  - .2 Wrought copper: to CAN/CSA-B125.
- .2 Solder: 95:5, type TA, to ASTM B32.

2.2 CAST IRON PIPING AND FITTINGS

.1 Buried sanitary, storm and vent minimum NPS 3, to: CAN/CSA-B70, with one layer of protective coating.
- .1 Joints.
  - .1 Mechanical joints.
    - .1 Neoprene or butyl rubber compression gaskets: to ASTM C564 or CAN/CSA-B70.
    - .2 Stainless steel clamps.
  - .2 Hub and spigot.
    - .1 Caulking lead: to CSA B67.
    - .2 Cold caulking compounds.

.2 Above ground sanitary, storm and vent: to CAN/CSA-B70.
- .1 Joints.
  - .1 Hub and spigot.
    - .1 Caulking lead: to CSA B67.

.2 Mechanical joints.
.1 Neoprene or butyl rubber compression gaskets with stainless steel clamps.

3 Execution

3.1 INSTALLATION

.1 In accordance with Section 23 05 05 - Installation of Pipework.

.2 Install in accordance with Provincial Plumbing Code and local authority having jurisdiction.

3.2 TESTING

.1 Pressure test buried systems before backfilling.

.2 Hydraulically test to verify grades and freedom from obstructions.

3.3 PERFORMANCE VERIFICATION

.1 Cleanouts:
.1 Ensure accessible and that access doors are correctly located.
.2 Open, cover with linseed oil and re-seal.
.3 Verify that cleanout rods can probe as far as the next cleanout, at least.

.2 Test to ensure traps are fully and permanently primed.

.3 Storm water drainage:
.1 Verify domes are secure.
.2 Ensure weirs are correctly sized and installed correctly.
.3 Verify provisions for movement of roof system.

.4 Ensure that fixtures are properly anchored, connected to system and effectively vented.

END OF SECTION

1 General

1.1 SUMMARY

.1 Section Includes:
  .1 The installation of drainage waste and venting piping - plastic.
.2 Sustainable requirements for construction and verification.

1.2 REFERENCES

.1 American Society for Testing and Materials International, (ASTM).
  .1 ASTM D2564-02, Specification for Solvent Cements for Poly (Vinyl-Chloride) (PVC) Plastic Piping Systems.

.2 Canadian Standards Association (CSA International).
  .1 CSA-Series B1800-02, Plastic Nonpressure Pipe Compendium.
  .2 CSA-B181.2-02, PVC Drain, Waste and Vent Pipe and Pipe Fittings.
  .3 CSA-B182.1-02, Plastic Drain and Sewer Pipe and Pipe Fittings.

2 Products

2.1 PIPING AND FITTINGS

.1 For buried and or above ground DWV piping to:
  .1 CSA-B181.1.
  .2 CSA-B181.2.
  .3 CSA-B182.1.

2.2 JOINTS

.1 Solvent weld for PVC: to ASTM D2564.

3 Execution

3.1 INSTALLATION

.1 In accordance with Section 23 05 05 - Installation of Pipework.

.2 Install in accordance with Provincial Plumbing Code and local authority having jurisdiction.

3.2 TESTING

.1 Pressure test buried systems before backfilling.

.2 Hydraulically test to verify grades and freedom from obstructions.

3.3 PERFORMANCE VERIFICATION

.1 Cleanouts:
  .1 Ensure accessible and that access doors are correctly located.
  .2 Open, cover with linseed oil and re-seal.

.3 Verify cleanout rods can probe as far as the next cleanout, at least.

.2 Test to ensure traps are fully and permanently primed.

.3 Storm water drainage:
- .1 Verify domes are secure.
- .2 Ensure weirs are correctly sized and installed correctly.
- .3 Verify provisions for movement of roof system.

.4 Ensure fixtures are properly anchored, connected to system and effectively vented.

END OF SECTION

1 General

1.1 SUMMARY

.1 Section Includes:
- .1 Materials and installation for plumbing specialties and accessories.
- .2 Sustainable requirements for construction and verification.

1.2 REFERENCES

.1 American Society for Testing and Materials International (ASTM).
- .1 ASTM A126-95 (2001), Specification for Gray Iron Castings for Valves, Flanges and Pipe Fittings.
- .2 ASTM B62-02, Specification for Composition Bronze or Ounce Metal Castings.

.2 Canadian Standards Association (CSA International).
- .1 CSA-B64 Series-01, Backflow Preventers and Vacuum Breakers.
- .2 CSA-B79-94 (R2000), Floor, Area and Shower Drains, and Cleanouts for Residential Construction.
- .3 CSA-B356-00, Water Pressure Reducing Valves for Domestic Water Supply Systems.

.3 Health Canada/Workplace Hazardous Materials Information System (WHMIS).
- .1 Material Safety Data Sheets (MSDS).

.4 Plumbing and Drainage Institute (PDI).
- .1 PDI-G101-96, Testing and Rating Procedure for Grease Interceptors with Appendix of Sizing and Installation Data.
- .2 PDI-WH201-92, Water Hammer Arresters Standard.

1.3 SUBMITTALS

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

.2 Product Data:
- .1 Submit manufacturer's printed product literature, specifications and datasheet for fixtures and equipment.
- .2 Indicate dimensions, construction details and materials for specified items.

.3 Shop Drawings:
- .1 Submit shop drawings to indicate materials, finishes, method of anchorage, number of anchors, dimensions, construction and assembly details and accessories.

.4 Certificates: submit certificates signed by manufacturer certifying that materials comply with specified performance characteristics and physical properties.

.5 Instructions: submit manufacturer's installation instructions.

1.4 QUALITY ASSURANCE

.1 Health and Safety:
- .1 Do construction occupational health and safety in accordance with Section 01 35 29.06 - Health and Safety Requirements.

.2 Provide materials, equipment and labour to install plumbing as required by Provincial and Local Codes and as specified herein.

.3 Provide water and drainage connections to equipment furnished in other sections of this specification and by the Departmental Representative.

.4 Fittings of same type shall be product of one manufacturer.

2 Products

2.1 FLOOR DRAINS

.1 Floor Drains: to CSA B79.

.2 Provide trap primer tapping on all floor drains where trap primers are required by Code and authority having jurisdiction.

.3 FD-1 – Regular Floor Drain

.1 Type 1 (General Duty): Epoxy coated cast iron body with double drainage flange, reversible clamping collar with primary and secondary weep holes, combined two piece body and adjustable nickel-bronze strainer. Shower and washroom floor drains shall have a removable perforated sediment bucket.

.2 Type 2 (Heavy Duty): Epoxy coated cast iron body with double drainage flange, reversible clamping collar with primary and secondary weep holes, combined two piece body and adjustable heavy duty nickel-bronze strainer.

.3 Type 3 (Combination Funnel Floor Drain): Epoxy coated cast iron body with double drainage flange, reversible clamping collar with primary and secondary weep holes, combined two piece body and adjustable nickel-bronze strainer with integral 102 mm x 229 mm oval nickel bronze funnel.

2.2 CLEANOUTS

.1 Cleanout: Adjustable floor cleanout with lacquered cast iron body and anchor flange, secondary O ring test seal, 4" diameter cleanout opening and combined scoriated satin finished nickel bronze cover and plug top assembly with stainless steel vandal-proof allan key screws and primary gasket seal. Provide membrane clamp for all membrane floors. Specification based on Mifab Model C1100.

.2 Access Covers:

.1 Wall Access: face or wall type, polished nickel bronze with chrome plated cap, round cover with flush head securing screws, bevelled edge frame complete with anchoring lugs.

.2 Floor Access: round cast iron body and frame with adjustable secured nickel bronze top and:

.1 Plugs: bolted bronze with neoprene gasket.

.2 Cover for Unfinished Concrete Floors: round, nickel bronze, gasket, vandal-proof screws.

.3 Cover for Terrazzo Finish: Polished nickel bronze with recessed cover for filling with terrazzo, vandal-proof locking screws.

.4 Cover for Tile and Linoleum Floors: polished nickle bronze with recessed cover for linoleum or tile infill, complete with vandal-proof locking screws.

.5 Cover for Carpeted Floors; polished nickel bronze with deep flange cover for carpet infill, complete with carpet retainer vandal–proof locking screws.

.3 Provide bolted cover plates on all vertical rainwater leaders.

2.3 WATER HAMMER ARRESTORS

.1 Stainless steel bellow type or copper piston type to PDIWH201.

.2 Air chamber same size as supply line or 19 mm minimum, and minimum 450 mm long.

2.4 TRAP SEAL PRIMERS

.1 Trap Seal Primer: Pressure drop activated brass trap seal primer, with inlet opening of 12 mm male NPT and outlet opening of female 12 mm NPT. Complete with four view holes and removable filter screen. Size to serve number of floor drains connected to primer. Primer shall require no adjustments and no air pre-charge. Specification based on Mifab Model M-500.

.2 Air Gap Fitting: Copper air gap fitting complete with a 12 mm male NPT fitting at the inlet supply incorporating a stream directing nozzle, a 12 mm NPT female outlet, and a ANSI/ASME A112.1.2 air gap in plumbing systems standard. Specification based on Mifab Model MI-GAP.

.3 Distribution Unit: Trap seal primer distribution unit with four brass compression outlet connections 12 mm, ABS body and HDPE lid with top 12 mm MIP connection, four 6 mm diameter vent holes in the flange and three 3 mm diameter Phillips head screws to secure the lid to the body. Unit complete with four wall internal body design that aligns with the slots in the underside of the lid to distribute water evenly and to only the desired number of ports. Specification based on Mifab Model M1-DU.

2.5 VACUUM BREAKERS

.1 Breakers: To CSA-B64 Series.

2.6 STRAINERS

.1 Size 50 mm and under: Screwed brass, Y pattern with 0.7 mm stainless steel perforated screen.

.2 Size 63 mm to 100 mm: Flanged iron body with bolted cap, Y pattern with 1.2 mm stainless steel perforated screen.

.3 Size 127 mm and larger: Flanged iron body, basket pattern with 3 mm stainless steel perforated screen.

.4 Screen free area shall be minimum three times area of inlet pipe. Provide valved drain and hose connection off strainer bottom.

2.7 LAUNDRY SERVICE BOX (Fire Rated LB-1)

.1 Fire Rated double outlet washing machine outlet box complete with ¼ turn brass ball valves with copper seat connections and 50mm PVC drain opening. Fire rating to meet or exceed fire rating on Architectural wall detail.

.2 Box to be bulk molded compound of thermoset fire-rated plastic.

.3 Unit to be complete with drain piece sleeve of galvanized steel with integrated intumescent pad.

.4 Unit to be complete with bulk molded compound thermoset fire-rated plastic plugs.

.5 Unit to be complete with PVC test cap.

.6 Unit to be complete with box fire rated pad, UL classified FyreWrap Insulation Material

.7 Unit to have adjustable mounting bracket to secure into stud wall.

.8 Unit to be complete with snap-on faceplate that accommodates up to two-layers of 5/8" drywall.

.9 Specification based on Oatey Fire Rated.

2.8 EMERGENCY SHOWER ES-1

.1 Existing combination emergency shower and eyewash to be relocated. Disconnect, protect and store until unit can be mounted in new location.

.2 Mount unit as per manufacturers requirements and connect to required services. Eyewash drain to be connected to sanitary.

2.9 EMERGENCY SHOWER ES-2

.1 Existing combination emergency shower and eyewash to be relocated. Disconnect, protect and store until unit can be mounted in new location.

.2 Mount unit as per manufacturers requirements and connect to required services. Eyewash drain to discharge to floor, provide elbow and piping to direct water to trench drain.

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 data sheet.

3.2 INSTALLATION

.1 Install in accordance with Provincial Codes, and local authority having jurisdiction.

.2 Install in accordance with manufacturer's instructions and as specified.

3.3 CLEANOUTS

.1 Install cleanouts at base of soil and waste stacks, and rainwater leaders, at locations required by Code, and as indicated.

.2 Bring cleanouts to wall or finished floor unless serviceable from below floor.

.3 Building drain cleanout and stack base cleanouts: line size to maximum NPS4.

.4 Lubricate cleanout plugs with mixture of graphite and linseed oil. Prior to building turnover remove cleanout plugs, relubricate and reinstall using only enough force to ensure permanent leak proof joint.

3.4 WATER HAMMER ARRESTORS

.1 Install on branch supplies to fixtures or group of fixtures as required to eliminate water hammer.

3.5 TRAP SEAL PRIMERS

.1 Install for floor drains and elsewhere, as required by Code and/or where indicated on drawings. Trap primers shall be electronic.

.2 Install on cold water supply to nearest frequently used plumbing fixture, in concealed space, to approval of Departmental Representative.

.3 Install plastic PEX tubing to floor drain.

3.6 STRAINERS

.1 Install with sufficient room to remove basket.

3.7 VACUUM BREAKERS

.1 Install vacuum breakers on plumbing lines where contamination of domestic water may occur; generally make-up lines, hose bibbs, and flush valves.

3.8 START-UP

.1 Timing: Start-up only after:
- .1 Pressure tests have been completed.
- .2 Disinfection procedures have been completed.
- .3 Certificate of static completion has been issued.
- .4 Water treatment systems operational.

.2 Provide continuous supervision during start-up.

3.9 TESTING AND ADJUSTING

.1 Timing:
- .1 After start-up deficiencies rectified.
- .2 After certificate of completion has been issued by authority having jurisdiction.

.2 Application tolerances:
- .1 Pressure at fixtures: within tolerance allowable by manufacturer.
- .2 Flow rate at fixtures: +/- 10%.

.3 Adjustments:
- .1 Verify that flow rate and pressure meet design criteria.
- .2 Make adjustments while flow rate or withdrawal is (1) maximum and (2) 25% of maximum and while pressure is (1) maximum and (2) minimum.

.4 Floor drains:
- .1 Verify operation of trap seal primer.
- .2 Prime, using trap primer. Adjust flow rate and timer to suit site conditions.
- .3 Check operations of flushing features.
- .4 Check security, accessibility, removeability of strainer.
- .5 Clean out baskets.

.5 Vacuum breakers, backflow preventers, backwater valves:
- .1 Test tightness, accessibility for O&M of cover and of valve.
- .2 Simulate reverse flow and back-pressure conditions to test operation of vacuum breakers, backflow preventers.
- .3 Verify visibility of discharge from open ports.

.6 Access doors:
- .1 Verify size and location relative to items to be accessed.

.7 Cleanouts:
- .1 Verify covers are gas-tight, secure, yet readily removable.

.8 Water hammer arrestors:
- .1 Verify proper installation of correct type of water hammer arrester.

.9 Strainers:
- .1 Clean out repeatedly until clear.
- .2 Verify accessibility of cleanout plug and basket.
- .3 Verify that cleanout plug does not leak.

.10 Hose bibbs, sediment faucets:
- .1 Verify operation of vacuum breakers.

.11 Training:
- .1 In accordance with Section 21 05 01 Common Work Results - Mechanical, Training of Operation and Maintenance Personnel, supplemented as specified.
- .2 Demonstrate full compliance with Design Criteria.

END OF SECTION

1 General

1.1 SUMMARY

.1 Section Includes:
- .1 The supply and installation of Plumbing Fixtures and Trim.

.2 Products Installed but not Supplied Under this Section:
- .1 Install rough-in for equipment supplied by others, complete with valves on hot and cold water supplies, waste and vent.
- .2 Equipment installed by others.
  - .1 Connect with unions.

1.2 REFERENCES

.1 Canadian Standards Association (CSA International).
- .1 CAN/CSA-B45 Series-02, Plumbing Fixtures.
- .2 CAN/CSA-B125-01, Plumbing Fittings.
- .3 CAN/CSA-B651-95(R2001), Barrier-Free Design.

1.3 SUBMITTALS

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

.2 Closeout Submittals:
- .1 Submit maintenance data in accordance with Section 01 78 00 - Closeout Submittals.
- .2 Include:
  - .1 Description of fixtures and trim, giving manufacturer's name, type, model, year, capacity, material, water consumption and details of all items noted under specification..
  - .2 Details of operation, servicing, maintenance.
  - .3 List of recommended spare parts.

1.4 GENERAL REQUIREMENTS

.1 Provide new fixtures, CSA approved, free from flaws and blemishes with finished surfaces clear, smooth and bright.

.2 Provide CSA approved plumbing fittings. Visible parts of fixture brass and accessories shall be heavily chrome plated.

.3 Fixtures shall be product of one manufacturer. Fittings of same type shall be product of one manufacturer.

.4 Protect fixtures against use and damage during construction.

1.5 JOB CONDITIONS

.1 Check millwork shop drawings. Confirm location and size of fixtures and openings before rough-in and installation.

2 Products

2.1 MANUFACTURED UNITS

.1 Fixtures: manufacture in accordance with CAN/CSA-B45 series.

.2 Trim, fittings: manufacture in accordance with CAN/CSA-B125.

.3 Exposed plumbing brass to be chrome plated.

.4 Number, locations: architectural drawings to govern.

.5 Fixtures in any one location to be product of one manufacturer and of same type.

.6 Trim in any one location to be product of one manufacturer and of same type.

2.2 SINK SK-1 (Single Compartment)

.1 Bowl: single compartment, 18-10 stainless steel, 18 gauge, self-rimming sink 520 mm x 510 mm x 250 mm, complete with 89 mm removable drain assembly and 89 mm crumb cup strainer.

.2 Trim: heavy duty cast brass 200mm (8") center two handle sink faucet complete with 150mm (6") radius vandal resistant spout with 5.7 L/minute vandal resistant laminar flow control and limited swing. Handles to be 152mm (6") wrist blade handles.

.3 Trap: cast brass adjustable swivel pattern P-trap with cleanout.

.4 Supplies and Riser Tubes: chrome plated angle supplies with lockshield stem, screwdriver stop, 9.5 mm O.D. x 305 mm long flexible braided stainless steel riser and stainless steel escutcheon plate.

.5 Design based on the following: Bowl - Franke LBS6810P-1, Trim - Delta 26C3925-LS, Supplies – Delta 47T2312SD, Tailpiece - Delta 33T290-1, Trap - Delta 33T311.

3 Execution

3.1 INSTALLATION

.1 Install each fixture that is to be operational with its own trap, easily removable for servicing and cleaning. At completion thoroughly clean plumbing fixtures and equipment.

.2 Provide chrome plated rigid or stainless steel flexible supplies to fixtures that are to be operational complete with screwdriver stops, reducers and escutcheons.

.3 Install wall mounted lavatories, urinals and water closets with approved wall carriers, model to suit installation.

.4 Mount fixtures above finished floor as noted on Architectural drawings.

.5 Install hose and faucets and hose connections with vacuum breakers.

.6 Mounting heights:
.1 Standard: to comply with manufacturer's recommendations unless otherwise indicated or specified by architect.
.2 Physically handicapped: to comply with most stringent of either NBCC or CAN/CSA B651.

3.2 PLUMBING FIXTURE ROUGH-IN SCHEDULE

.1 Rough-in fixture piping connections in accordance with the following table of minimum sizes or as required for particular fixtures:

	Hot Water	Cold Water	Waste	Vent
Sink	12 mm (½")	12 mm (½")	38 mm (1-1/2")	32 mm (1-1/4")

3.3 ADJUSTING

.1 Conform to water conservation requirements specified this section.

.2 Adjustments:
.1 Adjust water flow rate to design flow rates.
.2 Adjust pressure to fixtures to ensure no splashing at maximum pressures.

.3 Checks:
.1 Aerators or laminar flow control: operation, cleanliness.
.2 Vacuum breakers, backflow preventers: operation under all conditions.

.4 Thermostatic controls:
.1 Verify temperature settings, operation of control, limit and safety controls.

END OF SECTION

Part 1 - General

1.1 RELATED WORK

.1	Fire Extinguishers	Division 10
.2	Fire Suppression	Division 21
.3	Plumbing	Division 22
.4	Heating, Ventilating and Air Conditioning	Division 23
.5	Integrated Automation	Division 25
.6	Utilities	Division 33

1.2 INTENT

.1 Provide a complete and fully operational mechanical system with facilities and services to meet requirements described herein and in complete accord with applicable codes and ordinances.

.2 Contract documents of for mechanical scope are diagrammatic and approximately to scale unless detailed otherwise. They establish scope, material and installation quality and are not detailed installation instructions.

.3 Should any discrepancies occur on drawings or in specifications which leaves doubt as to the intent and meaning of the drawings and specifications, obtain a ruling from the designer before submitting tender. If this is not done, it will be assumed that the most expensive alternate has been allowed for.

.4 Follow manufacturer's recommended installation details and procedures for equipment supplemented by details given herein and on plans subject to approval of the Departmental Representative.

.5 Install equipment generally in locations and routes shown, close to building structure with minimum interference with other services or free space. Remove and replace improperly installed equipment to satisfaction of the Departmental Representative at no extra cost.

.6 Provide labour and materials required to install, test and place into operation complete mechanical system. Provide additional material for modifications required to correct minor job conflictions.

.7 Connect to equipment furnished in other Sections and by Departmental Representative, including uncrating equipment, moving in place and installing complete, start-up and test.

3. MATERIALS

.1 Replace materials or workmanship below specified quality and relocate work wrongly placed to satisfaction of the Departmental Representative.

.2 Materials and equipment installed shall be new, full weight and of the best quality specified. Use same brand or manufacturer for each specific application. Statically and dynamically balance rotating equipment for minimum vibration and low operating noise level.

.3 Each major component of equipment shall have manufacturer's name, address, catalog and serial number in a conspicuous place.

.4 Install materials and equipment in a neat and workmanlike manner by competent specialists.

4. CUTTING AND PATCHING

.1 Locate and provide holes and sleeves, cutting and fitting required for mechanical work. Relocate improperly located holes and sleeves at no extra cost.

.2 Drill for expansion bolts, hanger rods, brackets, and supports.

.3 Do no cutting or burning of structural members of building frame without obtaining prior written approval from the Departmental Representative.

.4 Provide openings and holes required in precast members for mechanical work. Cast holes larger than 100 mm (4") in diameter. Field-cut smaller than 100 mm (4").

.5 All patching of finished construction of building shall be performed under the sections of specifications covering these materials.

5. SEMI-FINAL AND FINAL INSPECTIONS

.1 Perform the following items prior to semi-final inspection.

.1 Heating and air conditioning systems capable of operation with alarm controls functional and automatic controls in operation generally, but not necessarily finally calibrated.

.2 Necessary tests on equipment made including those required by authorities and certificates of approval obtained.

.3 Rough balance of air and water systems completed.

.4 Valve tagging completed and equipment identified. Equipment and piping painted and escutcheons installed.

.5 Equipment lubricated as per manufacturer's data.

.6 Warranty forms have been mailed to manufacturer. Provide copy of original warranty for equipment which has warranty period longer than one year.

.7 Systems chemically cleaned, flushed and water treatment initiated. Provide report from manufacturer's representative to confirm status of treatment.

.8 Submit sample of Operating/Maintenance Manuals. Arrange Operating and Maintenance Instructions and submit schedule for approval.

.9 Review and ensure access doors are suitably located and equipment easily accessible including plumbing cleanouts.

.10 Have noise and vibration control devices and flexible connections inspected by manufacturer's representative and submit written report.

.11 Equipment alignment carried out by qualified millwright and certified report submitted.

.12 Check operations of plumbing systems and fixtures and ensure fixtures are solidly supported.

.13 Fan plenums cleaned, temporary filters removed and permanent filters installed.

.4 Provide declaration in writing that semi-final deficiencies and the following items have been completed prior to the final inspection:

.1 Equipment cleaned inside, outside and lubricated. Plumbing fixtures and brass cleaned.

.2 Final balancing completed and rough data of balance reports submitted.

.3 Final calibration of controls completed.

6. SHOP DRAWINGS

.1 Refer to Division 1.

.2 Submit 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 in the Departmental Representative's office. Maintenance and operating manuals are not suitable submittal material.

.3 Clearly mark each sheet of printed submittal material (using arrows, underlining or circling) to show particular sizes, types, model numbers, ratings, capacities and options actually being proposed. Cross out non-applicable material. Specifically note on the submittal specified features such as special tank linings, pump seals, materials or painting.

.4 Include dimensional data for roughing in and installation, technical data sufficient to check that equipment meets requirements of drawings and specifications, wiring, piping, and service connection data, motor sizes complete with voltage ratings and schedules as applicable.

7. OPERATING AND MAINTENANCE MANUALS

.1 Provide services of qualified and experienced personnel to prepare proper documentation and to instruct the Operating Staff in the operation and preventative maintenance of each piece of equipment and system supplied and installed. Complete and turn over documentation prior to final inspection.

.2 Provide 215 mm x 280 mm (8-1/2" x 11") capacity extension type catalogue binders bound with heavy fabric, hot stamped in gold lettering front and spine. Refer to Division 1 for colour and quantity.

.3 Each binder shall be indexed according to the following indexing system:

.4 Tab-1.0 Mechanical Systems: Title page with clear plastic protection cover.

.5 Tab-1.1 List of Mechanical Drawings.

.6 Tab-1.2 Description of Systems: Provide complete description of each system. Include detailed system description and components comprising that system, explanation of how each component interfaces with others to complete the system, location of each thermostat, controller or operating setpoints. Refer to 21 0-5 01, 1.1.5 for additional required information.

.7 Tab-1.3 Operation Division: Provide complete and detailed operation of each major component. Include how to energize and exact location of switches and controls, how the component interfaces with other components, operation of controls, including the operational sequence, operational characteristic changes for summer or winter operation, and how to accomplish the changeover, complete troubleshooting sequence, setpoints cannot be maintained, and safeguards to check if equipment goes off line. Refer to 21 0-5 01, 1.1.5 for additional required information.

.8 Tab-1.4 Maintenance and Lubrication Division: Provide detailed preventative maintenance and lubrication schedule for each of the major components to include daily, weekly, monthly, semi-annual and yearly checks and tasks. Explain how to proceed with each task required for each piece of typical equipment such as bearings, drives, motors and filters. Compile this

information for each typical piece of equipment separate from the shop drawings section. Refer to 21 0-5 01, 1.1.5 for additional required information.

.9 Tab-1.5 List of Equipment Suppliers and Contractors: Provide complete list of equipment suppliers and contractors, including address and telephone number. Outline procedures for purchasing parts and equipment. Include steps to take in order to purchase new parts.

.10 Tab-Certification (2.0, 2.1, etc.): Include copy of test data degreasing and flushing of heating system analysis of system water taken at time system was put into operation, hydrostatic or air tests performed on piping systems, equipment alignment certificates, copy of balancing data for air and water systems, copy of valve tag identification and pipe colour code, inspection approval certificates for plumbing system, hot air heating and ventilation systems and fire damper schedule.

.11 Tab-Shop Drawings and Maintenance Bulletins (3.0, 3.1, etc.): Provide materials as received in compliance with clause "Shop Drawings".

.12 The divider tabs shall be laminated mylar plastic, and coloured according to section. The colouring is as follows: Mechanical Systems - 1.0 - 1.5 - Orange, Certification - 2.0 - 2.4 - Green, Shop Drawings and Maintenance - 3.0 - 3.17 - Yellow. Plastic tabs with typed insertions will not be accepted.

.13 Submit documents to the Departmental Representative for approval prior to being turned over to the Departmental Representative. At completion of project, hold a Seminar to instruct the Operating Staff in operation and preventative maintenance of each piece of equipment and system supplied and installed.

.14 Provide one digital copy on compact disk of the final operation and maintenance manual in each of the manuals (six in total).

8. RECORD DRAWINGS

.1 Refer to Division 1.

.2 Site records:

- .1 Departmental Representative will provide one (1) set of reproducible mechanical drawings. Provide sets of white prints as required for each phase of work. Mark changes as work progresses and as changes occur. Include changes to existing mechanical systems, control systems and low voltage control wiring.
- .2 Record drawings shall identify location of fire dampers, major control lines, access doors, tagged valves and actual room names or numbers.
- .3 Transfer information weekly to reproducibles, revising reproducibles to show work as actually installed.
- .4 Use different colour waterproof ink for each service.
- .5 Make available for reference purposes and inspection.

.3 As-built drawings:

- .1 Prior to start of Testing, Adjusting and Balancing for HVAC, finalize production of as-built drawings.
- .2 Identify each drawing in lower right hand corner in letters at least 12 mm high as follows: - "AS BUILT DRAWINGS: THIS DRAWING HAS BEEN REVISED TO SHOW MECHANICAL SYSTEMS AS INSTALLED" (Signature of Contractor) (date).
- .3 Submit to Departmental Representative for approval and make corrections as directed.

.4 Perform testing, adjusting and balancing for HVAC using as-built drawings.
.5 Submit completed as-built drawings with Operating and Maintenance Manuals.

9. IDENTIFICATION

.1 Refer to Section 23 05 54, Mechanical Identification.

10. TEMPORARY FACILITIES

.1 Refer to General Requirements - Division 01.

11. SUPERVISION

.1 Refer to General Requirements - Division 01.

12. 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 and 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 re-use existing materials and equipment unless specifically indicated.

13. TEMPORARY OR TRIAL USAGE

.1 Temporary or trial usage by the Departmental Representative of mechanical equipment supplied under contract and claimed complete before final acceptance shall not represent acceptance.

.2 Repair or replace permanent equipment used temporarily.

.3 Take responsibility for damage caused by defective materials or workmanship during temporary or trial usage.

14. WASTE MANAGEMENT AND DISPOSAL

.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.
.3 Store and manage hazardous materials in accordance with cepa, tdga AND Regional and Municipal Regulations.

.2 Waste Management and Disposal:
- .1 Remove from site and dispose of packaging materials at appropriate recycling facilities.
- .2 Collect and separate for disposal paper, plastic, polystyrene, corrugated cardboard packaging material in appropriate on-site bins for recycling in accordance with Waste Management Plan.
- .3 Divert unused metal materials from landfill to metal recycling facility as approved by Departmental Representative.
- .4 Unused sealant materials must not be disposed of into sewer system, into streams, lakes, onto ground or in other location where it will pose health or environmental hazard.
- .5 Fold up metal and plastic banding, flatten and place in designated area for recycling.
- .6 Handle and dispose of hazardous materials in accordance with CEPA, TDGA, Regional and Municipal regulations.
- .7 Disposal of asbestos waste generated by removal activities must comply with Federal, Provincial, Territorial and Municipal regulations. Dispose of asbestos waste in sealed double thickness 6 ml bags or leak proof drums. Label containers with appropriate warning labels.
- .8 Provide manifests describing and listing waste created. Transport containers by approved means to licenced landfill for burial.

15. DEMOLITION

.1 Mechanical Contractor shall include in his Base Price the cost to provide the removal of all existing mechanical equipment and material that is not to be reused under this contract. Equipment shall be Departmental Representatives' salvage unless noted otherwise.

16. INSTRUCTION OF OPERATING STAFF

.1 Provide trained personnel to instruct operating staff on maintenance, adjustment and operation of mechanical equipment. Instruct staff on changes or modification in equipment made under terms of guarantee.

.2 Provide instruction during regular work hours prior to acceptance and turnover to operating staff for regular operation.

.3 Use operation and maintenance data manual for instruction purposes. On completion of instruction, turn one manual over to chief operating personnel, the balance to Departmental Representative.

.4 Record every instruction and training session on digital video.

.5 Time allocated for Instruction:

Fire Protection	One (1) hour instruction
Controls	Total training to be 4 hours of instruction.
Freezer Equipment	Two (2) hour instruction
Air Conditioning	Two (2) hour instruction

17. SUBSTANTIAL COMPLETION

.1 The mechanical portion of the project shall be deemed substantially complete when ALL mechanical systems are operational as designed. In addition, the air and/or water balance must be completed with the report submitted and approved by the Departmental

Representative and the temperature control system must be complete, as designed, operational, with all control components calibrated and the maintenance manuals in final form must be submitted. The date will be established by the Departmental Representative and will set the date for the start of the one (1) year warranty on all mechanical systems.

18. EXCESSIVE ADMINISTRATION

.1 Following the "Substantial Completion" Inspection a "Final" Inspection will be conducted and a follow up inspection will be conducted to "check off" all outstanding mechanical deficiencies.

.2 If the mechanical portion of the project is not 100 percent completed at that time the cost of all additional inspections will be back-charged to the Mechanical Contractor.

.3 The cost of each inspection will be $750.00 plus travel, and will be deducted from the total Mechanical Contract amount.

.4 The frequency of the additional inspections will be determined by the Departmental Representative.

19. ALTERNATE AND SEPARATE PRICES

.1 Referenced specification sections and drawings contain pertinent requirements for materials and methods to achieve work described herein.

.2 Coordinate pertinent related work and modify surrounding work as required to complete project under each alternate designated.

.3 Alternate products may vary in operation or construction, but shall meet or exceed the requirements of the specifications, drawings and the specified equipment for performance capacities, controllability and equipment options.

.4 Revisions required to adapt equipment other than that specified shall be made without extra charge to the Departmental Representative.

20. ALTERNATE MATERIALS & EQUIPMENT

.1 This contract shall be based on materials and equipment as specified.

.2 Make proposals to supply alternate materials or equipment in writing to the Departmental Representative at least ten days prior to closing date of tender for Mechanical Trade.

.3 All proposed equipment is subject to the requirements of the drawings and specifications. Revisions required to adapt equipment other than that specified shall be made without extra charge to the contract. All suppliers, except those specified, shall guarantee in writing that their individual proposed products meet or exceed the performance and quality of specified products.

.4 The following products shall be supplied as specified, there is no equal product that will be accepted:

.1 EMCS: shall be expansion of existing Honeywell Controls.

Part 2 - Materials

2.1 NOT USED

.1 Not Used

Part 3 - Execution

3.1 NOT USED

.1 Not Used.

END OF SECTION

1 General

1.1 REFERENCES

.1 Canadian General Standards Board (CGSB)
.1 CAN/CGSB-1.181-99, Ready-Mixed Organic Zinc-Rich Coating.

2 Products

2.1 PIPE

	Service	Material
.1	Hot water heating (to 110 deg.C)	Steel Schedule 40, black, 9.5 mm wall for sizes 300 mm and larger, Grooved for 50 mm and larger.
.2	Equipment drains and overflows	Steel Schedule 40, galvanized, PVC
.3	Sanitary drainage and vent above grade	Type “M” or “DWV” copper, cast iron, plastic PVC-XFR-15/50, CPVC
.4	Domestic water unburied	Type "L" hard copper, PEX.
.5	Fire protection	Lightwall pipe, as approved by NFPA, Schedule 30 or to match existing.

2.2 FITTINGS

	Service	Material	Joint
.1	Hot water heater to 110 deg.C	Malleable iron 1034 kPa	Threaded banded Grooved mechanical
		Steel same thickness as pipe Wrought copper or cast bronze	 Pressfit fittings
.2	Vents	Malleable iron 1034 kPa banded	Threaded
.3	Equipment drains	Malleable iron 1034 kPa banded, galvanized. Steel, same thickness as pipe, galvanized. Malleable iron, grooved galvanized. Wrought copper or cast brass. PVC	Threaded Welded Grooved mechanical 95-5 solder, grooved mechanical Solvent weld or grooved mechanical

.4	Sanitary drainage and Vent unburied	Wrought copper or cast iron	95-5 solder Hub & Spigot
		Solvent weld or	PVC-XFR-15/50, CPVC grooved mechanical
.5	Domestic water inside building	Wrought copper bronze	95-5 solder, or cast brass grooved mechanical
		PEX	Mechanical joint
.6	Fire protection	Malleable iron or cast iron	Screwed or flanged
		Malleable iron or steel grooved Steel, same thickness as pipe	Grooved mechanical
.7	Storm	Cast iron	Hub & Spigot Gasket & Clamp
		PVC	Solvent weld, or grooved mechanical

.8 Use factory fabricated butt welded fittings for welded steel pipes.

.9 Use long radius elbows for steel and cast iron water piping.

3 Execution

3.1 CONNECTIONS TO EQUIPMENT

.1 In accordance with manufacturer's instructions unless otherwise indicated.

.2 Use valves and unions or flanges (as indicated) for isolation and ease of maintenance and assembly.

.3 Use double swing joints when equipment mounted on vibration isolation and when piping subject to movement.

3.2 CLEARANCES

.1 Provide clearance around systems, equipment and components for observation of operation, inspection, servicing, maintenance and as recommended by manufacturer.

.2 Provide space for disassembly, removal of equipment and components as recommended by manufacturer or as indicated (whichever is greater) without interrupting operation of other system, equipment, components.

3.3 DRAINS

.1 Install piping with grade in direction of flow except as indicated.

.2 Install drain valve complete with isolation at low points in piping systems, at equipment and at section isolating valves.

.3 Pipe each drain valve discharge separately to nearest floor drain where indicated. Discharge to be visible.

.4 Drain valves: NPS 3/4 gate or globe valves unless indicated otherwise, with hose end male thread, cap and chain.

3.4 AIR VENTS

.1 Install manual air vents at high points in piping systems complete with isolation valve and u-bend copper tubing to allow discharge to bucket.

.2 Install automatic air valve at each air separator and where indicated.

.3 Install isolating valve at each automatic air valve.

.4 Install drain piping to approved location and terminate where discharge is visible.

3.5 DIELECTRIC COUPLINGS

.1 General: Compatible with system, to suit pressure rating of system.

.2 Locations: Where dissimilar metals are joined.

.3 NPS 2 and under: isolating unions or bronze valves.

.4 Over NPS 2: Isolating flanges.

3.6 ROUTE AND GRADES

.1 Route piping in orderly manner and maintain proper grades. Install to conserve headroom and interfere as little as possible with use of space. Run exposed piping parallel to walls. Group piping wherever practical at common elevations. Install concealed pipes close to the building structure to keep furrings to a minimum.

.2 Slope water piping 25 mm in 12 m and arrange to drain at low points.

.3 On closed systems, equip low points with 20 mm drain valves and hose nipples. Provide, at high points, collecting chambers and high capacity float operated automatic air vents.

.4 Make reductions in water pipes with eccentric reducing fittings installed to provide drainage and venting.

.5 Grade horizontal drainage and vent piping 20 mm per meter minimum.

3.7 PIPEWORK INSTALLATION

.1 Screwed fittings jointed with Teflon tape.

.2 Protect openings against entry of foreign material.

.3 Install to isolate equipment and allow removal without interrupting operation of other equipment or systems.

.4 Assemble piping using fittings manufactured to ANSI standards.

.5 Saddle type branch fittings may be used on mains if branch line is no larger than half the size of main.

.1 Hole saw (or drill) and ream main to maintain full inside diameter of branch line prior to welding saddle.
.2 Do not project branch pipe inside the main pipe.

.6 Install exposed piping, equipment, rectangular cleanouts and similar items parallel or perpendicular to building lines.

.7 Install concealed pipework to minimize furring space, maximize headroom, conserve space.

.8 Slope piping, except where indicated, in direction of flow for positive drainage and venting.

.9 Install, except where indicated, to permit separate thermal insulation of each pipe.

.10 Provide clearance for proper installation of insulation and for access to valves, air vents, drains and unions.

.11 Group piping wherever possible.

.12 Ream pipes, remove scale, welding slag and other foreign material, inside and outside before assembly.

.13 Use eccentric reducers at pipe size changes to ensure positive drainage and venting.

.14 Install piping to allow for expansion and contraction without unduly stressing pipe or equipment connected.

.15 Screw joint steel piping up to and including 38 mm . Weld piping 63 mm and larger, including branch connections. Screw or weld 50 mm piping.

.16 Make screwed joints with full cut standard taper pipe threads with red lead and linseed oil or other approved non-toxic joint compound applied to male threads only.

.17 Clamp cast iron water pipe at fittings with 20 mm rods and properly anchor and support.

.18 Use grooved mechanical couplings and mechanical fasteners in accessible locations, risers, pipe chases, and in other locations as approved by Departmental Representative. Use flexible couplings at pumps, coils and all vibration isolated equipment in lieu of flexible connectors, all other couplings to be rigid.
.1 Grooved joints shall be installed in accordance with the manufacturer's latest published installation instructions.
.2 The grooved coupling manufacturer's factory trained representative shall provide on-site training for Contractor's field personnel in the use of grooving tools and installation of grooved joint products. The representative shall periodically visit the job site and review Contractor is following best recommended practices in grooved product installation. (A distributor's representative is not considered qualified to conduct the training or job site visits.)

.19 Make connections to equipment and branch mains with unions or flanges, as indicated:
.1 Unions are not required in installations using grooved mechanical joint couplings (The couplings shall serve as disconnect points.)

.20 Provide non-conducting type connections wherever jointing dissimilar metals in systems. Brass adaptors and valves are acceptable. Refer to dielectric couplings.

.21 Pressfit piping and fittings are not permitted.

.22 Install piping to allow for expansion and contraction without unduly stressing pipe or equipment connected.

.1 For mechanical pipe jointing systems, use adequate numbers of Victaulic Style 77 flexible couplings in header piping to accommodate thermal growth and contraction, and for the elimination of expansion loops. (In accordance with Victaulic instructions and as approved by the Departmental Representative.) Where expansion loops are required, use Victualic Style 77 couplings on the loops.

.23 Install piping material specified as inside the building to 2.4 meters outside of building.

.24 Use of PVC plastic pipe allowed where approved by the authority having jurisdiction. PVC pipe run in plenum spaces shall have flame and smoke rating for that purpose. PVC pipe to be complete with ULC labelled fire stopping wherever penetrating fire separations.

.25 Valves:

.1 Install in accessible locations.
.2 Remove interior parts before soldering.
.3 Install with stems upright or horizontal, not inverted.
.4 Valves accessible for maintenance without removing adjacent piping.
.5 Install globe valves in bypass around control valves.
.6 Use ball valves up to 50 mm or butterfly valves 63 mm and larger at branch take-offs for isolating purposes except where otherwise specified.
.7 Install butterfly valves between weld neck flanges to ensure full compression of liner.
.8 Install ball valves for glycol service and domestic water.
.9 Install gate, ball and butterfly valves for isolating service, to isolate equipment, part of systems or vertical risers.
.10 Install globe, ball or angle valves for throttling service.
.11 Use plug cocks in water systems for throttling service. Use non-lubricated plug cocks only when shut-off or isolation valves are also provided.
.12 Use butterfly valves in fire protection systems where approved.
.13 Provide drain valves at main shut-off valves, low points of piping and apparatus.

.26 Provide thermometers, thermometer wells, and DDC sensor wells where thermometers are indicated on drawings and schematics.

.27 Provide plug cocks at all pressure tapping locations.

3.8 SLEEVES

.1 General: Install where pipes pass through masonry, concrete structures, fire rated assemblies, and elsewhere as indicated.

.2 Material: Schedule 40 black steel pipe.

.3 Construction: Foundation walls and where sleeves extend above finished floors to have annular fins continuously welded on at mid-point.

.4 Sizes: 6 mm minimum clearance between sleeve and uninsulated pipe or between sleeve and insulation.

.5 Installation:
- .1 Concrete, masonry walls, concrete floors on grade: Terminate flush with finished surface.
- .2 Other floors: Terminate 25 mm above finished floor.
- .3 Before installation, paint exposed exterior surfaces with heavy application of zinc-rich paint to CAN/CGSB-1.181.

.6 Sealing:
- .1 Foundation walls and below grade floors: Fire retardant, waterproof non-hardening mastic.
- .2 Elsewhere: Provide space for firestopping. Maintain fire rating integrity.
- .3 Sleeves installed for future use: Fill with lime plaster or other easily removable filler.
- .4 Ensure no contact between copper pipe or tube and sleeve.

3.9 ESCUTCHEONS

.1 Install on pipes passing through walls, partitions, floors, and ceilings in finished areas.

.2 Construction: One piece type with set screws. Chrome or nickel plated brass or type 302 stainless steel.

.3 Sizes: Outside diameter to cover opening or sleeve. Inside diameter to fit around pipe or outside of insulation if so provided.

3.10 PREPARATION FOR FIRESTOPPING

.1 Material and installation within annular space between pipes, ducts, insulation and adjacent fire separation to Section 07 84 00 - Firestopping.

.2 Uninsulated unheated pipes not subject to movement: No special preparation.

.3 Uninsulated heated pipes subject to movement: Wrap with non-combustible smooth material to permit pipe movement without damaging firestopping material or installation.

.4 Insulated pipes and ducts: Ensure integrity of insulation and vapour barriers.

3.11 FLUSHING OUT OF PIPING SYSTEMS

.1 In accordance with Section 23 08 02 - Cleaning and Start-up of Mechanical Piping Systems.Before start-up, clean interior of piping systems in accordance with requirements of Section 01 74 11-Cleaning supplemented as specified in relevant sections of Mechanical.

.3 Preparatory to acceptance, clean and refurbish equipment and leave in operating condition, including replacement of filters in piping systems.

3.12 PRESSURE TESTING OF EQUIPMENT AND PIPEWORK

.1 Advise Departmental Representative 48 hours minimum prior to performance of pressure tests.

.2 Pipework: Test as specified in relevant sections of Mechanical or to 1.5 times maximum operating pressure. All installed piping to be tested unless noted otherwise.

.3 Maintain specified test pressure without loss for 4 hours minimum unless specified for longer period of time in relevant sections of Mechanical.

.4 Prior to tests, isolate equipment and other parts which are not designed to withstand test pressure or media.

.5 Conduct tests in presence of Departmental Representative.

.6 Pay costs for repairs or replacement, retesting, and making good. Departmental Representative to determine whether repair or replacement is appropriate.

.7 Insulate or conceal work only after approval and certification of tests by Departmental Representative.

3.13 EXISTING SYSTEMS

.1 Connect into existing piping systems at times approved by Departmental Representative.

.2 Request written approval 10 days minimum, prior to commencement of work.

.3 Be responsible for damage to existing plant by this work.

.4 Ensure daily clean-up of existing areas.

END OF SECTION

1 General

1.1 SUMMARY

.1 Section Includes:
  .1 Bronze - valves.
.2 Sustainable requirements for construction and verification.

1.2 REFERENCES

.1 American National Standards Institute (ANSI)/ American Society of Mechanical Engineers (ASME).
  .1 ANSI/ASME B1.20.1-1983(R2001), Pipe Threads, General Purpose (Inch).
  .2 ANSI/ASME B16.18-2001, Cast Copper Alloy Solder Joint Pressure Fittings.

.2 American Society for Testing and Materials International, (ASTM).
  .1 ASTM A276-04, Specification for Stainless Steel Bars and Shapes.
  .2 ASTM B62-02, Specification for Composition Bronze or Ounce Metal Castings.
  .3 ASTM B283-99a, Specification for Copper and Copper Alloy Die Forgings (Hot-Pressed).
  .4 ASTM B505/B505M-02, Specification for Copper-Base Alloy Continuous Castings.

.3 Manufacturers Standardization Society of the Valve and Fittings Industry, Inc. (MSS).
  .1 MSS-SP-25-1998, Standard Marking System for Valves, Fittings, Flanges and Unions.
  .2 MSS-SP-80-2003, Bronze Gate Globe, Angle and Check Valves.
  .3 MSS-SP-110-1996, Ball Valves, Threaded, Socket-Welding, Solder Joint, Grooved and Flared Ends.

1.3 SUBMITTALS

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

.2 Product Data: submit WHMIS MSDS - Material Safety Data Sheets in accordance with Section 02 61 33 - Hazardous Materials.
  .1 Submit shop drawings and product data in accordance with Section 01 33 00 - Submittal Procedures.
  .2 Submit data for valves specified in this section.

.3 Closeout Submittals:
  .1 Submit maintenance data for incorporation into manual specified in Section 01 78 00 - Closeout Submittals.

2 Products

2.1 MATERIALS

.1 Valves:
  .1 Except for specialty valves, to be single manufacturer.
  .2 All products to have CRN registration numbers.

.2 End Connections:
.1 Connection into adjacent piping/tubing:
.1 Steel pipe systems: Screwed ends to ANSI/ASME B1.20.1.
.2 Copper tube systems: Solder ends to ANSI/ASME B16.18.
.3 Provide flanged ends as indicated under 23 05 01, Installation of Pipework.

.3 Lockshield Keys:
.1 Where lockshield valves are specified, provide 10 keys of each size: malleable iron cadmium plated.

.4 Gate Valves:
.1 Requirements common to gate valves, unless specified otherwise:
.1 Standard specification: MSS SP-80.
.2 Bonnet: union with hexagonal shoulders.
.3 Connections: screwed with hexagonal shoulders.
.4 Inspection and pressure testing: to MSS SP-80. Tests to be hydrostatic.
.5 Packing: non-asbestos.
.6 Handwheel: non-ferrous.
.7 Handwheel Nut: bronze to ASTM B62.
.2 NPS 2 and under, non-rising stem, solid wedge disc, Class 125
.1 Body: with long disc guides, screwed bonnet with stem retaining nut.
.2 Operator: Handwheel.
.3 NPS 2 and under, non-rising stem, solid wedge disc, Class 150:
.1 Body: with long disc guides, screwed bonnet with stem retaining nut.
.2 Operator: Handwheel.
.4 NPS 2 and under, rising stem, split wedge disc, Class 125:
.1 Body: with long disc guides, screwed bonnet.
.2 Disc: split wedge, bronze to ASTM B283, loosely secured to stem.
.3 Operator: Handwheel.
.5 NPS 2 and under, rising stem, solid wedge disc, Class 125:
.1 Body: with long disc guides, screwed bonnet.
.2 Operator: Handwheel.
.6 NPS 2 and under, rising stem, solid wedge disc, Class 150:
.1 Body: with long disc guides, screwed bonnet.
.2 Operator: Handwheel.

.5 Globe Valves:
.1 Requirements common to globe valves, unless specified otherwise:
.1 Standard specification: MSS SP-80.
.2 Bonnet: union with hexagonal shoulders.
.3 Connections: screwed with hexagonal shoulders.
.4 Pressure testing: to MSS SP-80. Tests to be hydrostatic.
.5 Stuffing box: threaded to bonnet with gland follower, packing nut, high grade non-asbestos packing.
.6 Handwheel: non-ferrous.
.7 Handwheel Nut: bronze to ASTM B62.
.2 NPS 2 and under, composition disc, Class 125:
.1 Body and bonnet: screwed bonnet.
.2 Disc and seat: renewable rotating PTFE disc, composition to suit service conditions, regrindable bronze seat, loosely secured to bronze stem to ASTM B505.

.3 Operator: Handwheel.

.3 NPS 2 and under, composition disc, Class 150:

.1 Body and bonnet: union bonnet.

.2 Disc and seat: renewable rotating PTFE disc in easily removable disc holder, regrindable bronze seat, loosely secured to bronze stem to ASTM B505.

.3 Operator: Handwheel.

.4 NPS 2 and under, plug disc, Class 150, screwed ends:

.1 Body and bonnet: union bonnet.

.2 Disc and seat ring: tapered plug type with disc stem ring of AISI S420 stainless steel to ASTM A276, loosely secured to stem.

.3 Operator: Handwheel.

.5 Angle valve, NPS 2 and under, composition disc, Class 150:

.1 Body and bonnet: union bonnet.

.2 Disc and seat: renewable rotating PTFE disc in slip-on easily removable disc holder having integral guides, regrindable bronze seat, loosely secured to stem.

.3 Operator: Handwheel.

.6 Check Valves:

.1 Requirements common to check valves, unless specified otherwise:

.1 Standard specification: MSS SP-80.

.2 Connections: screwed with hexagonal shoulders.

.2 NPS 2 and under, swing type, bronze disc, Class 125:

.1 Body: Y-pattern with integral seat at 45 degrees, screw-in cap with hex head.

.2 Disc and seat: renewable rotating disc, two-piece hinge disc construction; seat: regrindable.

.3 NPS 2 and under, swing type, bronze disc:

.1 Body: Y-pattern with integral seat at 45 degrees, screw-in cap with hex head.

.2 Disc and seat: renewable rotating disc, two-piece hinge disc construction; seat: regrindable.

.4 NPS 2 and under, swing type, composition disc, Class 200:

.1 Body: Y-pattern with integral seat at 45 degrees, screw-in cap with hex head.

.2 Disc: renewable rotating disc of number 6 composition to suit service conditions, bronze two-piece hinge disc construction.

.5 NPS 2 and under, horizontal lift type, composition disc, Class 150:

.1 Body: with integral seat, union bonnet ring with hex shoulders, cap.

.2 Disc: renewable PTFE rotating disc in disc holder having guides top and bottom, of bronze to ASTM B62.

.6 NPS 2 and under, vertical lift type, bronze disc, Class 125:

.1 Disc: rotating disc having guides top and bottom, disc guides, retaining rings.

.7 Silent Check Valves:

.1 NPS 2 and under:

.1 Body: cast high tensile bronze to ASTM B62 with integral seat.

.2 Pressure rating: Class 125.

.3 Connections: screwed ends to ANSI B1.20.1 and with hex shoulders.

.4 Disc and seat: renewable rotating disc.
.5 Stainless steel spring, heavy duty.
.6 Seat: regrindable.

.8 Ball Valves:
.1 NPS 2 and under:
.1 Body and cap: cast high tensile brass to C37700.
.2 Pressure rating: Class 150 WSP/600 WOG.
.3 Connections: Screwed ends to ANSI B1.20.1 and with hexagonal shoulders or solder ends to ANSI.
.4 Stem: tamperproof ball drive.
.5 Stem packing nut: external to body.
.6 Ball and seat: replaceable solid hard chrome full port ball and teflon seals.
.7 Stem seal: TFE with external packing nut.
.8 Operator: removable lever handle.

3 Execution

3.1 INSTALLATION

.1 Install rising stem valves in upright position with stem above horizontal.

.2 Remove internal parts before soldering.

.3 Install valves with unions or flanges at each piece of equipment arranged to allow servicing, maintenance, and equipment removal. Refer to 23 05 05 - Installation of Pipework.

END OF SECTION

1 General

1.1 SUMMARY

.1 Section Includes:
- .1 Concrete housekeeping pads, hangers and supports for mechanical piping, ducting and equipment.
- .2 Sustainable requirements for construction and verification.

1.2 REFERENCES

.1 American National Standards Institute/American Society of Mechanical Engineers (ANSI/ASME)
- .1 ANSI/ASME B31.1-04, Power Piping.

.2 American Society for Testing and Materials International (ASTM)
- .1 ASTM A125-1996(R2001), Specification for Steel Springs, Helical, Heat-Treated.
- .2 ASTM A307-04, Specification for Carbon Steel Bolts and Studs, 60,000 PSI Tensile Strength.
- .3 ASTM A563-04a, Specification for Carbon and Alloy Steel Nuts.

.3 Factory Mutual (FM)

.4 Health Canada/Workplace Hazardous Materials Information System (WHMIS)
- .1 Material Safety Data Sheets (MSDS).

.5 Manufacturer's Standardization Society of the Valves and Fittings Industry (MSS)
- .1 MSS SP58-2002, Pipe Hangers and Supports - Materials, Design and Manufacture.
- .2 ANSI/MSS SP69-2003, Pipe Hangers and Supports - Selection and Application.
- .3 MSS SP89-2003, Pipe Hangers and Supports - Fabrication and Installation Practices.

.6 Underwriter's Laboratories of Canada (ULC)

1.3 SYSTEM DESCRIPTION

.1 Design Requirements:
- .1 Construct pipe hanger and support to manufacturer's recommendations utilizing manufacturer's regular production components, parts and assemblies.
- .2 Base maximum load ratings on allowable stresses prescribed by ASME B31.1 or MSS SP58.
- .3 Ensure that supports, guides, anchors do not transmit excessive quantities of heat to building structure.
- .4 Design hangers and supports to support systems under conditions of operation, allow free expansion and contraction, prevent excessive stresses from being introduced into pipework or connected equipment and prevent vibration.
- .5 Provide for vertical adjustments after erection and during commissioning. Amount of adjustment in accordance with MSS SP58.
- .6 Pipe supports shall meet the requirements of ASME B31.1 Power Piping and ASME B31.9 Building Services Piping.

.7 Automatic sprinkler pipe supports shall meet the requirements of NFPA No. 13, Standard for Installation of Sprinkler Systems.
.8 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.
.9 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.
.10 Fasten hangers and supports to building steel or inserts in concrete construction.
.11 Provide and set sleeves required for equipment, including openings required for placing equipment.
.12 Obtain approval prior to drilling for inserts and supports for piping systems.
.13 Obtain approval prior to using percussion type fastenings.
.14 Use of existing piping or equipment for hanger supports is not permitted.
.15 Use of perforated band iron, wire or chain as hangers is not permitted.

2 Products

2.1 GENERAL

.1 Fabricate hangers, supports and sway braces in accordance with ASME B31.1, ASME B31.9 and MSS SP58.

.2 Use components for intended design purpose only. Do not use for rigging or erection purposes.

.3 Design hangers so they cannot become disengaged by movements of supported pipe.

2.2 PIPE HANGERS

.1 Finishes:
.1 Pipe hangers and supports: galvanized after manufacture.
.2 Use electro-plating galvanizing process or hot dipped galvanizing process.
.3 Ensure steel hangers in contact with copper piping are copper plated.

.2 Upper attachment structural: suspension from lower flange of I-Beam:
.1 Cold piping NPS 2 maximum: malleable iron C-clamp with hardened steel cup point setscrew, locknut and carbon steel retaining clip.
.1 Rod: to be UL listed.
.2 Cold piping NPS 2 1/2 or greater, hot piping: malleable iron beam clamp, eye rod, jaws and extension with carbon steel retaining clip, tie rod, nuts and washers, UL listed to MSS-SP58 and MSS-SP69.

.3 Upper attachment structural: suspension from upper flange of I-Beam:
.1 Cold piping NPS 2 maximum: ductile iron top-of-beam C-clamp with hardened steel cup point setscrew, locknut and carbon steel retaining clip, UL listed to MSS SP69.
.2 Cold piping NPS 2 1/2 or greater, hot piping: malleable iron top-of-beam jaw-clamp with hooked rod, spring washer, plain washer and nut UL listed.

.4 Upper attachment to concrete:
- .1 Ceiling: carbon steel welded eye rod, clevis plate, clevis pin and cotters with weldless forged steel eye nut. Ensure eye 6 mm minimum greater than rod diameter.
- .2 Concrete inserts: wedge shaped body with knockout protector plate UL listed to MSS SP69.

.5 Shop and field-fabricated assemblies:
- .1 Trapeze hanger assemblies: Steel channels with welded spacers and hanger rods, cast iron roll and stand for hot pipe sizes 150 mm and over.
- .2 Steel brackets: Welded and wrought steel clamp.

.6 Hanger rods: threaded rod material to MSS SP58:
- .1 Ensure that hanger rods are subject to tensile loading only.
- .2 Provide linkages where lateral or axial movement of pipework is anticipated.
- .3 Threaded both ends, one end or continuous.

.7 Pipe attachments: material to MSS SP58:
- .1 Attachments for steel piping: carbon steel black.
- .2 Attachments for copper piping: copper plated black steel.
- .3 Use insulation shields for hot pipework.
- .4 Oversize pipe hangers and supports.

.8 Adjustable clevis: material to MSS SP69 UL listed, clevis bolt with nipple spacer and vertical adjustment nuts above and below clevis.
- .1 Ensure "U" has hole in bottom for rivetting to insulation shields.

.9 Yoke style pipe roll: carbon steel yoke, rod and nuts with cast iron roll, to MSS SP69.

.10 U-bolts: carbon steel to MSS SP69 with 2 nuts at each end to ASTM A563.
- .1 Finishes for steel pipework: black.
- .2 Finishes for copper, glass, brass or aluminum pipework: black, with formed portion plastic coated.

.11 Pipe rollers: cast iron roll and roll stand with carbon steel rod to MSS SP69.

.12 Wall Support:
- .1 Up to 75 mm: Cast iron hook.
- .2 100 mm and over: Welded steel bracket and wrought steel clamp.

.13 Floor Support:
- .1 Pipe sizes up to 100 mm and all cold pipe sizes: Cast iron adjustable pipe saddle, locknut nipple, floor flange and concrete pier to steel support.
- .2 Hot pipe sizes 150 mm and over: Adjustable cast iron roll and stand, steel screws and concrete pier or steel support.

2.3 RISER CLAMPS

.1 Steel or cast iron pipe: black carbon steel to MSS SP58, type 42, UL listed.

.2 Copper pipe: carbon steel copper plated to MSS SP58, type 42.

.3 Bolts: to ASTM A307.

.4 Nuts: to ASTM A563.

2.4 INSULATION PROTECTION SHIELDS

.1 Insulated cold piping:
  .1 64 kg/m^3 density insulation plus insulation protection shield to: MSS SP69, galvanized sheet carbon steel. Length designed for maximum 3 m span.

.2 Insulated hot piping:
  .1 Curved plate 300 mm long, with edges turned up, welded-in centre plate for pipe sizes NPS 12 and over, carbon steel to comply with MSS SP69.

2.5 CONSTANT SUPPORT SPRING HANGERS

.1 Springs: alloy steel to ASTM A125, shot peened, magnetic particle inspected, with +/-5% spring rate tolerance, tested for free height, spring rate, loaded height and provided with Certified Mill Test Report (CMTR).

.2 Load adjustability: 10% minimum adjustability each side of calibrated load. Adjustment without special tools. Adjustments not to affect travel capabilities.

.3 Provide upper and lower factory set travel stops.

.4 Provide load adjustment scale for field adjustments.

.5 Total travel to be actual travel + 20%. Difference between total travel and actual travel 25 mm minimum.

.6 Individually calibrated scales on each side of support calibrated prior to shipment, complete with calibration record.

2.6 VARIABLE SUPPORT SPRING HANGERS

.1 Vertical movement: 13 mm minimum, 50 mm maximum, use single spring pre-compressed variable spring hangers.

.2 Vertical movement greater than 50 mm: use double spring pre-compressed variable spring hanger with 2 springs in series in single casing.

.3 Variable spring hanger complete with factory calibrated travel stops. Provide certificate of calibration for each hanger.

.4 Steel alloy springs: to ASTM A125, shot peened, magnetic particle inspected, with +/-5 % spring rate tolerance, tested for free height, spring rate, loaded height and provided with CMTR.

2.7 EQUIPMENT SUPPORTS

.1 Fabricate equipment supports not provided by equipment manufacturer from structural grade steel meeting requirements of Section 05 12 23 - Structural Steel for Buildings.

2.8 EQUIPMENT ANCHOR BOLTS AND TEMPLATES

.1 Provide templates to ensure accurate location of anchor bolts.

2.9 SLEEVES

.1 Pipes through floors: Form with 18 gauge galvanized steel.

.2 Pipes through beams, walls, fire proofing, footings, potentially wet floor: Form with steel pipe or 18 gauge galvanized steel.

.3 Size large enough to allow for movement due to expansion and to provide for continuous insulation.

2.10 OTHER EQUIPMENT SUPPORTS

.1 Fabricate equipment supports from structural grade steel meeting requirements of Section 05 12 23 - Structural Steel for Buildings.

.2 Submit structural calculations with shop drawings.

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 in accordance with manufacturer's instructions and recommendations.

.2 Vibration Control Devices:
- .1 Install on piping systems at pumps, at all vibration isolated equipment and as indicated.

.3 Clamps on riser piping:
- .1 Support independent of connected horizontal pipework using riser clamps and riser clamp lugs welded to riser.
- .2 Bolt-tightening torques to industry standards.
- .3 Steel pipes: install below coupling or shear lugs welded to pipe.
- .4 Cast iron pipes: install below joint.

.4 Clevis plates:
- .1 Attach to concrete with 4 minimum concrete inserts, one at each corner.

.5 Provide supplementary structural steelwork where structural bearings do not exist or where concrete inserts are not in correct locations.

.6 Use approved constant support type hangers where:
- .1 Vertical movement of pipework is 13 mm or more,
- .2 Transfer of load to adjacent hangers or connected equipment is not permitted.

.7 Use variable support spring hangers where:
.1 Transfer of load to adjacent piping or to connected equipment is not critical.
.2 Variation in supporting effect does not exceed 25% of total load.

3.3 INSERTS

.1 Use inserts for suspending hangers for 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 pipe over 100 mm.

.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.

3.4 HANGER SPACING

.1 Plumbing piping: to Canadian Plumbing Code, Provincial Code, authority having jurisdiction.

.2 Fire protection: to applicable Fire Code.

.3 Copper piping: up to NPS 1/2: every 1.5 m.

.4 Flexible joint roll groove pipe: in accordance with table below, but not less than one hanger at joints.

.5 Within 300 mm of each elbow.

Maximum Pipe Size : NPS	Maximum Spacing Steel	Maximum Spacing Copper	Rod Diameter
up to 32 mm	1.8 m	1.8 m	9.5 mm
38 mm	1.8 m	1.8 m	9.5 mm
50 mm and 63 mm	3.0 m	3.0 m	9.5 mm
75 mm - 100 mm	3.6 m	3.0 m	15.8 mm
150 mm - 200 mm	4.3 m	4.3 m	22.2 mm

.6 Install hangers to provide a minimum 12 mm clear space between finished covering and adjacent work.

3.5 HANGER INSTALLATION

.1 Install hanger so that rod is vertical under operating conditions.

.2 Adjust hangers to equalize load.

.3 Support from structural members. Where structural bearing does not exist or inserts are not in suitable locations, provide supplementary structural steel members.

.4 Use hangers which are vertically adjustable 38 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.

.9 Hangers: Pipe sizes 12 mm to 38 mm: Adjustable wrought steel ring.

.10 Hangers: Pipe sizes 50 mm to 100 mm and Cold Pipe Sizes: Adjustable wrought steel clevis.

3.6 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 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.

.5 All penetrations through fire rated walls, floors or partition assemblies shall be sealed/fire stopped with fire stop materials that will remain in place and prevent the passage of smoke, toxic gases, flame, etc., when subjected to the standard test method Can 4-S115, "Standard Method of Fire Tests for Firestop Systems" for a period of time equal to fire protection rating required for the grade of fire separation of the penetrated wall or floor.

.6 Acceptable Product: According to instructions provided, all penetrations in fire rated walls, floors, or partition assemblies shall be sealed/fire stopped with:

- .1 3M Brand Intumescent, "Fire Barrier" Caulk CP-25, Putty 303, Penetration Sealing Systems 7902 or 7904 Series, Composite Sheet CS-195, or Wrap Strip FS-195.
- .2 Tremco Firestop Systems: Fyresil, Fyreshield for penetrations and perimeters. Dymeric ULC, THC 900 ULC

3.7 HORIZONTAL MOVEMENT

.1 Angularity of rod hanger resulting from horizontal movement of pipework from cold to hot position not to exceed 4 degrees from vertical.

.2 Where horizontal pipe movement is less than 13 mm, offset pipe hanger and support so that rod hanger is vertical in the hot position.

3.8 FINAL ADJUSTMENT

.1 Adjust hangers and supports:
- .1 Ensure that rod is vertical under operating conditions.
- .2 Equalize loads.

.2 Adjustable clevis:
- .1 Tighten hanger load nut securely to ensure proper hanger performance.
- .2 Tighten upper nut after adjustment.

.3 C-clamps:
- .1 Follow manufacturer's recommended written instructions and torque values when tightening C-clamps to bottom flange of beam.

.4 Beam clamps:
- .1 Hammer jaw firmly against underside of beam.

3.9 FIELD QUALITY CONTROL

.1 Site Tests: conduct following tests in accordance with Section 01 45 00 - Quality Control and submit report as described in PART 1 - SUBMITTALS.

.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.

END OF SECTION

1 General

1.1 SUMMARY

.1 Section Includes:
- .1 Materials and requirements for the identification of piping systems, duct work, valves and controllers, including the installation and location of identification systems.
- .2 Sustainable requirements for construction and verification.

1.2 REFERENCES

.1 Canadian Gas Association (CGA)
- .1 CSA/CGA B149.1-05, Natural Gas and Propane Installation Code.

.2 Canadian General Standards Board (CGSB)
- .1 CAN/CGSB-1.60-97, Interior Alkyd Gloss Enamel.
- .2 CAN/CGSB-24.3-92, Identification of Piping Systems.

.3 National Fire Protection Association (NFPA)
- .1 NFPA 13-2002, Standard for the Installation of Sprinkler Systems.
- .2 NFPA 14-2003, Standard for the Installation of Standpipe and Hose Systems.

1.3 QUALITY ASSURANCE

.1 Quality assurance submittals: submit following in accordance with Section 01 33 00 - Submittal Procedures.

2 Products

2.1 MANUFACTURER'S EQUIPMENT NAMEPLATES

.1 Metal or plastic laminate nameplate mechanically fastened to each piece of equipment by manufacturer.

.2 Lettering and numbers raised or recessed.

.3 Information to include, as appropriate:
- .1 Equipment: manufacturer's name, model, size, serial number, capacity.
- .2 Motor: voltage, Hz, phase, power factor, duty, frame size.

2.2 SYSTEM NAMEPLATES

.1 Colours:
- .1 Hazardous: red letters, white background.
- .2 Elsewhere: black letters, white background (except where required otherwise by applicable Codes).

.2 Construction:
- .1 3 mm thick laminated plastic or white anodized aluminum, matte finish, with square corners, letters accurately aligned and machine engraved into core.

.3 Sizes:

.1 Conform to following table:

Size # mm	Sizes (mm)	No. of Lines	Height of Letters (mm)
1	10 x 50	1	3
2	13 x 75	1	5
3	13 x 75	2	3
4	20 x 100	1	8
5	20 x 100	2	5
6	20 x 200	1	8
7	25 x 125	1	12
8	25 x 125	2	8
9	35 x 200	1	20

.2 Use maximum of 25 letters/numbers per line.

.4 Locations:

.1 Terminal cabinets, control panels: use size #5.

.2 Equipment in Mechanical Rooms: use size #9.

.5 Identification for PWGSC Preventive Maintenance Support System (PMSS):

.1 Use arrangement of Main identifier, Source identifier, Destination identifier.

.2 Equipment in Mechanical Room:

.1 Main identifier: size #9.

.2 Source and Destination identifiers: size #6.

.3 Terminal cabinets, control panels: size #5.

.3 Equipment elsewhere: sizes as appropriate.

2.3 EXISTING IDENTIFICATION SYSTEMS

.1 Apply existing identification system to new work.

.2 Where existing identification system does not cover for new work, use identification system specified this section.

2.4 PIPING SYSTEMS GOVERNED BY CODES

.1 Identification:

.1 Natural gas: to CSA/CGA B149.1 and authority having jurisdiction.

.2 Sprinklers: to NFPA 13.

2.5 IDENTIFICATION OF PIPING SYSTEMS

.1 Identify contents by background colour marking, pictogram (as necessary), legend; direction of flow by arrows. To CAN/CGSB 24.3 except where specified otherwise.

.2 Pictograms:
- .1 Where required: Workplace Hazardous Materials Information System (WHMIS) regulations.

.3 Legend:
- .1 Block capitals to sizes and colours listed in CAN/CGSB 24.3.

.4 Arrows showing direction of flow:
- .1 Outside diameter of pipe or insulation less than 75 mm: 100 mm long x 50 mm high.
- .2 Outside diameter of pipe or insulation 75 mm and greater: 150 mm long x 50 mm high.
- .3 Use double-headed arrows where flow is reversible.

.5 Extent of background colour marking:
- .1 To full circumference of pipe or insulation.
- .2 Length to accommodate pictogram, full length of legend and arrows.

.6 Materials for background colour marking, legend, arrows:
- .1 Pipes and tubing 20 mm and smaller: waterproof and heat-resistant pressure sensitive plastic marker tags.
- .2 Other pipes: pressure sensitive plastic-coated cloth or vinyl with protective overcoating, waterproof contact adhesive undercoating, suitable for ambient of 100% RH and continuous operating temperature of 150 degrees C and intermittent temperature of 200 degrees C.

.7 Colours and Legends:
- .1 Where not listed, obtain direction from Departmental Representative.
- .2 Colours for legends, arrows: to following table:

Background colour:	Legend, arrows:
Yellow	BLACK
Green	WHITE
Red	WHITE

.3 Background colour marking and legends for piping systems:

Contents	Background colour marking	Legend
City water	Green	CITY WATER
Hot water heating supply	Yellow	HEATING SUPPLY
Hot water heating return	Yellow	HEATING RETURN
Domestic hot water supply	Green	DOM. HW SUPPLY
Dom. HWS recirculation	Green	DOM. HW CIRC
Domestic cold water supply - hard	Green	DOM. CHW

Contents	Background colour marking	Legend
Domestic cold soft supply - hard	Green	DOM. CSW
Sanitary	Green	SAN
Plumbing vent	Green	SAN. VENT
Fire protection water	Red	FIRE PROT. WTR
Sprinklers	Red	SPRINKLERS

2.6 IDENTIFICATION DUCTWORK SYSTEMS

.1 50 mm high stencilled letters and directional arrows 150 mm long x 50 mm high.

.2 Colours: back, or co-ordinated with base colour to ensure strong contrast.

2.7 VALVES, CONTROLLERS

.1 Brass tags with 12 mm stamped identification data filled with black paint.

.2 Include flow diagrams for each system, of approved size, showing charts and schedules with identification of each tagged item, valve type, service, function, normal position, location of tagged item.

2.8 CONTROLS COMPONENTS IDENTIFICATION

.1 Identify all systems, equipment, components, controls, sensors with system nameplates specified in this section.

.2 Inscriptions to include function and (where appropriate) fail-safe position.

2.9 LANGUAGE

.1 Identification in English.

2.10 EQUIPMENT WITHIN CEILING SPACE

.1 Provide identification on the ceiling for all equipment concealed within a ceiling space.

.2 Equipment Labels:
- .1 Colours: Black lettering on transparent background.
- .2 Height of letter: 5 mm.
- .3 T-bar ceilings: Label shall be located on the metal ceiling grid beside the ceiling tile that provides service access to the equipment. The label shall include the equipment tag and an arrow indicating the ceiling tile to remove for servicing and access to the equipment.
- .4 Solid ceilings: Label shall be located on the trim of the access panel used for servicing the equipment and include the equipment tag.

.3 Colour Coded Dots:
- .1 Confirm site standard colour coding with the Departmental Representative prior to commencing work. Coordinate with all trades.
- .2 Provide a Legend in the operating and maintenance manual identifying the colour coding utilized on site.

.3 T-bar ceilings: Dot shall be located on the metal ceiling grid beside the ceiling tile that provides service access to the equipment.

.4 Solid ceilings: Dot shall be located on the trim of the access panel used for servicing the equipment.

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 TIMING

.1 Provide identification only after painting specified Section 09 91 23 - Interior Painting has been completed.

3.3 INSTALLATION

.1 Perform work in accordance with CAN/CGSB-24.3 except as specified otherwise.

.2 Provide ULC and/or CSA registration plates as required by respective agency.

.3 Identify systems, equipment to conform to PWGSC PMSS.

3.4 NAMEPLATES

.1 Locations:

.1 In conspicuous location to facilitate easy reading and identification from operating floor.

.2 Standoffs:

.1 Provide for nameplates on hot and/or insulated surfaces.

.3 Protection:

.1 Do not paint, insulate or cover.

3.5 LOCATION OF IDENTIFICATION ON PIPING AND DUCTWORK SYSTEMS

.1 On long straight runs in open areas in boiler rooms, equipment rooms, galleries, tunnels: at not more than 17 m intervals and more frequently if required to ensure that at least one is visible from any one viewpoint in operating areas and walking aisles.

.2 Adjacent to each change in direction.

.3 At least once in each small room through which piping or ductwork passes.

.4 On both sides of visual obstruction or where run is difficult to follow.

.5 On both sides of separations such as walls, floors, partitions.

.6 Where system is installed in pipe chases, ceiling spaces, galleries, confined spaces, at entry and exit points, and at access openings.

.7 At beginning and end points of each run and at each piece of equipment in run.

.8 At point immediately upstream of major manually operated or automatically controlled valves, and dampers. Where this is not possible, place identification as close as possible, preferably on upstream side.

.9 Identification easily and accurately readable from usual operating areas and from access points.

.1 Position of identification approximately at right angles to most convenient line of sight, considering operating positions, lighting conditions, risk of physical damage or injury and reduced visibility over time due to dust and dirt.

3.6 VALVES, CONTROLLERS

.1 Valves and operating controllers, except at plumbing fixtures, radiation, or where in plain sight of equipment they serve: Secure tags with non-ferrous chains or closed "S" hooks.

.2 Install one copy of flow diagrams, valve schedules mounted in frame behind non-glare glass where directed by Departmental Representative. Provide one copy (reduced in size if required) in each operating and maintenance manual.

.3 Number valves in each system consecutively.

3.7 ELECTRIC SWITCH

.1 Identify electric starting switches and remote push button stations with 6 mm laminated plastic plates.

3.8 AUTOMATIC CONTROLS

.1 Tag automatic controls, instruments, and relays and key to controls schematic on which instruments are numbered in sequence.

3.9 CLEANING

.1 Proceed in accordance with Section 01 74 11 - 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 SUMMARY

.1 TAB is used throughout this Section to describe the process, methods and requirements of testing, adjusting and balancing for HVAC.

.2 TAB means to test, adjust and balance to perform in accordance with requirements of Contract Documents and to do other work as specified in this section.

1.2 QUALIFICATIONS OF TAB PERSONNEL

.1 Submit names of personnel to perform TAB to Departmental Representative within 90 days of award of contract.

.2 Provide documentation confirming qualifications, successful experience.

.3 TAB: performed in accordance with the requirements of standard under which TAB Firm's qualifications are approved:

- .1 Associated Air Balance Council, (AABC) National Standards for Total System Balance, MN-1-2002.
- .2 National Environmental Balancing Bureau (NEBB) TABES, Procedural Standards for Testing, Adjusting, Balancing of Environmental Systems-1998.
- .3 Sheet Metal and Air Conditioning Contractors' National Association (SMACNA), HVAC TAB HVAC Systems - Testing, Adjusting and Balancing-2002.

.4 Recommendations and suggested practices contained in the TAB Standard: mandatory.

.5 Use TAB Standard provisions, including checklists, and report forms to satisfy Contract requirements.

.6 Use TAB Standard for TAB, including qualifications for TAB Firm and Specialist and calibration of TAB instruments.

.7 Where instrument manufacturer calibration recommendations are more stringent than those listed in TAB Standard, use manufacturer's recommendations.

.8 TAB Standard quality assurance provisions such as performance guarantees form part of this contract.

- .1 For systems or system components not covered in TAB Standard, use TAB procedures developed by TAB Specialist.
- .2 Where new procedures, and requirements, are applicable to Contract requirements have been published or adopted by body responsible for TAB Standard used (AABC, NEBB, or TABB), requirements and recommendations contained in these procedures and requirements are mandatory.

1.3 PURPOSE OF TAB

.1 Test to verify proper and safe operation, determine actual point of performance, evaluate qualitative and quantitative performance of equipment, systems and controls at design, average and low loads using actual or simulated loads.

.2 Adjust and regulate equipment and systems to meet specified performance requirements and to achieve specified interaction with other related systems under normal and emergency loads and operating conditions.

.3 Balance systems and equipment to regulate flow rates to match load requirements over full operating ranges.

1.4 EXCEPTIONS

.1 TAB of systems and equipment regulated by codes, standards to satisfaction of authority having jurisdiction.

1.5 CO-ORDINATION

.1 Schedule time required for TAB (including repairs, re-testing) into project construction and completion schedule to ensure completion before acceptance of project.

.2 Do TAB of each system independently and subsequently, where interlocked with other systems, in unison with those systems.

1.6 PRE-TAB REVIEW

.1 Review contract documents before project construction is started and confirm in writing to Departmental Representative adequacy of provisions for TAB and other aspects of design and installation pertinent to success of TAB.

.2 Review specified standards and report to Departmental Representative in writing proposed procedures which vary from standard.

.3 During construction, co-ordinate location and installation of TAB devices, equipment, accessories, measurement ports and fittings.

1.7 START-UP

.1 Follow start-up procedures as recommended by equipment manufacturer.

.2 Follow start-up procedures specified elsewhere in Division 23 in accordance with manufacturer’s requirements.

1.8 OPERATION OF SYSTEMS DURING TAB

.1 Operate systems for length of time required for TAB and as required by Departmental Representative for verification of TAB reports.

1.9 START OF TAB

.1 Notify Departmental Representative 7 days prior to start of TAB.

.2 Start TAB when building is essentially completed, including:

.3 Installation of ceilings, doors, windows, other construction affecting TAB.

.4 Application of weatherstripping, sealing, and caulking.

.5 Pressure, leakage, other tests specified elsewhere Division 23.

.6 Provisions for TAB installed and operational.

.7 Start-up, verification for proper, normal and safe operation of mechanical and associated electrical and control systems affecting TAB including but not limited to:
- .1 Proper thermal overload protection in place for electrical equipment.
- .2 Air systems:
  - .1 Filters in place, clean.
  - .2 Duct systems clean.
  - .3 Ducts, air shafts, ceiling plenums are airtight to within specified tolerances.
  - .4 Correct fan rotation.
  - .5 Fire, smoke, volume control dampers installed and open.
  - .6 Coil fins combed, clean.
  - .7 Access doors, installed, closed.
  - .8 Outlets installed, volume control dampers open.
- .3 Liquid systems:
  - .1 Flushed, filled, vented.
  - .2 Correct pump rotation.
  - .3 Strainers in place, baskets clean.
  - .4 Isolating and balancing valves installed, open.
  - .5 Calibrated balancing valves installed, at factory settings.
  - .6 Chemical treatment systems complete, operational.

1.10 APPLICATION TOLERANCES

.1 Do TAB to following tolerances of design values:
- .1 HVAC systems: plus 10%, minus 10%.
- .2 Hydronic systems: plus or minus 10%.

1.11 ACCURACY TOLERANCES

.1 Measured values accurate to within plus or minus 2% of actual values.

1.12 INSTRUMENTS

.1 Prior to TAB, submit to Departmental Representative list of instruments used together with serial numbers.

.2 Calibrate in accordance with requirements of most stringent of referenced standard for either applicable system or HVAC system.

.3 Calibrate within 3 months of TAB. Provide certificate of calibration to Departmental Representative and include TAB report.

1.13 SUBMITTALS

.1 Submit, prior to commencement of TAB:

.2 Proposed methodology and procedures for performing TAB if different from referenced standard.

1.14 PRELIMINARY TAB REPORT

.1 Submit for checking and approval of Departmental Representative, prior to submission of formal TAB report, sample of rough TAB sheets. Include:
- .1 Details of instruments used.
- .2 Details of TAB procedures employed.
- .3 Calculations procedures.

.4 Summaries.

1.15 TAB REPORT

.1 Format in accordance with referenced standard.

.2 TAB report to show results in SI units and to include:
.1 Project record drawings.
.2 System schematics.

.3 Submit 6 copies of TAB Report to Departmental Representative for verification and approval, in English in D-ring binders, complete with index tabs.

1.16 VERIFICATION

.1 Reported results subject to verification by Departmental Representative.

.2 Provide personnel and instrumentation to verify up to 30 % of reported results.

.3 Number and location of verified results as directed by Departmental Representative.

.4 Pay costs to repeat TAB as required to satisfaction of Departmental Representative.

1.17 SETTINGS

.1 After TAB is completed to satisfaction of Departmental Representative, replace drive guards, close access doors, lock devices in set positions, and insure sensors are at required settings.

.2 Permanently mark settings to allow restoration at any time during life of facility. Do not eradicate or cover markings.

1.18 COMPLETION OF TAB

.1 TAB considered complete when final TAB Report received and approved by Departmental Representative.

1.19 AIR SYSTEMS

.1 Standard: TAB to most stringent of SMACNA.

.2 Do TAB of systems, equipment, components, controls specified Division 23 following systems, equipment, components, controls.

.3 Qualifications: personnel performing TAB qualified to standards of AABC or NEBB.

.4 Quality assurance: perform TAB under direction of supervisor qualified to standards of AABC or NEBB.

.5 Measurements: to include as appropriate for systems, equipment, components, controls: air velocity, static pressure, flow rate, pressure drop (or loss), temperatures (dry bulb, wet bulb, dewpoint), duct cross-sectional area, RPM, electrical power, voltage, noise, vibration.

.6 Locations of equipment measurements: to include as appropriate:
.1 Inlet and outlet of dampers, filter, coil, humidifier, fan, other equipment causing changes in conditions.

.2 At controllers, controlled device.

.7 Locations of systems measurements to include as appropriate: main ducts, main branch, sub-branch, run-out (or grille, register or diffuser).

1.20 OTHER TAB REQUIREMENTS

.1 General requirements applicable to work specified this paragraph:
- .1 Qualifications of TAB personnel: as for air systems specified this section.
- .2 Quality assurance: as for air systems specified this section.

.1 Zone pressure differences:
- .1 Adjust HVAC systems, equipment, controls to establish specified air pressure differentials, with systems in every possible combinations of normal operating modes.

.2 Smoke management systems:
- .1 Test for proper operation of all smoke and fire dampers, sensors, detectors, installed or modified as component parts of air systems specified Division 23.

1.21 BALANCE REPORTS

.1 Balance reports to include the following at minimum (data shall always include design and actual measured data):
- .1 Title Page: Company Name, Address, and Telephone Number; Project Name, Location, Architect, Engineer, and Project Contractor.
- .2 Include types, serial number and dates of calibration of instruments used.
- .3 Air Handling Units: Location, Local Identification, Manufacturer, Model, Size, Arrangement, discharge and class, Supply Air Flow, Return Air Flow, Outside Air Flow, Static Pressures, Fan RPM, inlet and outlet dry bulb and wet bulb temperatures.
- .4 Duct air quantities: Mains, Branches, Outside Air and Exhausts (Maximum and Minimum), Duct sizes; Number of pressure readings; Sum of velocity measurements; Average velocity; duct air flow rate.
- .5 Exhaust Fan Data: Location, Manufacturer, Model, Specified and Actual Air Flow, Static Pressure, and Fan RPM.
- .6 Electric Motors: Manufacturer, HP/BHP, Phase, Voltage, Amperage (maximum operating and full load), RPM, Service Factor, Starter Heater Elements.
- .7 V-Belt Drive: Identification/Location, Driven Sheave Diameter and RPM belt Size and Quantity, Motor Sheave Diameter and RPM.
- .8 Air Distribution: Terminal Number, Room Number/Location, Terminal Type and Size, Area Factor, Design Velocity and Air Flow, Test Velocity and Air Flow.
- .9 Air Inlets and Outlets: Outlet identification location and Designation; Manufacturer's catalogue identification and type; Application factors; air velocities; air flow rates; Deflector vane or diffuser cone settings.
- .10 Coil Data: Location, Identification/Number, Service, Manufacturer, Element type, Air Flow Rate, Entering Air and Leaving Air Temperatures (dry bulb and wet bulb), Water Flow rate and Pressure Drop, Entering and Leaving Water Temperatures, energy transfer rate.
- .11 Terminal Heating/Cooling Equipment (radiation, panels, in-floor etc.): Location, Element Type, Designation, Manufacturer, Entering and Leaving Water Temperatures, Length of Fin, Water Pressure drops, Water Flow Rates. If a steam system include steam pressure, temperature and condensate temperature. If a heating/cooling system provide data for both modes of operation. Provide total

flow for in-floor manifold.

2 Products

2.1 NOT USED

.1 Not used.

3 Execution

3.1 PREPARATION

.1 Before adjusting and balancing, verify that systems are complete and operable. Ensure temperature control systems are complete and operable, thermal overload protection is in place, final filters installed, hydronic systems, flushed, filled, and vented.

.2 Provide instruments required for testing, adjusting, and balancing operations. Make instruments available to Consultant to facilitate spot checks during testing.

.3 Recorded data shall represent actually measured, or observed condition.

3.2 GENERAL PROCEDURES

.1 Balance to maximum measured flow, allowable deviation as specified.

.2 Permanently mark settings on valves, splitters, dampers, and other adjustment devices.

.3 Subsequent to correctional work, take measurements to verify balance has not been disrupted or that any such disruption has been rectified.

.4 At final inspection, re-check random selections of data recorded in report. Re-check points of areas as selected and witnessed by the Owner.

.5 Check and adjust systems approximately six (6) months after final acceptance and submit report.

.6 The Balancing Contractor shall include the cost of sheave changes necessary to achieve specified air flow within limits specified.

3.3 AIR SYSTEM PROCEDURES

.1 Adjust air handling and distribution systems to provide required or design supply, return and exhaust air quantities. Permanently mark settings of damper and other adjustment devices allowing settings to be restored.

.2 Make air quantity measurements in ducts by Pitot tube traverse of entire cross-sectional area of duct.

.3 Measure air quantities at each air inlet and outlet. Use volume control devices to regulate air quantities.

.4 Vary total system air quantities by adjustment of fan speeds. Where Variable Frequency Drives (VFDs) are installed, utilize VFDs to adjust fan speed. Provide drive changes where required.

.5 Where modulating dampers are provided, take measurements and balance at extreme

conditions. Balance variable volume systems at maximum air flow rate - full cooling, and at minimum air flow rate - full heating.

.6 Provide system schematic with required and actual air quantities recorded at each outlet or inlet.

.7 Measure static air pressure conditions on air supply units, including filter and coil pressure drops, and total pressure across the fan. Make allowances for 50 percent loading of filters.

3.4 WATER SYSTEM PROCEDURE

.1 Adjust water systems to provide required or design quantities. Permanently mark settings of valves and other adjustment devices allowing settings to be restored. Set and lock memory stops.

.2 Use calibrated venturi tubes, orifices, or other metered fittings and pressure gauges in conjunction with permanent and portable type flow meters to determine flow rates for system balance. Where flow metering devices are not installed, base flow balance on temperature difference across various heat transfer elements in the system.

.3 Adjust systems to provide specified pressure drops and flows through heat transfer elements prior to thermal testing. Perform balancing by measurement of temperature differential in conjunction with air balancing.

.4 Effect system balance with automatic control valves fully open to heat transfer elements.

.5 Effect adjustment of water distribution systems by means of balancing cocks, valves and fittings. Do not use service or shut-off valves for balancing unless indexed for balance point.

.6 Where pump capacity available is less than total flow requirements or individual system parts, full flow in any part may be simulated by temporary restriction of flow to other parts.

.7 Where flow restrictors are used provide record data of air and water inlet and outlet temperatures at design conditions.

END OF SECTION

1 General

1.1 REFERENCES

.1 American Society of Heating, Refrigeration and Air Conditioning Engineers (ASHRAE)
- .1 ANSI/ASHRAE/IESNA 90.1-01, SI; Energy Standard for Buildings Except Low-Rise Residential Buildings.

.2 American Society for Testing and Materials International, (ASTM)
- .1 ASTM B209M, Specification for Aluminum and Aluminum Alloy Sheet and Plate (Metric).
- .2 ASTM C335, Test Method for Steady State Heat Transfer Properties of Horizontal Pipe Insulation.
- .3 ASTM C411, Test Method for Hot-Surface Performance of High-Temperature Thermal Insulation.
- .4 ASTM C449/C449M, Standard Specification for Mineral Fiber-Hydraulic-Setting Thermal Insulating and Finishing Cement.
- .5 ASTM C547, Specification for Mineral Fiber Pipe Insulation.
- .6 ASTM C553, Specification for Mineral Fiber Blanket Thermal Insulation for Commercial and Industrial Applications.
- .7 ASTM C612, Specification for Mineral Fiber Block and Board Thermal Insulation.
- .8 ASTM C795, Specification for Thermal Insulation for Use with Austenitic Stainless Steel.
- .9 ASTM C921-(1998)e1, Standard Specification for Thermal Insulation for Use in Contact with Austenitic Stainless Steel.

.3 Canadian General Standards Board (CGSB)
- .1 CGSB 51-GP-52Ma, Vapour Barrier, Jacket and Facing Material for Pipe, Duct and Equipment Thermal Insulation.

.4 Thermal Insulation Association of Canada (TIAC): National Insulation Standards (R1999).

.5 Underwriters Laboratories of Canada (ULC)
- .1 CAN/ULC-S102, Surface Burning Characteristics of Building Materials and Assemblies.
- .2 CAN/ULC-S701, Thermal Insulation Polyotrene, Boards and Pipe Covering.

1.2 DEFINITIONS

.1 For purposes of this section:
- .1 "CONCEALED" - insulated mechanical services and equipment in suspended ceilings and non-accessible chases and furred-in spaces.
- .2 "EXPOSED" - will mean "not concealed" as defined herein.
- .3 Insulation systems - insulation material, fasteners, jackets, and other accessories.

.2 TIAC Codes:
- .1 CRD: Code Round Ductwork,
- .2 CRF: Code Rectangular Finish.

1.3 SHOP DRAWINGS

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

.2 Submit for approval manufacturer's catalogue literature related to installation, fabrication for duct jointing recommendations.

1.4 MANUFACTURERS' INSTRUCTIONS

.1 Submit manufacturer's installation instructions in accordance with Section 01 33 00 - Submittal Procedures.

.2 Installation instructions to include procedures used, and installation standards achieved.

1.5 QUALIFICATIONS

.1 Installer: specialist in performing work of this section, and have at least 3 years successful experience in this size and type of project, qualified to standards of TIAC.

2 Products

2.1 FIRE AND SMOKE RATING

.1 In accordance with CAN/ULC-S102:
- .1 Maximum flame spread rating: 25.
- .2 Maximum smoke developed rating: 50.

2.2 INSULATION

.1 Mineral fibre: as specified includes glass fibre, rock wool, slag wool.

.2 Thermal conductivity ("k" factor) not to exceed specified values at 24 deg.C mean temperature when tested in accordance with ASTM C335. Maximum “K” factor to be 0.034 W/m. deg.K (0.24 BTU in/hr/sq.ft. Deg.K) to ASTM C5553.

.3 TIAC Code C-1: Rigid mineral fibre board to ASTM C612, with or without factory applied vapour retarder jacket to CGSB 51-GP-52Ma (as scheduled in PART 3 of this Section).

.4 TIAC Code C-2: Mineral fibre blanket to ASTM C553 faced with or without factory applied vapour retarder jacket to CGSB 51-GP-52Ma (as scheduled in PART 3 of this section).
- .1 Mineral fibre: to ASTM C553.
- .2 Jacket: to CGSB 51-GP-52Ma.

2.3 JACKETS

.1 Canvas:
- .1 Not permitted.

.2 Lagging adhesive: Compatible with insulation.

.3 Aluminum:
- .1 To ASTM B209 with or without moisture barrier as scheduled in PART 3 of this section.
- .2 Thickness: 0.50 mm sheet.
- .3 Finish: Smooth.
- .4 Jacket banding and mechanical seals: 12 mm wide, 0.5 mm thick stainless steel.
  - .1 Stainless steel:
- .5 Type: 316.
- .6 Thickness: 0.25 mm sheet.
- .7 Finish: Stucco embossed.
- .8 Jacket banding and mechanical seals: 12 mm wide, 0.5 mm thick stainless steel.

2.4 ACCESSORIES

.1 Vapour retarder lap adhesive:
- .1 Water based, fire retardant type, compatible with insulation.

.2 Indoor Vapour Retarder Finish:
- .1 Vinyl emulsion type acrylic, compatible with insulation.

.3 Insulating Cement: hydraulic setting on mineral wool, to ASTM C449.

.4 Outdoor Vapour Retarder Mastic:
- .1 Vinyl emulsion type acrylic, compatible with insulation.
- .2 Reinforcing fabric: Fibrous glass, untreated 305 g/m^2.

.5 Tape: self-adhesive, aluminum, reinforced, 50 mm wide minimum.

.6 Contact adhesive: quick-setting

.7 Tie wire: 1.5 mm stainless steel.

.8 Banding: 19 mm wide, 0.5 mm thick stainless steel.

.9 Facing: 25 mm galvanized steel hexagonal wire mesh stitched on one face of insulation.

.10 Fasteners: 4 mm diameter pins with 35 mm diameter or square clips, length to suit thickness of insulation.

.11 Adhesives to be waterproof.

3 Execution

3.1 PRE-INSTALLATION REQUIREMENTS

.1 Pressure testing of ductwork systems complete, witnessed and certified.

.2 Surfaces clean, dry, free from foreign material.

3.2 INSTALLATION

.1 Install in accordance with TIAC National Standards.

.2 Apply materials in accordance with manufacturer's instructions and as indicated.

.3 Use two layers with staggered joints when required nominal thickness exceeds 75 mm.

.4 Maintain uninterrupted continuity and integrity of vapour retarder jacket and finishes.
.1 Hangers, supports to be outside vapour retarder jacket.

.5 Supports, Hangers in accordance with Section 23 05 29 - Hangers and Supports for HVAC Piping and Equipment.
.1 Apply high compressive strength insulation where insulation may be compressed by weight of ductwork.

.6 Fasteners: At 300 mm oc in horizontal and vertical directions, minimum two rows each side.

.7 Ensure insulation is continuous through inside walls. Pack around ducts with fire proof self-supporting insulation material, properly sealed.

.8 Finish insulation neatly at hangers, supports and other protrusions.

.9 Locate insulation or cover seams in least visible locations.

.10 Provide recovering jackets on exposed insulation throughout, including equipment roof. Insulation located in crawl spaces, shafts and suspended ceiling spaces is not considered exposed. Use pre-sized paper under recovering at uneven insulated surfaces.

.11 Exposed Rectangular Ducts: Secure rigid insulation with 50% coverage of adhesive and 12 gauge galvanized impale anchor tabs on 400 mm centres. Seal joints and breaks with 250 mm wide strips of open mesh glass cloth or tape imbedded between two coats of vapour barrier sealant. Point up other joints and breaks with hydraulic setting cement.

.12 Round Ducts and Concealed Rectangular Ducts: Adhere flexible insulation to ductwork with adhesive applied in 150 mm wide strips on 400 mm centres. Provide 16 gauge annealed tie wire tied, spiral wound or half hitched at 200 mm centres for securing duct insulation until adhesive sets. Butt insulation and seal joints and breaks with 50 mm lap of foil adhered over joint.

.13 Acoustic Lining: Apply to interior of ducts where shown. Secure to ductwork with adhesive using 100% coverage and 12 gauge impale anchor tabs on 400 mm centres. Cut off excess fastener length and cover with brush coat of mastic. Use 25 mm thick insulation unless otherwise noted. Provide vapour barrier located on the warm side for outside air intakes. Ducts with acoustic insulation do not require external thermal insulation. Lining to be coated or lined to prevent fibre-erosion at air velocities up to 20 m/s (4000 fmp)

3.3 DUCTWORK INSULATION SCHEDULE

.1 Insulation types and thicknesses: Conform to following table:

	TIAC Code	Vapour Retarder	Thickness (mm)
Rectangular cold and dual temperature supply air ducts	C-1	yes	50
Round cold and dual temperature supply air ducts	C-2	yes	50
Rectangular warm air ducts	C-1	no	25
Round warm air ducts	C-1	no	25
Exhaust duct between dampers and louvres	C-1	no	25
Acoustically lined ducts	none		25

.2 HERE Exposed round ducts 600 mm and larger, smaller sizes where subject to abuse:

.1 Use TIAC code C-1 insulation, scored to suit diameter of duct.

.1 Finishes: Conform to following table:

	TIAC Code	
	Rectangular	Round
Indoor, concealed	none	none
Indoor, exposed within mechanical room	CRF/1	CRD/2
Indoor, exposed elsewhere	CRF/2	CRD/3
Outdoor, exposed to precipitation	CRF/3	CRD/4
Outdoor, elsewhere	CRF/4	CRD/5

END OF SECTION

1 General

1.1 SUMMARY

1. Section Includes:
   .1 Thermal insulation for piping and piping accessories.

1.2 REFERENCES

.1 American Society of Heating, Refrigeration and Air Conditioning Engineers (ASHRAE)
   .1 ASHRAE Standard 90.1-01, Energy Standard for Buildings Except Low-Rise Residential Buildings (IESNA co-sponsored; ANSI approved; Continuous Maintenance Standard).

.2 American Society for Testing and Materials International (ASTM)
   .1 ASTM B209M-04, Standard Specification for Aluminum and Aluminum Alloy Sheet and Plate Metric.
   .2 ASTM C335-04, Standard Test Method for Steady State Heat Transfer Properties of Horizontal Pipe Insulation.
   .3 ASTM C411-04, Standard Test Method for Hot-Surface Performance of High-Temperature Thermal Insulation.
   .4 ASTM C449/C449M-00, Standard Specification for Mineral Fiber-Hydraulic-Setting Thermal Insulating and Finishing Cement.
   .5 ASTM C533-2004, Calcium Silicate Block and Pipe Thermal Insulation.
   .6 ASTM C547-2003, Mineral Fiber Pipe Insulation.
   .7 ASTM C795-03, Standard Specification for Thermal Insulation for Use in Contact with Austenitic Stainless Steel.
   .8 ASTM C921-03a, Standard Practice for Determining the Properties of Jacketing Materials for Thermal Insulation.

.3 Canadian General Standards Board (CGSB)
   .1 CGSB 51-GP-52Ma-89, Vapour Barrier, Jacket and Facing Material for Pipe, Duct and Equipment Thermal Insulation.
   .2 CAN/CGSB-51.53-95, Poly (Vinyl Chloride) Jacketting Sheet, for Insulated Pipes, Vessels and Round Ducts

.4 Department of Justice Canada (Jus)
   .1 Canadian Environmental Assessment Act (CEAA), 1995, c. 37.
   .2 Canadian Environmental Protection Act (CEPA), 1999, c. 33.
   .3 Transportation of Dangerous Goods Act (TDGA), 1992, c. 34.

.5 Health Canada/Workplace Hazardous Materials Information System (WHMIS)
   .1 Material Safety Data Sheets (MSDS).

.6 Manufacturer's Trade Associations
   .1 Thermal Insulation Association of Canada (TIAC): National Insulation Standards (Revised 2004).

.7 Underwriters' Laboratories of Canada (ULC)
- .1 CAN/ULC-S102-03, Surface Burning Characteristics of Building Materials and Assemblies.
- .2 CAN/ULC-S701-01, Thermal Insulation, Polystyrene, Boards and Pipe Covering.
- .3 CAN/ULC-S702-1997, Thermal Insulation, Mineral Fibre, for Buildings
- .4 CAN/ULC-S702.2-03, Thermal Insulation, Mineral Fibre, for Buildings, Part 2: Application Guidelines.

1.3 DEFINITIONS

.1 For purposes of this section:
- .1 "CONCEALED" - insulated mechanical services in suspended ceilings and non-accessible chases and furred-in spaces.
- .2 "EXPOSED" - will mean "not concealed" as specified.

.2 TIAC ss:
- .1 CRF: Code Rectangular Finish.
- .2 CPF: Code Piping Finish.

1.4 QUALITY ASSURANCE

.1 Installer: specialist in performing work of this Section, and have at least 3 years successful experience in this size and type of project, qualified to standards of TIAC.

2 Products

2.1 FIRE AND SMOKE RATING

.1 In accordance with CAN/ULC-S102.
- .1 Maximum flame spread rating: 25.
- .2 Maximum smoke developed rating: 50.

2.2 INSULATION

.1 Mineral fibre specified includes glass fibre and rock wool. Insulation on steam lines to be rock wool only, glass fibre is not permitted.

.2 Thermal conductivity ("k" factor) not to exceed specified values at 24 degrees C mean temperature when tested in accordance with ASTM C335. Mineral fibre maximum thermal conductivity “K” to be 0.034 W/m. deg.K (0.24 BTU in/hr/sq.ft. Deg.F). Elastomer closed cell insulation maximum thermal conductivity “K: to be 0.04 W/M deg.K (0.28 BTU in/hr/sq.ft. Deg.F).

.3 TIAC Code A-1: rigid moulded mineral fibre without factory applied vapour retarder jacket.
- .1 Mineral fibre: to CAN/ULC-S702, ASTM C547.
- .2 Maximum "k" factor: to CAN/ULC-S702.

.4 TIAC Code A-3: rigid moulded mineral fibre with factory applied vapour retarder jacket.
- .1 Mineral fibre: to CAN/ULC-S702, ASTM C547.
- .2 Jacket: to CGSB 51-GP-52Ma.

.3 Maximum "k" factor: to CAN/ULC-S702, ASTM C547.

.5 TIAC Code C-2: mineral fibre blanket faced with or without factory applied vapour retarder jacket (as scheduled in PART 3 of this section).
- .1 Mineral fibre: to CAN/ULC-S702, ASTM C547.
- .2 Jacket: to CGSB 51-GP-52Ma.
- .3 Maximum "k" factor: to CAN/ULC-S702, ASTM C547.

.6 TIAC Code A-6: flexible unicellular tubular elastomer.
- .1 Insulation: with vapour retarder jacket.
- .2 Maximum water transmission rating of 0.1 perms.

2.3 REMOVABLE, PRE-FABRICATED INSULATING ENCLOSURES

.1 Use of insulating materials other than those stated in this specification requires Departmental Representative's approval. Standard of acceptance for re-usable insulation blankets shall be Reflex Re-usable flexible insulation covers.

.2 All materials shall be of flame resistant materials.

.3 Re-usable flexible insulation blanket outer jacket material shall be 0.26 kg/m2. Teflon coated fibreglass cloth.

.4 Material used to secure seams and attachments on re-usable flexible insulation blankets shall be 10 strand stainless steel thread with polyester wrap.

.5 Re-usable flexible insulation blanket liner material shall be 560 grams/m2 Teflon coated fibreglass cloth for operating temperatures up to 232 deg.C.

.6 Minimum insulation thickness shall be 25 mm insulation for operating temperatures up to 232 deg.C.

.7 Insulation materials shall be Type E needled fibreglass mat containing no organic binders and no less than 11 pound density for operating temperatures up to 538 deg.C.

.8 Fasteners shall be velcro closures incorporated with seam flaps in conjunction with sewn on straps and stainless steel D rings.

.9 Flaps shall be used to cover all closing seams and cover slots. The flaps shall be 50 mm wide plain flaps for operating temperatures up to 232 deg.C.

.10 6 mm matrix braded Nomex draw-cord closures shall be used on cover openings over 50 mm in diameter. Close the ends of covers over adjacent insulation or piping.

.11 Quilting fasteners shall be 14 gauge stainless steel quilt pins and locking washers.

.12 A stainless steel drain grommet, 11 mm in diameter, shall be installed at the low point on the cover.

.13 A permanent stainless steel or aluminum identification tag shall be attached to each blanket. Tags shall be secured to the re-usable blanket with aluminum rivets and shall be installed in the most visible location on the blanket.

.14 Re-usable flexible insulation blanket construction:
- .1 Blankets up to 25 mm thick shall be inside seam construction with double stitching, with the liner and jacket material sewn together to form the insulation pocket.
  - .1 Perimeter flaps shall be formed as an extension of the liner and jacket, and shall not be attached to blanket as separate pieces.
  - .2 All blankets up to 25 mm thick must be double stitched. First stitch will be performed with cloth layers sewn together inside out. Blanket will then be turned right side out and top stitched around all penetrations and around the perimeter of the insulation pocket to create a separation between the insulation pocket and the perimeter flaps.
  - .3 All draw-cord and closure flaps, required inside the perimeter of the blanket shall be attached inside the seam, between the liner and jacket layers of the blanket.
- .2 Blankets over 25 mm thick shall be constructed using boxed corners and gussets in order to maintain consistent thickness across the entire area of the blanket.
  - .1 Perimeter flaps shall be formed as an extension of the outer jacket, and shall not be attached to the blanket as separate pieces.
  - .2 All draw-cord and closure flaps, required inside the perimeter of the blanket, shall be attached inside the seam, between the liner and jacket layers of the blanket.

2.4 INSULATION SECUREMENT

.1 Tape: self-adhesive, aluminum, plain, 50 mm wide minimum.

.2 Contact adhesive: quick setting.

.3 Canvas adhesive: washable.

.4 Tie wire: 1.5 mm diameter stainless steel.

.5 Bands: stainless steel, 19 mm wide, 0.5 mm thick.

2.5 CEMENT

.1 Thermal insulating and finishing cement:
- .1 Hydraulic setting on mineral wool, to ASTM C449/C449M.

2.6 VAPOUR RETARDER LAP ADHESIVE

.1 Water based, fire retardant type, compatible with insulation.

2.7 INDOOR VAPOUR RETARDER FINISH

.1 Vinyl emulsion type acrylic, compatible with insulation.

2.8 OUTDOOR VAPOUR RETARDER FINISH

.1 Vinyl emulsion type acrylic, compatible with insulation.

.2 Reinforcing fabric: fibrous glass, untreated 305 g/m^2.

2.9 JACKETS

.1 Aluminum:
- .1 To ASTM B209.
- .2 Thickness: 0.50 mm sheet.
- .3 Finish: stucco embossed.
- .4 Joining: longitudinal and circumferential slip joints with 50 mm laps.
- .5 Fittings: 0.5 mm thick die-shaped fitting covers with factory-attached protective liner.
- .6 Metal jacket banding and mechanical seals: stainless steel, 19 mm wide, 0.5 mm thick at 300 mm spacing.

2.10 WEATHERPROOF CAULKING FOR JACKETS INSTALLED OUTDOORS

.1 Caulking to: Section 07 92 10 - Joint Sealing.

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 PRE-INSTALLATION REQUIREMENT

.1 Pressure testing of piping systems and adjacent equipment to be complete, witnessed and certified.

.2 Surfaces clean, dry, free from foreign material.

3.3 INSTALLATION

.1 Install in accordance with TIAC National Standards.

.2 Apply materials in accordance with manufacturer’s instructions and this specification.

.3 Use two layers with staggered joints when required nominal wall thickness exceeds 75 mm.

.4 Maintain uninterrupted continuity and integrity of vapour retarder jacket and finishes.
- .1 Install hangers, supports outside vapour retarder jacket.

.5 Supports, Hangers:
- .1 Apply high compressive strength insulation, suitable for service, at oversized saddles and shoes where insulation saddles have not been provided.

.6 Perform work at ambient and equipment temperatures, as recommended by the adhesive manufacturer. Make good separation of joints or cracking of insulation due to thermal movement or poor workmanship.

.7 Ensure installation is continuous through inside walls. Pack around pipes with fire proof self-supporting insulation material, properly sealed.

.8 Insulate fittings and valves. Do not insulate unions, flanges, strainers, flexible connections and expansion joints in Equipment Rooms. Terminate insulation neatly.

.9 Finish insulation neatly at hangers, supports and other protrusions.

.10 Locate insulation or cover seams in least visible locations.

.11 Provide recovering jackets on exposed insulation throughout, including equipment rooms. Insulation located in crawl spaces, pipe shafts and suspended ceiling spaces are not considered exposed. Aluminum jacket to be installed as per manufacturer's recommendations.

.12 Cover insulation exposed to outdoors with 16.5 kg/sq.m. coated glass base sheet with aluminum bands on 200 mm centres. Lap joints 75 mm minimum and seal with compatible waterproof lap cement.

.13 Cold Piping: Cover fittings and valves with equivalent thickness of insulation material. Cover with open mesh glass cloth sealed with vapour barrier sealant. Seal lap joints with 100% coverage of vapour barrier sealant and adhesive. Seal butt joints with 100 mm wide strips of vapour barrier sealed with vapour barrier adhesive. For exposed fittings and valves, apply hydraulic setting cement paste over insulation material before applying recovering.

.14 Hot Piping: Cover fittings and valves with equivalent thickness of insulation material. Recover. For exposed fittings and valves apply hydraulic setting cement paste over insulating material before applying recovering.

.15 Roof Drains, Vents and Coil Drains: Adhere flexible insulation with adhesive applied win 150 mm wide strips on 400 mm centres. Provide 16 gauge annealed tie wire tied, spiral wound or half hitched at 400 mm centres for securing insulation until adhesive sets. Butt insulation and seal joints and breaks with 50 mm of foil adhered over joint.

3.4 REMOVABLE, PRE-FABRICATED, INSULATION AND ENCLOSURES

.1 Removable insulation bags must be provided for the following: control valves, unions or flanges at equipment, and flanged valves.

.2 Design: to permit movement of expansion joint and to permit periodic removal and replacement without damage to adjacent insulation.

.3 Blankets on flanged valves and equipment shall be designed to cover adjacent mating flanges and overlap line insulation by a minimum of 50 mm. Allowance of stud length plus 25 mm from the back of the mating flange shall be used to calculate the cut back distance of line insulation. Draw-cold flaps shall not be considered as part of the overlap.

.4 Blankets on valves shall be designed to cover the valve body and the bonnet flange of the valve.

.5 Blankets for pressure gauges include block and bleed valve.

.6 Blankets for PSV's shall include the outlet flange. Blanket shall cover entire spring chamber.

.7 All blankets shall be fitted with an identification tag clearly marked with the following information:

.1	Equipment size and type	i.e. 6" 300# Control Valve
.2	Equipment location and tag number	i.e. 21-PV-129
.3	Manufacturer's Serial Number	i.e SN01010

.8 All equipment shall be field measured by blanket supplier. Measurements shall be performed after equipment is installed. All necessary allowances for the blankets shall be coordinated between the blanket supplier and the mechanical, electrical and insulation Contractors.

.9 Existing insulation bags will all be salvaged. Contractor may reuse bags on this project. All unused bags will be turned over to Owner.

3.5 INSTALLATION OF ELASTOMERIC INSULATION

.1 Insulation to remain dry. Overlaps to manufacturers instructions. Ensure tight joints.

.2 Provide vapour retarder as recommended by manufacturer.

3.6 PIPING INSULATION SCHEDULES

.1 Includes valves, valve bonnets, strainers, flanges and fittings unless otherwise specified.

.2 TIAC Code: A-1.
- .1 Securements: SS bands at 150 mm on centre.
- .2 Seals: lap seal adhesive, lagging adhesive.
- .3 Installation: TIAC Code 1501-H.
- .4 Aluminum jacket.

.3 TIAC Code: A-3.
- .1 Securements: SS bands at 150 mm on centre.
- .2 Seals: VR lap seal adhesive, VR lagging adhesive.
- .3 Installation: TIAC Code: 1501-C.
- .4 Aluminum jacket.

.4 TIAC Code: C-2 with vapour retarder jacket.
- .1 Insulation securements.
- .2 Seals: lap seal adhesive, lagging adhesive.
- .3 Installation: TIAC Code: 1501-C.
- .4 Aluminum jacket.

.5 TIAC Code: A-6.
- .1 Seals: lap seal adhesive, lagging adhesive.
- .2 Installation: to TIAC standards.

.6 Thickness of insulation as listed in following table.
- .1 Run-outs to individual units and equipment not exceeding 4000 mm long.

.2 Do not insulate exposed runouts to plumbing fixtures, chrome plated piping, valves, fittings.

Application	Temp deg C	TIAC code	Pipe sizes (NPS) and insulation thickness (mm)				
			Run out	to 1	1 1/4 to 2	2 1/2 to 4	5 to 6
Hot Water Heating	60 - 94	A-1	25	38	38	38	38
Domestic DHW, Tempered		A-1	25	25	25	38	38
Domestic DCW		A-3	25	25	25	25	25
Refrigerant	4 - 13	A-6	25	25	25	25	25
Refrigerant	below 4	A-6	25	25	38	38	38

.7 Finishes:

.1 Exposed indoors: Stucco embossed aluminum jacket.

.2 Exposed in mechanical rooms: Stucco embossed aluminum jacket.

.3 Concealed, indoors: Stucco embossed aluminum jacket.

.4 Use vapour retarder jacket on TIAC code A-3 insulation compatible with insulation.

.5 Outdoors: water-proof stucco embossed aluminum jacket.

.6 Finish attachments: SS bands, at 150 mm on centre. Seals: closed.

.7 Installation: to appropriate TIAC code CRF/1 through CPF/5.

.8 High temperature fabric on all removable insulation bags.

3.7 CLEANING

.1 Proceed in accordance with Section 01 74 11 - 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 REFERENCES

.1 American Society for Testing and Materials International (ASTM)
- .1 ASTM E202-04, Standard Test Methods for Analysis of Ethylene Glycols and Propylene Glycols.

1.2 HYDRONIC SYSTEMS - PERFORMANCE VERIFICATION (PV)

.1 Perform hydronic systems performance verification after cleaning is completed and system is in full operation.

.2 When systems are operational, perform following tests:
- .1 Conduct full scale tests at maximum design flow rates, temperatures and pressures for continuous consecutive period of 48 hours to demonstrate compliance with design criteria.

1.3 POTABLE WATER SYSTEMS

.1 When cleaning is completed and system filled:
- .1 Verify performance of equipment and systems as specified elsewhere in Division 23.
- .2 Check for proper operation of water hammer arrestors. Run one outlet for 10 seconds, then shut of water immediately. If water hammer occurs, replace water hammer arrestor or recharge air chambers. Repeat for each outlet and flush valve.
- .3 Confirm water quality consistent with supply standards, verifying that no residuals remain resulting from flushing and/or cleaning.

1.4 WET AND DRY PIPE SPRINKLER SYSTEM, STANDPIPE AND HOSE SYSTEMS

.1 Cleaning, testing, start-up, performance verification of equipment, systems, components, and devices is specified elsewhere in Division 23.

.2 Verification of controls, detection devices, alarm devices is specified Division 26.

.3 Verify operation of interlocks between HVAC systems and fire alarm systems as required by Code or specified.

1.5 REPORTS

.1 Include record of all tests in Operation and Maintenance Manuals.

1.6 TRAINING

.1 In accordance with Section 23 05 02 - General Mechanical Provisions.

2 Products

2.1 NOT USED

.1 Not Used.

3 Execution

3.1 NOT USED

.1 Not Used.

END OF SECTION

1 General

1.1 SUMMARY

.1 Section Includes:
  .1 The supply and installation of Hydronic Specialties Equipment.
.2 Sustainable requirements for construction and verification.

1.2 REFERENCES

.1 American Society of Mechanical Engineers (ASME).
  .1 ASME-04, Boiler and Pressure Vessel Code.

.2 American Society for Testing and Materials, (ASTM).
  .1 ASTM A47/A47M-99, Specification for Ferritic Malleable Iron Castings.
  .2 ASTM A278M-01, Specification for Gray Iron Castings for Pressure-Containing Parts for Temperatures up to 650 degrees F (345 degrees C).
  .3 ASTM A516/A516M-96(e1), Specification for Pressure Vessel Plates, Carbon Steel, for Moderate - and Lower - Temperature Service.
  .4 ASTM A536-84(1999)e1, Specification for Ductile Iron Castings.
  .5 ASTM B62-93, Specification for Composition Bronze or Ounce Metal Castings.

.3 Canadian Standards Association (CSA International).
  .1 CSA B51-03, Boiler, Pressure Vessel, and Pressure Piping Code.

1.3 SUBMITTALS

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

.2 Product Data: submit WHMIS MSDS - Material Safety Data Sheets in accordance with Section 02 61 33 - Hazardous Materials.
  .1 Submit shop drawings and product data in accordance with Section 01 33 00 - Submital Procedures.
  .2 Indicate on product data expansion tanks, air vents, separators, valves, strainers.

.3 Closeout Submittals:
  .1 Submit maintenance data in accordance with Section 01 78 00 - Closeout Submittals.

2 Products

2.1 AUTOMATIC AIR VENT

.1 Industrial float vent: cast iron body with stainless steel, brass and epdm internal components and NPS 19 mm inlet connection, 9.5 mm discharge and rated at 1034 kPa working pressure.

.2 Float: solid material suitable for 121 degrees C working temperature.

2.2 PIPE LINE STRAINER

.1 NPS 1/2 to 2: bronze body to ASTM B62, solder end or screwed connections, Y pattern.

.2 NPS 2 1/2 to 12: cast steel body to ASTM A278M, Class 30, cast iron body to ASTM, Class 30 flanged connections.

.3 NPS 2 to 12: T type with ductile iron body to ASTM A536, malleable iron body to ASTM A47M, grooved ends.

.4 Blowdown connection: NPS 1.

.5 Screen: stainless steel with 1.19 mm perforations.

.6 Working pressure: 860 kPa.

2.3 RELIEF VALVES

.1 Provide ASME rated direct spring loaded type, lever operated non-adjustable factory set discharge pressure as indicated.

2.4 CIRCUIT SETTER (BALANCE VALVE)

.1 Provide bronze (copper alloy), ductile iron or cast iron with bronze or copper alloy disc, complete with pressure tappings, memory lock and insulation blocks.

2.5 AUTOMATIC FLOW RESTRICTOR (BALANCE VALVE)

.1 Automatic flow control valve complete with isolation and strainer, sized for design flow rate.

.2 Body: Forged brass or cast brass.

.3 Strainer: 20 mesh stainless steel filter screen complete with drain vale.

.4 Isolation: Ball valve with Teflon seats, refer to valve specifications.

.5 Provide manual air vents.

.6 Provide P/T test (gauge) ports.

3 Execution

3.1 GENERAL

.1 Install as indicated and to manufacturer's recommendations.

.2 Run drain lines and blow off connections to terminate above nearest drain.

.3 Maintain proper clearance to permit service and maintenance.

.4 Should deviations beyond allowable clearances arise, request and follow 's directive.

.5 Check shop drawings for conformance of all tappings for ancillaries and for equipment operating weights.

3.2 STRAINERS

.1 Install in horizontal or down flow lines.

.2 Ensure clearance for removal of basket.

.3 Install ahead of each pump.

.4 Install ahead of each automatic control valve larger than NPS 1 and radiation and as indicated.

3.3 AIR VENTS

.1 Install manual air vents at high points of systems unless noted otherwise.

.2 Install gate valve on automatic air vent inlet. Run discharge to nearest drain or service sink.

.3 Construct manual air vent from short vertical section of 50 mm diameter pipe to form air chamber. Provide 3 mm brass needle valve at top of chamber. Provide U-bend copper tubing on discharge of valve to allow discharge to a 5 gallon pail.

.4 Use automatic float type at heating units and system high points not readily accessible for servicing.

.5 Where large air quantities can accumulate, provide enlarged air collection standpipes.

.6 For float type air vents in ceiling spaces or other concealed locations, provide vent tubing to nearest drain.

.7 Install isolation valves prior to all air vents.

3.4 PRESSURE SAFETY RELIEF VALVES

.1 Run discharge pipe to terminate above floor drain.

3.5 RELIEF VALVES

.1 Provide relief valves on pressure tanks, low pressure side of reducing valves, heating convertors, expansion tanks and where indicated.

.2 Drain relief valve to nearest floor drain.

.3 System relief valve capacity shall equal make-up pressure reducing valve capacity. Equipment relief valve capacity shall exceed input rating of connected equipment.

.4 Where one line vents several relief valves, cross sectional area shall equal sum of individual vent areas.

3.6 CIRCUIT SETTERS

.1 Provide on heating and cooling equipment to facilitate system balancing, as indicated on drawing, details and schematics.

3.7 FLOW RESTRICTORS

.1 Provide on heating equipment to facilitate system balancing, as indicated on drawings, details and schematics.

3.8 PERFORMANCE VERIFICATION

.1 In accordance with Section 23 08 01 - Performance Verification of Mechanical Piping Systems, supplemented as specified herein.

1 General

1.1 SUMMARY

.1 Section Includes:
  .1 Copper piping valves and fittings for hydronic systems.
.2 Sustainable requirements for construction and verification.

1.2 REFERENCES

.1 American National Standards Institute (ANSI)/American Welding Society (AWS)
  .1 ANSI/AWS A5.8/A5.8M-04, Specification Filler Metals for Brazing and Bronze Welding.

.2 American Society of Mechanical Engineers (ASME)
  .1 ANSI/ASME B16.4-98, Gray-Iron Threaded Fittings.
  .2 ANSI/ASME B16.15-1985(2004), Cast Bronze Threaded Fittings.
  .3 ANSI B16.18-2001, Cast Copper Alloy, Solder Joint Pressure Fittings.
  .4 ANSI/ASME B16.22-2001, Wrought Copper and Copper-Alloy Solder Joint Pressure Fittings.

.3 American Society for Testing and Materials International (ASTM)
  .1 ASTM B32-04, Standard Specification for Solder Metal.
  .2 ASTM B61-02, Standard Specification for Steam or Valve Bronze Castings.
  .3 ASTM B62-02, Standard Specification for Composition Bronze or Ounce Metal Castings.
  .4 ASTM B88M-03, Standard Specification for Seamless Copper Water Tube Metric.
  .5 ASTM E202-04, Standard Test Methods for Analysis of Ethylene Glycols and Propylene Glycols.

.4 Health Canada/Workplace Hazardous Materials Information System (WHMIS)
  .1 Material Safety Data Sheets (MSDS).

.5 Manufacturers Standardization Society (MSS)
  .1 MSS SP67-2002a, Butterfly Valves.
  .2 MSS SP70-1998, Cast Iron Gate Valves, Flanged and Threaded Ends.
  .3 MSS SP71-1997, Grey Iron Swing Check Valves, Flanged and Threaded Ends.
  .4 MSS SP80-2003, Bronze Gate, Globe, Angle and Check Valves.
  .5 MSS SP85-2002, Cast Iron Globe and Angle Valves, Flanged and Threaded Ends.

1.3 QUALITY ASSURANCE

.1 Regulatory Requirements: ensure Work is performed in compliance with applicable Provincial /Territorial regulations.

2 Products

2.1 TUBING

.1 Type A hard drawn copper tubing: to ASTM B88M.

2.2 FITTINGS

.1 Cast bronze threaded fittings: to ANSI/ASME B16.15.

.2 Wrought copper and copper alloy solder joint pressure fittings: to ANSI/ASME B16.22.

.3 Cast iron threaded fittings: to ANSI/ASME B16.4.

.4 Cast copper alloy solder joint pressure fittings: to ANSI B16.18.

2.3 FLANGES

.1 Brass or bronze: threaded.

.2 Cast iron: threaded.

.3 Orifice flanges: slip-on, raised face, 2100 kPa.

2.4 JOINTS

.1 Solder, tin-antimony, 95:5: to ASTM B32.

.2 Silver solder BCUP: to ANSI/AWS A5.8.

.3 Brazing: as indicated.

2.5 VALVES

.1 Connections:
- .1 NPS 2 and smaller: ends for soldering.
- .2 NPS 2 1/2 and larger: flanged or grooved ends.

.2 Gate Valves Application: isolating equipment, control valves, pipelines:
- .1 NPS 2 and under:
  - .1 Mechanical Rooms: Class 125, rising stem split wedge disc, as specified Section 23 05 22 - Valves - Bronze.
  - .2 Elsewhere: Class 125, non-rising stem, solid wedge disc, as specified Section 23 05 22 - Valves - Bronze.

.3 Butterfly valves: application: isolating each section of multiple component equipment (eg. multi-section coils):
- .1 NPS 2 1/2 and over: lug type, grooved ends: as specified Section 23 05 17 - Pipe Welding.

.4 Globe valves: application: throttling, flow control, emergency bypass:
- .1 NPS 2 and under:
  - .1 Mechanical Rooms: with PFTE disc, as specified Section 23 05 22 - Valves - Bronze.
  - .2 Elsewhere: with composition disc, as specified Section 23 05 22 - Valves - Bronze.

.5 Balancing, for TAB:
.1 Sizes: calibrated balancing valves, as specified.
.2 NPS 2 and under:
.1 To match existing.

.6 Drain valves: gate, Class 125, non-rising stem, solid wedge disc, as specified Section 23 05 22 - Valves - Bronze.

.7 Swing check valves:
.1 NPS 2 and under:
.1 Class 125, swing, with composition disc, as specified Section 23 05 22 - Valves - Bronze.

.8 Silent check valves:
.1 NPS 2 and under:
.1 As specified Section 23 05 22 - Valves - Bronze.

.9 Ball valves:
.1 NPS 2 and under: as specified Section 23 05 22 - Valves - Bronze.

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 INSTALLATION

.1 Refer to Section 23 05 05 Installation of Pipework

.2 Connect to equipment in accordance with manufacturer's instruction unless otherwise indicated.

.3 Install concealed pipes close to building structure to keep furring space to minimum. Install to conserve headroom and space. Run exposed piping parallel to walls. Group piping where ever practical.

.4 Slope piping in direction of drainage and for positive venting.

.5 Use eccentric reducers at pipe size change installed to provide positive drainage or positive venting.

.6 Provide clearance for installation of insulation and access for maintenance of equipment, valves and fittings.

.7 Assemble piping using fittings manufactured to ANSI standards.

3.3 VALVE INSTALLATION

.1 Refer to Section 23 05 05 - Installation of Pipework.

.2 Install rising stem valves in upright position with stem above horizontal.

.3 Install butterfly valves on chilled water and condenser water lines only.

.4 Install gate, ball or butterfly valves at branch take-offs and to isolate each piece of equipment, and as indicated.

.5 Install globe valves for balancing and in by-pass around control valves as indicated.

.6 Install swing check valves in horizontal lines on discharge of pumps and as indicated.

.7 Install ball valves for glycol service.

3.4 BALANCING VALVES

.1 Install flow measuring stations and flow balancing valves as indicated.

.2 Remove handwheel after installation and TAB is complete.

.3 Tape joints in prefabricated insulation on valves installed in chilled water mains.

3.5 AUTOMATIC CONTROL VALVES

.1 Install where indicated.

.2 Record flow or valve identification tag.

.3 Flow to be within 10% of specified value.

3.6 FLUSHING AND CLEANING

.1 Flush and clean in presence of Departmental Representative.

.2 Flush after pressure test for a minimum of 4h.

.3 Fill with solution of water and non-foaming, phosphate-free detergent 3% solution by weight. Circulate for minimum of 8h.

.4 Refill system with clean water. Circulate for at least 4h. Clean out strainer screens/baskets regularly. Then drain.

.5 Refill system with clean water. Circulate for at least 2h. Clean out strainer screens/baskets regularly. Then drain.

.6 Drainage to include drain valves, dirt pockets, strainers, low points in system.

.7 Re-install strainer screens/baskets only after obtaining Departmental Representative's approval.

3.7 FILLING OF SYSTEM

.1 Refill system with clean water/glycol solution, adding water treatment to match existing.

3.8 FIELD QUALITY CONTROL

.1 Testing:
- .1 Test system in accordance with Section 23 05 02 - General Mechanical Provisions.
- .2 For glycol systems, retest with ethylene glycol to ASTM E202, inhibited, for use in building system after cleaning. Repair leaking joints, fittings or valves.

.2 Balancing:
- .1 Balance water systems to within plus or minus 5% of design output.

.3 Glycol Charging:
- .1 Provide mixing tank and positive displacement pump for glycol charging.
- .2 Retest for concentration to ASTM E202 after cleaning.
- .3 Provide report to Departmental Representative.

3.9 CLEANING

.1 Proceed in accordance with Section 01 74 11 - 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 SUMMARY

.1 Section Includes.
- .1 Materials and installation for steel piping, valves and fittings for hydronic systems in building services piping.
- .2 Sustainable requirements for construction and verification.

1.2 REFERENCES

.1 American Society of Mechanical Engineers (ASME).
- .1 ASME B16.1-98, Cast Iron Pipe Flanges and Flanged Fittings.
- .2 ASME B16.3-98, Malleable Iron Threaded Fittings.
- .3 ASME B16.5-03, Pipe Flanges and Flanged Fittings.
- .4 ASME B16.9-01, Factory-Made Wrought Buttwelding Fittings.
- .5 ASME B18.2.1-03, Square and Hex Bolts and Screws (Inch Series).
- .6 ASME B18.2.2-87(R1999), Square and Hex Nuts (Inch Series).

.2 American Society for Testing and Materials International, (ASTM).
- .1 ASTM A47/A47M-99, Standard Specification for Ferritic Malleable Iron Castings.
- .2 ASTM A53/A53M-02, Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc Coated Welded and Seamless.
- .3 ASTM A536-84(1999)e1, Standard Specification for Ductile Iron Castings.
- .4 ASTM B61-02, Standard Specification for Steam or Valve Bronze Castings.
- .5 ASTM B62-02, Standard Specification for Composition Bronze or Ounce Metal Castings.
- .6 ASTM E202-00, Standard Test Method for Analysis of Ethylene Glycols and Propylene Glycols.

.3 American Water Works Association (AWWA).
- .1 AWWA C111-00, Rubber-Gasket Joints for Ductile-Iron Pressure Pipe and Fittings.

.4 Canadian Standards Association (CSA International).
- .1 CSA B242-M1980(R1998), Groove and Shoulder Type Mechanical Pipe Couplings.
- .2 CAN/CSA W48-01, Filler Metals and Allied Materials for Metal Arc Welding (Developed in cooperation with the Canadian Welding Bureau).

.5 Manufacturer's Standardization of the Valve and Fittings Industry (MSS).
- .1 MSS-SP-67-025, Butterfly Valves.
- .2 MSS-SP-70-98, Cast Iron Gate Valves, Flanged and Threaded Ends.
- .3 MSS-SP-71-97, Cast Iron Swing Check Valves Flanged and Threaded Ends.
- .4 MSS-SP-80-03, Bronze Gate, Globe, Angle and Check Valves.
- .5 MSS-SP-85-02, Cast Iron Globe and Angle Valves, Flanged and Threaded Ends.

1.3 SUBMITTALS

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

.2 Closeout Submittals.
- .1 Provide maintenance data for incorporation into manual specified in Section 01 78 00 - Closeout Submittals and include following:
  - .1 Special servicing requirements.

2 Products

2.1 PIPE

.1 Steel pipe: to ASTM A53/A53M, Grade B, as follows:
.1 To NPS6.

2.2 PIPE JOINTS

.1 NPS2 and under: screwed fittings with PTFE tape.

.2 NPS2-1/2 and over: flanges to CAN/CSA W48.

.3 Roll grooved: standard coupling to CSA B242.

.4 Flanges: plain or raised face, slip-on weld neck to AWWA C111.

.5 Orifice flanges: slip-on raised face, 2100 kPa.

.6 Flange gaskets: to AWWA C111.

.7 Pipe thread: taper.

.8 Bolts and nuts: to ASME B18.2.1 and ASME B18.2.2.

.9 Roll grooved coupling gaskets: type EPDM.

2.3 FITTINGS

.1 Screwed fittings: malleable iron, to ASME B16.3, Class 150.

.2 Pipe flanges and flanged fittings:
.1 Cast iron: to ASME B16.1, Class 125.
.2 Steel: to ASME B16.5.

.3 Butt-welding fittings: steel, to ASME B16.9.

.4 Unions: malleable iron, to ASTM A47/A47M and ASME B16.3.

.5 Fittings for roll grooved piping: malleable iron to ASTM A47/A47M, ductile iron to ASTM A536.

2.4 VALVES

.1 Connections:
.1 NPS2 and smaller: screwed ends.

.2 Gate valves: to MSS-SP-70. Application: Isolating equipment, control valves, pipelines:
.1 NPS2 and under:
.1 Mechanical Rooms: Class 125, rising stem, split wedge disc, as specified Section 23 05 22 - Valves - Bronze.
.2 Elsewhere: Class 125, non-rising stem, solid wedge disc, as specified Section 23 05 22 - Valves - Bronze.

.2 Globe valves: to MSS-SP-80, 85 Application: Throttling, flow control, emergency bypass.

.3 NPS2 and under:
.1 Mechanical Rooms: with PTFE disc, as specified Section 23 05 22 - Valves - Bronze.
.2 Elsewhere: Globe, with composition disc, as specified Section 23 05 22 - Valves - Bronze.

.3 Balancing, for TAB:
.1 Sizes: Calibrated balancing valves, as specified this section.

.2 NPS2 and under:
.1 Automatic flow control device where specified.
.2 Circuit setter where specified.

.4 Drain valves: Gate, Class 125, non-rising stem, solid wedge disc, as specified Section 23 05 22 - Valves - Bronze.

.5 Swing check valves: to MSS-SP-71.
.1 NPS2 and under:
.1 Class 125, swing, with composition disc, as specified Section 23 05 22 - Valves - Bronze.

.6 Silent check valves:
.1 NPS2 and under:
.1 As specified Section 23 05 22 - Valves - Bronze.

.7 Ball valves:
.1 NPS2 and under: as specified Section 23 05 22 - Valves - Bronze.

3 Execution

3.1 PIPING INSTALLATION

.1 Install pipework in accordance with Section 23 05 05 - Installation of Pipe Work.

3.2 BALANCING VALVES

.1 Install flow measuring stations and flow balancing valves as indicated.

.2 Remove handwheel after installation and when TAB is complete.

.3 Tape joints in prefabricated insulation on valves installed in chilled water mains.

3.3 TESTING

.1 Test system in accordance with Section 23 05 02 - General Mechanical Provisions.

.2 For glycol systems, retest with propylene glycol to ASTM E202, inhibited, for use in building system after cleaning. Repair leaking joints, fittings or valves.

3.4 BALANCING

.1 Balance water systems to within plus or minus 5% of design output.

.2 Refer to Section 23 05 93 - Testing, Adjusting and Balancing for HVAC for applicable procedures.

3.5 PERFORMANCE VERIFICATION

.1 In accordance with Section 23 08 01 - Performance Verification of Mechanical Piping.

END OF SECTION

1 General

1.1 SUMMARY

.1 Section Includes:

.1 Materials and installation for copper tubing and fittings for refrigerant.

1.2 REFERENCES

.1 American Society of Mechanical Engineers (ASME)

.1 ASME B16.22-01, Wrought Copper and Copper Alloy Solder - Joint Pressure Fittings.

.2 ASME B16.24-02, Cast Copper Pipe Flanges and Flanged Fittings: Class 150, 300, 400, 600, 900, 1500 and 2500.

.3 ASME B16.26-88, Cast Copper Alloy Fittings for Flared Copper Tubes.

.4 ASME B31.5-01, Refrigeration Piping and Heat Transfer Components.

.2 American Society for Testing and Materials International (ASTM)

.1 ASTM A307-04, Standard Specification for Carbon Steel Bolts and Studs, 60,000 PSI Tensile Strength.

.2 ASTM B280-03, Standard Specification for Seamless Copper Tube for Air Conditioning and Refrigeration Field Service.

.3 Canadian Standards Association (CSA International)

.1 CSA B52-99, Mechanical Refrigeration Code.

.4 Environment Canada (EC)

.1 EPS 1/RA/1-96, Environmental Code of Practice for the Elimination of Fluorocarbon Emissions from Refrigeration and Air Conditioning Systems.

.5 Health Canada / Workplace Hazardous Materials Information System (WHMIS)

.1 Material Safety Data Sheets (MSDS).

1.3 SUBMITTALS

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

.2 Product Data:

.1 Submit manufacturer's printed product literature, specifications and datasheet for piping, fittings and equipment.

.2 Submit WHMIS MSDS in accordance with Section 02 81 01 - Hazardous Materials. Indicate VOC's for adhesive and solvents during application and curing.

.3 Test Reports: submit certified test reports from approved independent testing laboratories indicating compliance with specifications for specified performance characteristics and physical properties.

.4 Certificates: submit certificates signed by manufacturer certifying that materials comply with specified performance characteristics and physical properties.

.5 Instructions: submit manufacturer's installation instructions.

.6 Closeout submittals: submit maintenance and engineering data for incorporation into manual specified in Section 01 78 00 - Closeout Submittals.

1.4 QUALITY ASSURANCE

.1 Comply with Provincial Regulations and Mechanical Refrigeration Codes.

.2 Pre-Installation Meeting:
- .1 Convene pre-installation meeting one week prior to beginning work of this Section and on-site installations in accordance with Section 01 32 16 - Construction Progress Schedules - Bar (GANTT) Charts.
  - .1 Verify project requirements.
  - .2 Review installation and substrate conditions.
  - .3 Co-ordination with other building subtrades.
  - .4 Review manufacturer's installation instructions and warranty requirements.

.3 Health and Safety:
- .1 Do construction occupational health and safety in accordance with Section 01 35 29.06 - Health and Safety Requirements.

1.5 START-UP AND TESTING

.1 Supply initial charge of refrigerant and oil for each refrigeration system. Losses of oil or refrigerant prior to acceptance of equipment or due to defects covered under guarantee shall be replaced. Supply to the Owner, one complete charge of lubricating oil in addition to that placed in the system.

.2 Charge the system with refrigerant and test entire system for leaks after completion of installation. Repair leaks, put system into operation, and test equipment performance.

.3 Shut-down system if initial start-up testing takes place in winter and machines are to remain inoperative. Repeat start-up and testing operation at beginning of first cooling season.

.4 Provide cooling season start-up, winter season shut-down for first year of operation.

2 Products

2.1 TUBING

.1 Processed for refrigeration installations, deoxidized, dehydrated and sealed.
- .1 Hard copper: to ASTM B280, type ACR.
- .2 Annealed copper: to ASTM B280, with minimum wall thickness as per CSA B52 and ASME B31.5.

.2 Steel Pipe: ASTM A53, Schedule 40, black, forged steel welding type fittings, welded joints.

.3 Flexible Connectors: Corrugated stainless steel or bronze hose with single layer of exterior braiding, minimum 230 mm long with copper tube ends.

2.2 FITTINGS

.1 Service: design pressure 2070 kPa and temperature 121 degrees C.

.2 Brazed:
- .1 Fittings: wrought copper to ASME B16.22.
- .2 Joints: silver solder or copper-phosphorous, 95% Cu-5%P and non-corrosive flux.

.3 Flanged:
- .1 Bronze or brass, to ASME B16.24, Class 150 and Class 300.
- .2 Gaskets: suitable for service.
- .3 Bolts, nuts and washers: to ASTM A307, heavy series.

.4 Flared:
- .1 Bronze or brass, for refrigeration, to ASME B16.26.

2.3 PIPE SLEEVES

.1 Hard copper or steel, sized to provide 6 mm clearance around between sleeve and uninsulated pipe or between sleeve and insulation.

2.4 VALVES

.1 22 mm and under: Class 500, 3.5 Mpa, globe or angle non-directional type, diaphragm, packless type, with forged brass body and bonnet, moisture proof seal for below freezing applications, brazed connections.

.2 Over 22 mm: Class 375, 2.5 Mpa, globe or angle type, diaphragm, packless type, back-seating, cap seal, with cast bronze body and bonnet, moisture proof seal for below freezing applications, brazed connections.

2.5 LIQUID INDICATORS

.1 Moisture and Liquid indicators shall be double port type with copper or brass body, and flared or solder ends.

.2 To include sight glass, colour coded paper moisture indicator with removable element cartridge and plastic cap.

.3 Provide removable seal caps on each port to inspect refrigerant condition.

2.6 STRAINERS

.1 Refrigerant strainers shall be angle replaceable cartridge type with brass shell.

.2 Cartridge material and screen size shall be suitable for refrigerant and pipe material utilized in the system.

2.7 FILTER DRIERS

.1 Combination filter driers shall be angle type, with brass shell and incorporate a combined straining and drying material.

.2 Desiccant material shall be replaceable.

2.8 SOLENOID VALVES

.1 Solenoid valves shall have copper or brass body with flared or screwed ends.

.2 Coil assembly shall be replaceable.

.3 Valves shall incorporate a manually operated stem to serve as a bypass in case of coil failure.

2.9 EXPANSION VALVES

.1 Provide angle type or straight through expansion valves suitable for the refrigerant utilized in the system.

.2 Valves shall have brass body, internal or external equalizer, adjustable super-heat setting and be complete with capillary tube and remote sensing bulb.

2.10 CHARGING VALVES

.1 Provide general purpose type refrigerant charging valves with brass body, flared or solder ends and with removable valve core.

.2 Provide valve inlet with quick coupling connection for ease of charging.

2.11 FLEXIBLE CONNECTORS

.1 Flexible connectors shall consist of close pitch corrugated bronze hose with single layer of exterior braiding to provide additional strength and prevent elongation of corrugated section.

.2 Connectors shall be minimum 9" long and provided with bronze fittings to facilitate connection to equipment.

2.12 Check Valves:

.1 Globe Type: Cast bronze or forged brass body, forged brass cap with neoprene seal, brass guide and disc holder, phosphor-bronze or stainless steel spring, teflon seat disc.

.2 Straight Thru Type: Brass body and disc, phosphor-bronze or stainless steel spring, neoprene seat.

2.13 Pressure Relief Valves:

.1 Straight Thru or Angle Type: Brass body and disc, neoprene seat, factory sealed and ASME stamped.

2.14 Receivers

.1 Internal Diameter 150 mm and Smaller: UL listed, steel, brazed with tappings for inlet, outlet, and pressure relief valve.

.2 Internal Diameter Over 150 mm: Welded steel, to ANSI ASME SEC 8D.

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 GENERAL

.1 Install in accordance with CSA B52, EPS1/RA/1 and ASME B31.5, Section 23 05 01 - Installation of Pipework.

3.3 BRAZING PROCEDURES

.1 Bleed inert gas into pipe during brazing.

.2 Remove valve internal parts, solenoid valve coils, sight glass.

.3 Do not apply heat near expansion valve and bulb.

3.4 PIPING INSTALLATION

.1 General:
- .1 Soft annealed copper tubing: bend without crimping or constriction. Hard drawn copper tubing: do not bend. Minimize use of fittings.

.2 Hot gas lines:
- .1 Pitch at least 1:240 down in direction of flow to prevent oil return to compressor during operation.
- .2 Provide trap at base of risers greater than 2400 mm high and at each 7600 mm thereafter.
- .3 Provide inverted deep trap at top of risers.
- .4 Provide double risers for compressors having capacity modulation.
  - .1 Large riser: install traps as specified.
  - .2 Small riser: size for 5.1 m/s at minimum load. Connect upstream of traps on large riser.

3.5 PRESSURE AND LEAK TESTING

.1 Close valves on factory charged equipment and other equipment not designed for test pressures.

.2 Leak test to CSA B52 before evacuation to 2MPa and 1MPa on high and low sides respectively.

.3 Test Procedure: build pressure up to 35 kPa with refrigerant gas on high and low sides. Supplement with nitrogen to required test pressure. Test for leaks with electronic or halide detector. Repair leaks and repeat tests.

3.6 DX EQUIPMENT START-UP AND TESTING

.1 Refrigeration equipment: Prepare system for start-up by having manufacturer's factory trained representative supervise testing, dehydration and charging of machine. Do start-up including co-ordination on start-up of condensers.

.2 Testing:
- .1 Provide sufficient refrigerant, dry nitrogen and refrigeration oil for pressure and operational testing under manufacturer's supervision.
- .2 Prior to testing ensure that system is complete. Protect relief valves during test procedure. After completion of test, reconnect and make good piping connections and leak test entire system.

3.7 AIR COOLED CONDENSING UNIT

.1 Check unit for damage before and after placement:
- .1 Protect and cover exposed units to the elements during construction.
- .2 Conform to installation drawings. Mount units on roof mounting frame.

3.8 LIQUID INDICATORS

.1 Provide full size liquid indicators in main liquid line leaving condenser. If receiver is used install in liquid line leaving receiver.

3.9 STRAINERS

.1 Provide full size strainer ahead of each automatic valve. Where multiple expansion valves with integral strainers are used, install single main liquid line strainer.

.2 On steel piping systems provide adequate strainer in suction line to remove scale and rust inherent in steel pipe.

.3 Provide shut-off valve on each side of strainer to facilitate maintenance.

3.10 FILTER-DRIERS

.1 Filter-driers may be used in systems instead of separate strainers and driers.

.2 Install with three valve bypass assembly to permit isolation for servicing.

3.11 SOLENOID VALVES

.1 Provide solenoid valves in liquid line of systems operating with single pump-out or pump-down compressor control, in liquid line of single or multiple evaporator systems and in oil bleeder lines from flooded evaporators to stop flow of oil and refrigerant into the suction line when system shuts down.

.2 Provide solenoid valves with manually operated stems.

3.12 EXPANSION VALVES

.1 Size expansion valves properly to avoid penalty of being undersized at full load and of being excessively oversized at partial load.

.2 Properly evaluate refrigerant pressure drop through system to determine the available pressure drop across the valve.

.3 Select valves for maximum load at design operating pressure and minimum 7.2 deg.C. of superheat.

.4 Locate remote expansion valve sensing bulb immediately after evaporator outlet on suction line.

3.13 CHARGING VALVES

.1 Provide refrigerant charging connections in liquid line between receiver shut-off valve and expansion valve.

3.14 FLEXIBLE CONNECTORS

.1 In general install suction and hot gas piping connections to compressors with three directional changes for distance of minimum six pipe diameters before reaching point of support.

.2 Flexible connectors shall only be utilized at or near compressors where it is not physically possible to absorb vibration within piping configuration.

3.15 FIELD QUALITY CONTROL

.1 Site Tests/Inspection:
- .1 Close service valves on factory charged equipment.

.2 Ambient temperatures to be at least 13 degrees C for at least 12 hours before and during dehydration.

.3 Use copper lines of largest practical size to reduce evacuation time.

.4 Use two-stage vacuum pump with gas ballast on 2nd stage capable of pulling 5Pa absolute and filled with dehydrated oil.

.5 Measure system pressure with vacuum gauge. Take readings with valve between vacuum pump and system closed.

.6 Triple evacuate system components containing gases other than correct refrigerant or having lost holding charge as follows:
- .1 Twice to 14 Pa absolute and hold for 4 h.
- .2 Break vacuum with refrigerant to 14 kPa.
- .3 Final to 5 Pa absolute and hold for at least 12 h.
- .4 Isolate pump from system, record vacuum and time readings until stabilization of vacuum.
- .5 Submit test results to Departmental Representative.

.7 Charging:

.1 Charge system through filter-drier and charging valve on high side. Low side charging not permitted.

.2 With compressors off, charge only amount necessary for proper operation of system. If system pressures equalize before system is fully charged, close charging valve and start up. With unit operating, add remainder of charge to system.

.3 Re-purge charging line if refrigerant container is changed during charging process.

.8 Checks:

.1 Make checks and measurements as per manufacturer's operation and maintenance instructions.

.2 Record and report measurements Departmental Representative.

END OF SECTION

1 General

1.1 SUMMARY

.1 Section Includes:
- .1 Materials and installation of low-pressure metallic ductwork, joints and accessories.
- .2 Sustainable requirements for construction and verification.

1.2 REFERENCES

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

.2 American Society for Testing and Materials International, (ASTM).
- .1 ASTM A480/A480M-03c, Standard Specification for General Requirements for Flat-Rolled Stainless and Heat-Resisting Steel Plate, Sheet and Strip.
- .2 ASTM A635/A635M-02, Standard Specification for Steel, Sheet and Strip, Heavy-Thickness Coils, Carbon, Hot Rolled.
- .3 ASTM A653/A653M-03, Standard Specification for Steel Sheet, Zinc Coated (Galvanized) or Zinc-Iron Alloy Coated (Galvannealed) by the Hot-Dip Process.

.3 Department of Justice Canada (Jus).
- .1 Canadian Environmental Protection Act (CEPA), 1999, c. 33.

.4 Health Canada/Workplace Hazardous Materials Information System (WHMIS).
- .1 Material Safety Data Sheets (MSDS).

.5 National Fire Protection Association (NFPA).
- .1 NFPA 90A-02, Standard for the Installation of Air-Conditioning and Ventilating Systems.
- .2 NFPA 90B-02, Standard for the Installation of Warm Air Heating and Air-Conditioning Systems.
- .3 NFPA 96-01, Standard for Ventilation Control and Fire Protection of Commercial Cooking Operations.

.6 Sheet Metal and Air Conditioning Contractors' National Association (SMACNA).
- .1 SMACNA HVAC Duct Construction Standards - Metal and Flexible, 2nd Edition 1995 and Addendum No. 1, 1997.
- .2 SMACNA HVAC Air Duct Leakage Test Manual, 1985, 1st Edition.
- .3 IAQ Guideline for Occupied Buildings Under Construction 1995, 1st Edition.

.7 Transport Canada (TC).
- .1 Transportation of Dangerous Goods Act (TDGA), 1992, c. 34.

1.3 QUALITY ASSURANCE

.1 Certification of Ratings:
- .1 Catalogue or published ratings shall be those obtained from tests carried out by manufacturer or independent testing agency signifying adherence to Codes and Standards.

1.4 DEFINITIONS

.1 Low pressure/low velocity: static pressure in duct less than 498 Pa and velocities less than 10 meters/second.

.2 Medium pressure/high velocity: Static pressure in duct less than 996 Pa and velocities between 10 meters/second and 20 meters/second.

.3 High pressure/high velocity: Static pressure in ducts more than 996 Pa and velocities greater than 4000 fpm.

.4 Duct sizes: as shown on drawings are outside dimensions. For acoustically lined or internally insulated ducts, sizes shown are actual duct sizes and the insulation thickness has been accounted for.

1.5 QUALITY ASSURANCE

.1 Ductwork shall meet the requirements of NFPA 90A, Air Conditioning and Ventilating Systems, and NFPA No. 96, Standard for the Installation of Equipment for the Removal of Smoke and Grease-Laden Vapours from Commercial Cooking Equipment.

.2 Fabricate in accordance with SMACNA duct manuals and ASHRAE handbooks.

2 Products

2.1 GENERAL

.1 Fasteners: Use rivets and bolts throughout; sheet metal screws accepted on low pressure ducts.

.2 Complete metal ducts within themselves with no single partition between ducts. Where width of duct exceeds 450 mm, cross break for rigidity. Open corners are not acceptable.

.3 Lap metal ducts in direction of air flow. Hammer down edges and slips to leave smooth duct interior.

.4 Where 1.5 time radius elbows are not possible and where rectangular elbows possible, use rectangular elbows and provide approved type air foil turning vanes. Where acoustical lining is provided, provide turning vanes of perforated metal type with fibre glass inside.

.5 Rigidly construct metal ducts with joints mechanically tight, substantially airtight, braced and stiffened so as not to breath, 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.

2.2 SEAL CLASSIFICATION

.1 Classification as follows:

Maximum Pressure Pa	SMACNA Seal Class
Up to 500	B

.2 Seal classification:
- .1 Class A: longitudinal seams, transverse joints, duct wall penetrations and connections made airtight with sealant and tape.
- .2 Class B: longitudinal seams, transverse joints and connections made airtight with sealant, tape, or combination thereof.
- .3 Class C: transverse joints and connections made air tight with gaskets, sealant, tape or combination thereof. Longitudinal seams unsealed.

2.3 SEALANT

.1 Oil resistant, water based, anti-microbial, anti-bacterial, ultra violet resistant, polymer type, flame resistant duct sealant.

.2 VOC content to be less than VOC limits of the State of California's South Coast Air Quality District Rule #1168. VOC content less than 30 g/L (less water and less exempt compounds) for sealing metal to metal contact.

.3 Sealant shall be cured for a minimum of 48 hours.

.4 Flame Spread Rating: 0 (zero).

.5 Smoke Spread Raring: 0 (zero).

2.4 TAPE

.1 Tape: polyvinyl treated, open weave fiberglass tape, 50 mm wide.

2.5 DUCT LEAKAGE

.1 In accordance with SMACNA HVAC Air Duct Leakage Test Manual.

2.6 FITTINGS

.1 Fabrication: to SMACNA.

.2 Radiused elbows.
- .1 Rectangular: standard radius with single thickness turning vanes. Centreline radius: 1.5 times width of duct.
- .2 Round: smooth radius. Centreline radius: 1.5 times diameter.

.3 Mitred elbows, rectangular:
- .1 To 400 mm: with single thickness Airfoil turning vanes.
- .2 Over 400 mm: with double thickness Airfoil turning vanes.

.4 Branches:
- .1 Rectangular main and branch: with radius on branch 1.5 times width of duct.
- .2 Round main and branch: enter main duct at 45 degrees with conical connection.
- .3 Provide volume control damper in branch duct near connection to main duct.
- .4 Main duct branches: with splitter damper.

.5 Transitions:
- .1 Diverging: 15 degrees maximum included angle when increasing duct sizes.
- .2 Converging: 45 degrees maximum included angle downstream of equipment.
- .3 Diverging: 30 degrees maximum included angle upstream of equipment.

.6 Offsets:
.1 Full radiused elbows, as indicated.

.7 Obstruction deflectors: maintain full cross-sectional area.
.1 Maximum included angles: as for transitions.

2.7 FIRE STOPPING

.1 Retaining angles around duct, on both sides of fire separation in accordance with Section 07 84 00 - Firestopping.

.2 Fire stopping material and installation must not distort duct.

2.8 FABRICATION

.1 Complete metal ducts within 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 possible and where rectangular elbows used, provide approved type air foil turning vanes. Where acoustical lining is provided, provide turning vanes or 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 degrees and 45 degrees convergence downstream.

.5 Rigidly construct metal ducts with joints mechanically tight, substantially airtight, braced and stiffened so as not to breath, 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.

2.9 HANGERS AND SUPPORTS

.1 Hangers and Supports: in accordance with Section 23 05 29 - Hangers and Supports for HVAC Piping and Equipment.
.1 Strap hangers: of same material as duct but next sheet metal thickness heavier than duct.
.1 Maximum size duct supported by strap hanger: 500.
.2 Hanger configuration: to SMACNA.

.3 Hangers: black steel angle with galvanized steel rods to following table:

Duct Size (mm)	Angle Size (mm)	Rod Size (mm)
up to 750	25 x 25 x 3	6
751 to 1050	40 x 40 x 3	6
1051 to 1500	40 x 40 x 3	10

Duct Size	Angle Size	Rod Size
1501 to 2100	50 x 50 x 3	10
2101 to 2400	50 x 50 x 5	10
2401 and over	50 x 50 x 6	10

.4 Horizontal Duct on Wall Supports Minimum Sizes:
- .1 Up to 450 mm wide: 38 mm x 16 ga. or 25 x 25 x 3 mm at 2400 mm spacing.
- .2 460 to 1000 mm wide: 38 x 38 x 3 mm at 12 00 mm spacing.

.5 Vertical Duct on Wall Supports Minimum Sizes:
- .1 At 3000 mm spacing: Up to 600 mm wide: 38 mm x 16 ga. 610 to 900 mm wide: 25 x 25 x 3 mm. 90 to 1200 mm wide: 32 x 32 x 3 mm.

.6 Vertical Duct Floor Supports Minimum Sizes: Riveted or screwed to duct.
- .1 Up to 1500 mm wide: 38 x 38 x 3 mm. Over 1500 mm wide: 50 mm x 3 mm.

.7 Upper hanger attachments:
- .1 For concrete: manufactured concrete inserts.
- .2 For steel joist: manufactured joist clamp.
- .3 For steel beams: manufactured beam clamps.

2.10 WIRE ROPE SUSPENSION SYSTEMS

.1 Wire rope suspension systems shall be ULC, CSA and SMACNA approved and tested.

.2 Wire suspensions systems consist of a pre-formed wire rope sling with either a ferruled loop, permanently fixed threaded 1/4ins (or 3/8ins) stud, or permanently fixed nipple end with toggle, at one end or hook or eyelet. The end fixings and the wire must be of the same manufacturer. The system is secured and tensioned with a hanger self-locking grip at the other end.

.3 Only wire and or supports supplied and or approved, shall be used with the system.

.4 The contractor shall select the correct specification of wire hanger to use for supporting each particular service from table 1 below. Each size is designated with a maximum Safe Working Load Limit (which incorporates a 5:1 safety factor). The correct specification of wire hanger required is determined using the following formula:

Weight per metre of object suspended (kg) x Distance between suspension points (m) = Weight loading per hanger suspension point (kg).

Table 1 Wire Hanger Safe Working Loads

Size	Working Load Limit (kg) Working Load Limit (lbs)
No. 1	0 - 10 kg 0 - 22 lbs
No. 2	10.5 - 45.5 kg 23 - 100 lbs
No. 3	46 - 91 kg 101 - 200 lbs
No. 4	95.5 - 225 kg 210 - 495 lbs
No. 5	225.5 - 325 kg 496 - 715 lbs

.5 Where the installed wire rope is not vertical then the working load limit shall be reduced in accordance with the recommendations given in the manufacturer’s handbook.

.6 The Contractor shall select and use the correct length of wire rope required to support the service.

.7 No in-line joins shall be permitted in the rope.

3. Execution

3.1 GENERAL

.1 Do work in accordance with SMACNA.

.2 Do not break continuity of insulation vapour barrier with hangers or rods.
.1 Ensure diffuser is fully seated.

.3 Support risers in accordance with SMACNA.

.4 Install breakaway joints in ductwork on sides of fire separation.

.5 Install proprietary manufactured flanged duct joints in accordance with manufacturer's instructions.

.6 Manufacture duct in lengths and diameter to accommodate installation of acoustic duct lining.

.7 At each point where ducts pass through partitions, the joints around the duct shall be sealed with non-combustible material.

3.2 INSTALLATION

.1 Provide openings in ductwork where required to accommodate thermometers and controllers. Provide pitot tube openings where required for testing of systems, complete with metal cam 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 and force air at high velocity through duct to remove accumulated dust. To obtain sufficient air, clean half the system at a time. Protect equipment which may be harmed by excessive dirt with filters, or bypass during cleaning.

.3 Locate ducts with sufficient space around equipment to allow normal operating and maintenance activities.

.4 Connection diffusers or troffer boots to low pressure ducts with 1.5 m maximum length of straight flexible duct. Hold in place with caulking compound and strap or clamp. Do not use flexible duct to change direction.

.5 At each point where ducts pass through partitions, the joints around the duct shall be sealed with non-combustible material.

3.3 WIRE ROPE SUSPENSION SYSTEMS

.1 The wire hangers shall be fixed to the building structure in accordance with the standard practice and structural limitations.

.2 Loop end can be wrapped around purlins, beams, roof trusses and other accessible building features.

.3 Stud end can be fixed with suitable anchors into concrete ceilings and structures, metal decking and pressed metal brackets (using nuts).

.4 Toggle end can be fixed into profile roof cladding, light fittings and luminaries.

.5 Other wire rope systems can be fixed to an approved structure, as determined by the Departmental Representative.

.6 The wire hangers shall not be fixed to any other services, without the approval of the Departmental Representative.

.7 The free end of the wire rope should be threaded through one channel of the self-locking grip before being either passed around the object being suspended or connected to it, using a suitable fixing. The wire rope is then threaded back through the second channel in the grip until the required level is achieved.

.8 Adjust duct elevations as required to remain level and plumb, the weight of the suspended object must be independently supported while making adjustments.

.9 The wire rope must not be damaged, twisted or deformed in any way prior to, or during, installation. Any such ropes must be discarded and replaced.

.10 When installing wire hangers the angle between the ropes when exiting the grip must never exceed the manufacturer's recommendations and/or 60 degrees.

.11 Lubricants, paint or any other coating shall not be applied to the wire hanger as it may impair its performance.

.12 Wire hangers must be installed in accordance with the manufacturer's loading and installation instructions and all the manufacturer's recommendations.

3.4 HANGERS

.1 Strap hangers: install in accordance with SMACNA.

.2 Angle hangers: complete with locking nuts and washers.

.3 Hanger spacing: in accordance with as follows:

Duct Size	Spacing
(mm)	(mm)
to 1500	3000
1501 and over	2500

3.5 SEALING AND TAPING

.1 Apply sealant to outside of joint to manufacturer's recommendations.

.2 Bed tape in sealant and recoat with minimum of one coat of sealant to manufacturers recommendations.

3.6 LEAKAGE TESTS

.1 In accordance with SMACNA HVAC Duct Leakage Test Manual.

.2 Do leakage tests in sections.

.3 Make trial leakage tests as instructed to demonstrate workmanship.

.4 Do not install additional ductwork until trial test has been passed.

.5 Test section minimum of 30 m long with not less than three branch takeoffs and two 90 degrees elbows.

.6 Complete test before performance insulation or concealment Work.

END OF SECTION

1 General

1.1 SUMMARY

.1 Section Includes:
  .1 Materials and installation of high-pressure metallic ductwork, joints and accessories.
.2 Sustainable requirements for construction and verification.

1.2 REFERENCES

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

.2 American Society for Testing and Materials (ASTM).
  .1 ASTM A653/A653M-04a, Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy Coated (Galvannealed) by the Hot-Dip Process. (Metric).

.3 Department of Justice Canada (Jus).
  .1 Canadian Environmental Protection Act (CEPA), 1999, c. 33.
  .2 Transportation of Dangerous Goods Act (TDGA), 1992, c. 34.

.4 Health Canada/Workplace Hazardous Materials Information System (WHMIS).
  .1 Material Safety Data Sheets (MSDS).

.5 Sheet Metal Air Conditioning Contractors' National Association (SMACNA).
  .1 SMACNA HVAC Duct Construction Standards, Metal and Flexible, 95 (Addendum No. 1, (1997).
  .2 SMACNA HVAC Air Duct Leakage Test Manual, 1st Edition 1985.
  .3 SMACNA IAQ Guideline for Occupied Buildings under Construction, 1st Edition 1995.

1.3 SUBMITTALS

.1 Submit shop drawings and product data in accordance with Section 01 33 00 - Submittal Procedures.

.2 Product Data: submit WHMIS MSDS - Section 02 61 33 - Hazardous Materials for the following:
  .1 Sealants.
  .2 Tape.
  .3 Proprietary joints.
  .4 Fittings.

1.4 QUALITY ASSURANCE

.1 Certification of Ratings:
  .1 Catalogue or published ratings to be those obtained from tests carried out by manufacturer or independent testing agency signifying adherence to Codes and Standards.

1.5 DEFINITIONS

.1 Low pressure/low velocity: static pressure in duct less than 498 Pa and velocities less than 10 meters/second.

.2 Medium pressure/high velocity: Static pressure in duct less than 996 Pa and velocities between 10 meters/second and 20 meters/second.

.3 High pressure/high velocity: Static pressure in ducts more than 996 Pa and velocities greater than 4000 fpm.

.4 Duct sizes: as shown on drawings are outside dimensions. For acoustically lined or internally insulated ducts, sizes shown are actual duct sizes and the insulation thickness has been accounted for.

1.6 QUALITY ASSURANCE

.1 Ductwork shall meet the requirements of NFPA 90A, Air Conditioning and Ventilating Systems, and NFPA No. 96, Standard for the Installation of Equipment for the Removal of Smoke and Grease-Laden Vapours from Commercial Cooking Equipment.

.2 Fabricate in accordance with SMACNA duct manuals and ASHRAE handbooks.

1.7 INDOOR AIR QUALITY (IAQ) MANAGEMENT PLAN

.1 During construction meet or exceed the requirements of SMACNA IAQ Guideline for Occupied Buildings under Construction.

2 Products

2.1 GENERAL

.1 Fasteners: Use rivets and bolts throughout; sheet metal screws accepted on low pressure ducts.

.2 Complete metal ducts within themselves with no single partition between ducts. Where width of duct exceeds 450 mm, cross break for rigidity. Open corners are not acceptable.

.3 Lop metal ducts in direction of air flow. Hammer down edges and slips to leave smooth duct interior.

.4 Where 1.5 time radius elbows are not possible and where rectangular elbows possible, use rectangular elbows and provide approved type air foil turning vanes. Where acoustical lining is provided, provide turning vanes of perforated metal type with fibre glass inside.

.5 Rigidly constructed metal ducts with joints mechanically tight, substantially airtight, braced and stiffened so as not to breath, rattle, vibrate or sag. Caulk duct joints and connections with sealant as ducts are being assembled.

2.2 DUCTWORK

.1 Material:
- .1 Galvanized steel with Z90 designation zinc coating lock forming quality: to ASTM A653/A653M.
- .2 Thickness: to SMACNA.

.2 Construction - round and oval.
- .1 Ducts: factory fabricated, spiral wound, with matching fittings and specials to SMACNA.
- .2 Transverse joints up to 900 mm: slip type with tape and sealants.
- .3 Transverse joints over 900 mm: Vanstone.
- .4 Fittings:
  - .1 Elbows: smooth radius or five-piece (for 90 degrees), three-piece (for 45 degrees). Centreline radius: 1.5 x diameter.
  - .2 Branches: conical transition with conical branch at 45 degrees and 45 degrees elbow.

.3 Construction - rectangular:
- .1 Ducts: to SMACNA.
- .2 Transverse joints: welded or proprietary duct joints to SMACNA seal Class A.
- .3 Fittings:
  - .1 Elbows: smooth radius; centreline radius 1.5 x width of duct. No vanes.
  - .2 Branches: with conical branch at 45 degrees and 45 degrees elbow.

.4 Firestopping:
- .1 50 x 50 x 3 mm retaining angles around duct, on both sides of fire separation.
- .2 Firestopping material must not distort duct.

2.3 SEAL CLASSIFICATION

.1 Classification as follows:

Maximum Pressure Pa	SMACNA Seal Class
2500	A
1500	A
1000	A
750	A

.2 Seal classification:
- .1 Class A: longitudinal seams, transverse joints, duct wall penetrations and connections made airtight with sealant, gaskets, tape or combination thereof.
- .2 Class B: longitudinal seams, transverse joints and connections made airtight with gaskets, sealant, tape or combination thereof.

2.4 SEALANT

.1 Oil resistant, water based, anti-microbial, anti-bacterial, ultra violet resistant, polymer type, flame resistant duct sealant.

.2 VOC content to be less than VOC limits of the State of California's South Coast Air Quality District Rule #1168. VOC content less than 30 g/L (less water and less exempt compounds) for sealing metal to metal contact.

.3 Sealant shall be cured for at minimum of 48 hours.

.4 Flame spread Rating: 0 (zero).

.5 Smoke Spread Rating: 0 (zero).

2.5 TAPE

.1 Polyvinyl treated, open weave fibre glass, 50 mm wide.

2.6 DUCT LEAKAGE

.1 In accordance with SMACNA HVAC air duct leakage test manual.

2.7 HANGERS AND SUPPORTS

.1 Hangers and Supports: in accordance with Section 23 05 29 - Hangers and Supports for HVAC Piping Equipment.
- .1 Band hangers: use on round and oval ducts up to 500 mm diameter, of same material as duct but next sheet metal thickness heavier than duct.
- .2 Trapeze hangers: ducts over 500 mm diameter or longest side, to SMACNA.
- .3 Hangers: steel angle with black steel rods to following table.

Duct Size (mm)	Angle Size (mm)	Rod Size (mm)
up to 750	25 x 25 x 3	6
751 to 1050	40 x 40 x 3	6
1051 to 1500	40 x 40 x 3	10
1501 to 2100	50 x 50 x 3	10
2101 to 2400	50 x 50 x 5	10
2401 and over	50 x 50 x 6	10

- .4 Upper hanger attachments:
  - .1 For concrete: manufactured concrete inserts.
  - .2 For steel joist: manufactured joist clamp or steel plate washer.
    - .1 Mount to top cord.
  - .3 For steel beams: manufactured beam clamps:

2.8 WIRE ROPE SUSPENSION SYSTEMS

.1 Wire rope suspension systems shall be ULC, CSA and SMACNA approved and tested.

.2 Wire suspensions systems consist of a pre-formed wire rope sling with either a ferruled loop, permanently fixed threaded 1/4ins (or 3/8ins) stud, or permanently fixed nipple end with toggle, at one end or hook or eyelet. The end fixings and the wire must be of the same manufacturer. The system is secured and tensioned with a hanger self-locking grip at the other end.

.3 Only wire and or supports supplied and or approved, shall be used with the system.

.4 The contractor shall select the correct specification of wire hanger to use for supporting each particular service from table 1 below. Each size is designated with a maximum Safe Working Load Limit (which incorporates a 5:1 safety factor). The correct specification of wire hanger required is determined using the following formula:

Weight per metre of object suspended (kg) x Distance between suspension points (m) = Weight loading per hanger suspension point (kg).

Table 1 Wire Hanger Safe Working Loads

Size	Working Load Limit (kg) Working Load Limit (lbs)
No. 1	0 - 10 kg 0 - 22 lbs
No. 2	10.5 - 45.5 kg 23 - 100 lbs
No. 3	46 - 91 kg 101 - 200 lbs
No. 4	95.5 - 225 kg 210 - 495 lbs
No. 5	225.5 - 325 kg 496 - 715 lbs

i) Where the installed wire rope is not vertical then the working load limit shall be reduced in accordance with the recommendations given in the manufacturer's handbook.

.5 The contractor shall select and use the correct length of wire rope required to support the service.

.6 No in-line joins shall be permitted in the rope.

3 Execution

3.1 GENERAL

.1 Do work in accordance with SMACNA.

.2 Do not break continuity of insulation vapour barrier with hangers or rods.
- .1 Insulate band hangers 100 mm beyond insulated duct.
- .2 Ensure diffuser is fully seated.

.3 Support risers in accordance with SMACNA.

.4 Install breakaway joints in ductwork on sides of fire separation.

.5 Ensure installation of firestopping does not distort duct.

.6 Provide openings in ductwork where required to accommodate thermometers and controllers. Provide pitot tube openings where required for testing of systems, complete with metal cam with spring device or screw to ensure against air leakage. Where openings are provided in insulated ductwork, install insulation material inside a metal ring.

.7 Clean duct systems and force air at high velocity through duct to remove accumulated dust. To obtain sufficient air, clean half the system at a time. Protect equipment which may be harmed by excessive dirt with filters, or bypass during cleaning.

.8 Locate ducts with sufficient space around equipment to allow normal operating and maintenance activities.

.9 Connect terminal units to medium pressure ducts with 300 mm maximum length of flexible duct. Do not use flexible duct to change directions.

.10 At each point where ducts pass through partitions, the joints around the duct shall be sealed with non-combustible material.

3.2 HANGERS

.1 Band hangers: install in accordance with SMACNA.

.2 Angle hangers: complete with locking nuts and washers.

.3 Hanger spacing: as follows:

Duct Size (mm)	Spacing (mm)
to 1500	3000
1501 and over	2500

3.3 SEALING AND TAPING

.1 Apply sealant in accordance with SMACNA and to manufacturer's recommendations.

.2 Bed tape in sealant and recoat with minimum of one coat of sealant to manufacturer's recommendations.

3.4 WIRE ROPE SUSPENSION SYSTEMS

.1 The wire hangers shall be fixed to the building structure in accordance with the standard practice and structural limitations.

.2 Loop end can be wrapped around purlins, beams, roof trusses and other accessible building features.

.3 Stud end can be fixed with suitable anchors into concrete ceilings and structures, metal decking and pressed metal brackets (using nuts).

.4 Toggle end can be fixed into profile roof cladding, light fittings and luminaries.

.5 Other wire rope systems can be fixed to an approved structure, as determined by the Departmental Representative.

.6 The wire hangers shall not be fixed to any other services, without the approval of the Departmental Representative.

.7 The free end of the wire rope should be threaded through one channel of the self-locking grip before being either passed around the object being suspended or connected to it, using a suitable fixing. The wire rope is then threaded back through the second channel in the grip until the required level is achieved.

.8 Adjust duct elevations as required to remain level and plumb, the weight of the suspended object must be independently supported while making adjustments.

.9 The wire rope must not be damaged, twisted or deformed in any way prior to, or during, installation. Any such ropes must be discarded and replaced.

.10 When installing wire hangers the angle between the ropes when exiting the grip must never exceed the manufacturer's recommendations and/or 60 degrees.

.11 Lubricants, paint or any other coating shall not be applied to the wire hanger as it may impair its performance.

.12 Wire hangers must be installed in accordance with the manufacturer's loading and installation instructions and all the manufacturer's recommendations.

3.5 LEAKAGE TESTS

.1 In accordance with SMACNA HVAC Duct Leakage Test Manual.

.2 Perform leakage tests in sections.

.3 Perform trial leakage tests, as instructed to demonstrate workmanship.

.4 Do not install additional ductwork until trial tests have been achieved.

.5 Test section minimum of 30 m long with not less than three branch takeoffs and two 90 degrees elbows.

.6 Complete tests before performing insulation or concealment Work.

END OF SECTION

1 General

1.1 SUMMARY

.1 Section Includes:
- .1 Materials and installation for duct accessories including flexible connections, access doors, vanes and collars.
- .2 Sustainable requirements for construction and verification.

1.2 REFERENCES

.1 Health Canada/Workplace Hazardous Materials Information System (WHMIS).
- .1 Material Safety Data Sheets (MSDS).

.2 Sheet Metal and Air Conditioning Contractors' National Association (SMACNA).
- .1 SMACNA - HVAC Duct Construction Standards - Metal and Flexible, 95.

1.3 SUBMITTALS

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

.2 Product Data:
- .1 Submit manufacturer's printed product literature, specifications and data sheet. Indicate the following:
  - .1 Flexible connections.
  - .2 Duct access doors.
  - .3 Turning vanes.
  - .4 Instrument test ports.
- .2 Submit WHMIS MSDS in accordance with Section 02 61 33 - Hazardous Materials. Indicate VOC's for adhesive and solvents during application and curing.

.3 Instructions: submit manufacturer's installation instructions.

2 Products

2.1 GENERAL

.1 Manufacture in accordance with SMACNA - HVAC Duct Construction Standards.

.2 Accessories shall meet MFPA 90a, Air Conditioning and Ventilating Systems.

2.2 FLEXIBLE CONNECTIONS

.1 Frame: galvanized sheet metal frame 1.2 mm thick with fabric clenched by means of double locked seams.

.2 Material:
- .1 Fire resistant, self extinguishing, neoprene coated glass fabric, temperature rated at minus 40 degrees C to plus 90 degrees C, density of 1.0 kg/m^2.

.3 Attach to ducting and equipment by screws or bolts at no more than 150 mm intervals.

2.3 ACCESS DOORS IN DUCTS

.1 ULC labelled.

.2 Non-Insulated Ducts: sandwich construction of same material as duct, one sheet metal thickness heavier, minimum 0.6 mm thick complete with sheet metal angle frame.

.3 Insulated Ducts: sandwich construction of same material as duct, one sheet metal thickness heavier, minimum 0.6 mm thick complete with sheet metal angle frame and 25 mm thick rigid glass fibre insulation.

.4 Gaskets: neoprene.

.5 Hardware:
- .1 Up to 300 x 300 mm: two sash locks complete with safety chain.
- .2 301 to 450 mm: four sash locks complete with safety chain.
- .3 451 to 1000 mm: piano hinge and minimum two sash locks.
- .4 Doors over 1000 mm: piano hinge and two handles operable from both sides.
- .5 Hold open devices.
- .6 300 x 300 mm glass viewing panels.
- .7 Fabricate in accordance with ASHRAE handbooks and SMACNA duct manuals.

2.4 TURNING VANES

.1 Factory or shop fabricated single thickness or double thickness, to recommendations of SMACNA and as indicated.

.2 Shall be airfoil type.

.3 Where acoustical lining is provided, provide turning vanes of perforated metal type with fibre glass inside.

2.5 INSTRUMENT TEST

.1 1.6 mm thick steel zinc plated after manufacture.

.2 Cam lock handles with neoprene expansion plug and handle chain.

.3 28 mm minimum inside diameter. Length to suit insulation thickness.

.4 Neoprene mounting gasket.

2.6 SPIN-IN COLLARS

.1 Conical galvanized sheet metal spin-in collars with lockable butterfly damper.

.2 Sheet metal thickness to co-responding round duct standards.

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 data sheet.

3.2 INSTALLATION

.1 Flexible Connections:
- .1 Install in following locations:
  - .1 Inlets and outlets to supply air units and fans.
  - .2 Inlets and outlets of exhaust and return air fans.
  - .3 As indicated.
- .2 Length of connection: 100 mm.
- .3 Minimum distance between metal parts when system in operation: 75 mm.
- .4 Install in accordance with recommendations of SMACNA.
- .5 When fan is running:
  - .1 Ducting on sides of flexible connection to be in alignment.
  - .2 Ensure slack material in flexible connection.

.2 Access Doors and Viewing Panels:
- .1 Size:
  - .1 600 x 600 mm for person size entry.
  - .2 900 x 900 mm for servicing entry.
  - .3 300 x 300 mm for viewing.
  - .4 As indicated.
- .2 Locations (before and after):
  - .1 Fire and smoke dampers (install at fire dampers).
  - .2 Control dampers.
  - .3 Devices requiring maintenance.
  - .4 Required by code.
  - .5 Reheat coils.
  - .6 Filters
  - .7 To facilitate cleaning of ductwork.
  - .8 Elsewhere as indicated.

.3 Instrument Test Ports:
- .1 General:
  - .1 Install in accordance with recommendations of SMACNA and in accordance with manufacturer's instructions.
- .2 Locate to permit easy manipulation of instruments.
- .3 Install insulation port extensions as required.
- .4 Locations:
  - .1 For traverse readings:
    - .1 Ducted inlets to roof and wall exhausters.
    - .2 Inlets and outlets of other fan systems.
    - .3 Main and sub-main ducts.
    - .4 And as indicated.
  - .2 For temperature readings:
    - .1 At outside air intakes.
    - .2 In mixed air applications in locations as approved by Departmental Representative.
    - .3 At inlet and outlet of coils.
    - .4 Downstream of junctions of two converging air streams of different temperatures.
    - .5 And as indicated.

.4 Turning vanes:
- .1 Install in accordance with recommendations of SMACNA and as indicated.

3.3 CLEANING

.1 Perform cleaning operations as specified and in accordance with manufacturer's recommendations.

.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 SUMMARY

.1 Section Includes:
- .1 Balancing dampers for mechanical forced air ventilation and air conditioning systems.
- .2 Sustainable requirements for construction and verification.

1.2 REFERENCE

.1 Sheet Metal and Air Conditioning National Association (SMACNA).
- .1 SMACNA HVAC Duct Construction Standards, Metal and Flexible-1985.

.2 Health Canada/Workplace Hazardous Materials Information System (WHMIS)
- .1 Material Safety Data Sheets (MSDS).

1.3 SUBMITTALS

.1 Product Data:
- .1 Submit manufacturer's printed product literature, specifications and datasheet in accordance with Section 01 33 00 - Submittal Procedures. Include product characteristics, performance criteria, and limitations.
  - .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 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.

2 Products

2.1 GENERAL

.1 Manufacture to SMACNA standards.

2.2 SPLITTER DAMPERS

.1 Fabricate from same material as duct but one sheet metal thickness heavier (minimum 16 gauge), with appropriate stiffening to avoid vibration.

.2 Double thickness construction to streamline shape.

.3 Control rod with locking device and position indicator.

.4 Rod configuration to prevent end from entering duct.

.5 Pivot: piano hinge.

.6 Folded leading edge.

.7 Size on basis of straight air volume proportioning.

2.3 SINGLE BLADE DAMPERS

.1 Fabricate from same material as duct, but one sheet metal thickness heavier (minimum 16 gauge). V-groove stiffened.

.2 Size and configuration to recommendations of SMACNA, except maximum height 100 mm.

.3 Locking quadrant with shaft extension to accommodate insulation thickness.

.4 Inside and outside nylon end bearings.

.5 Channel frame of same material as adjacent duct, complete with angle stop.

2.4 MULTI-BLADED DAMPERS

.1 Factory manufactured of material compatible with duct.

.2 Opposed blade: configuration, metal thickness and construction to recommendations of SMACNA.

.3 Maximum blade height: 100 mm.

.4 Bearings: self-lubricating nylon.

.5 Linkage: shaft extension with locking quadrant.

.6 Channel frame of same material as adjacent duct, complete with angle stop.

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 where indicated.

.2 Install in accordance with recommendations of SMACNA and in accordance with manufacturer's instructions.

.3 Locate balancing dampers in each low pressure branch duct, for supply, return and exhaust systems where branches are taken from longer duct.

.4 Runouts to registers and diffusers: install single blade damper located as close as possible to main ducts. Where indicated on the drawings, a balancing damper is not required for runouts in non-accessible ceiling spaces provided a damper is specified on the register and diffuser.

.5 Dampers: vibration free.

.6 Ensure damper operators are observable and accessible. Provide access doors in ceilings/ walls where required.

.7 Provide 100 mm x 100 mm quick opening access doors for inspection at balancing dampers.

3.3 FIELD QUALITY CONTROL

.1 Tests:

.1 Tests to cover period of not less than seven (7) days and demonstrate that system is functioning as specified.

3.4 CLEANING

.1 Upon completion and verification of performance of installation, remove surplus materials, excess materials, rubbish, tools and equipment.

END OF SECTION

1 General

1.1 SUMMARY

.1 Section Includes:
- .1 Fire and smoke dampers, and fire stop flaps.
- .2 Sustainable requirements for construction and verification.

1.2 REFERENCES

.1 American National Standards Institute/National Fire Protection Association (ANSI/NFPA)
- .1 ANSI/NFPA 90A-2002, Standard for the Installation of Air Conditioning and Ventilating Systems.

.2 Health Canada/Workplace Hazardous Materials Information System (WHMIS)
- .1 Material Safety Data Sheets (MSDS).

.3 Underwriters Laboratories of Canada (ULC)
- .1 CAN4-S112-M1990, Fire Test of Fire Damper Assemblies.
- .2 CAN4-S112.2-M84, Standard Method of Fire Test of Ceiling Firestop Flap Assemblies.
- .3 ULC-S505-1974, Fusible Links for Fire Protection Service.

1.3 SUBMITTALS

.1 Product Data:
- .1 Submit manufacturer's printed product literature, specifications and datasheet in accordance with Section 01 33 00 - Submittal Procedures. Include product characteristics, performance criteria, and limitations.
  - .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 Indicate the following:
  - .1 Fire dampers.
  - .2 Smoke dampers.
  - .3 Fire stop flaps.
  - .4 Operators.
  - .5 Fusible links.
  - .6 Design details of break-away joints.

.2 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 Closeout Submittals:
- .1 Provide maintenance data for incorporation into manual specified in Section 01 78 00 - Closeout Submittals.
- .2 Provide a Fire Damper Schedule identifying the following: damper tag, duct size, location, access door size, location.

1.4 QUALITY ASSURANCE

.1 Certificates:
- .1 Catalogue or published ratings those obtained from tests carried out by manufacturer or those ordered by manufacturer from independent testing agency signifying adherence to codes and standards.

1.5 MAINTENANCE

.1 Extra Materials:
- .1 Provide maintenance materials in accordance with Section 01 78 00 - Closeout Submittals.
- .2 Provide following:
  - .1 6 fusible links of each type.

2 Products

2.1 FIRE DAMPERS

.1 Fire dampers: arrangement Type A, B and C, listed and bear label of ULC, UL, Warnock Hersey, meet requirements of authorities having jurisdiction. Fire damper assemblies fire tested in accordance with CAN4-S112. Fusible links on fire dampers shall be constructed to ULC Standard S505.

.2 Mild steel, factory fabricated for fire rating requirement to maintain integrity of fire wall and/or fire separation.
- .1 Fire dampers: 1-1/2 hour fire rated unless otherwise indicated or required.
- .2 Fire dampers: automatic operating type and have dynamic rating suitable for maximum air velocity and pressure differential to which it will be subjected.

.3 Top hinged: offset single damper, round or square; multi-blade hinged or interlocking type; roll door type; or guillotine type; sized to maintain full duct cross section as indicated.

.4 Fusible link actuated, weighted to close and lock in closed position when released or having negator-spring-closing operator for multi-leaf type or roll door type in horizontal position with vertical air flow.

.5 50 x 50 x 3 mm retaining angle iron frame, on full perimeter of fire damper, on both sides of fire separation being pierced.

.6 Equip fire dampers with steel sleeve and frame installed disruption ductwork (breakaway ductwork) to ensure damper operation is not impaired.

.7 Equip sleeves or frames with perimeter mounting angles attached on both sides of wall or floor opening. Construct ductwork in fire-rated floor-ceiling or roof-ceiling assembly systems with air ducts that pierce ceiling to conform with ULC.

.8 Design and construct dampers to not reduce duct or air transfer opening cross-sectional area.

.9 Dampers shall be installed so that the centerline of the damper depth or thickness is located in the centerline of the wall, partition of floor slab depth or thickness.

.10 Unless otherwise indicated, the installation details given in SMACNA and in manufacturer's instructions for fire dampers shall be followed.

.11 Springs to be corrosion resistant.

2.2 SMOKE DAMPERS

.1 Fabricate to NFPA 90A, UL 555, UL 555S, and as indicated.

.2 Provide factory sleeve and collar for each damper.

.3 Multiple Blade Dampers: Fabricate with 1.5 mm galvanized steel frame and blades, oil-impregnated bronze or stainless steel sleeve bearings and plated steel axles, stainless steel jamb seals, 3.2 x 12.7 mm plated steel concealed linkage, stainless steel closure spring, blade stops, and lock, and 12.7 mm actuator shaft.

.4 Smoke Rating: Leakage Class III Smoke Damper in accordance with UL555S. A Class lll smoke damper leaks no more than 80 cubic feet per minute (2.27 m^3/min) at 4 in. wg. (1 kPa.) differential pressure

.5 Operators: UL listed and labelled Electric 120V, 60 Hz, two-position, fail close, externally mounted.

.6 Duct Smoke Detector: Factory mounted duct smoke detector with no minimum velocity requirement and powered from single point electrical connection to damper. Sensor to be photoelectronic type, as recommended for in duct application.

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 at locations shown, where ducts and outlets pass through fire rated components, and where required by authority having jurisdiction. Fire dampers shall be complete with required perimeter mounting angles, sleeves, breakaway duct connections, corrosion resistant springs, bearings, bushings, and hinges.

.2 Install in accordance with ANSI/NFPA 90A and in accordance with conditions of ULC listing.

.3 Maintain integrity of fire separation.

.4 After completion and prior to concealment obtain approvals of complete installation from authority having jurisdiction.

.5 Install access door adjacent to each damper. See Section 23 33 00 - Air Duct Accessories.

.6 Co-ordinate with installer of firestopping.

.7 Ensure access doors/panels, fusible links, damper operators are easily observed and accessible.

.8 Install break-away joints of approved design on each side of fire separation.

.9 Contractor to provide individually tag each and every fire damper and provide a fire damper schedule in the Operation and Maintenance manual showing tag, size, type and location.

.10 Contractor shall tag fire damper and access door with fire damper tag.

3.3 CLEANING

.1 Proceed in accordance with Section 01 74 11 - 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 SUMMARY

.1 Section Includes:
  .1 Materials and installation of flexible ductwork, joints and accessories.
.2 Sustainable requirements for construction and verification.

1.2 REFERENCES

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

.2 Department of Justice Canada (Jus).
  .1 Canadian Environmental Protection Act (CEPA), 1999, c. 33.
  .2 Transportation of Dangerous Goods Act, 1992 (TDGA), c. 34.

.3 Health Canada/Workplace Hazardous Materials Information System (WHMIS).
  .1 Material Safety Data Sheets (MSDS).

.4 National Fire Protection Association (NFPA).
  .1 NFPA 90A-02, Standard for the Installation of Air-Conditioning and Ventilating Systems.
  .2 NFPA 90B-02, Standard for Installation of Warm Air Heating and Air-Conditioning Systems.

.5 Sheet Metal and Air-Conditioning Contractors' National Association (SMACNA).
  .1 SMACNA HVAC Duct Construction Standards - Metal and Flexible, 95 (Addendum No.1, November 1997).
  .2 SMACNA IAQ Guideline for Occupied Buildings under Construction, 1st Edition 1995.

.6 Underwriters' Laboratories Inc. (UL).
  .1 UL 181-96, Standard for Factory-Made Air Ducts and Air Connectors.

.7 Underwriters' Laboratories of Canada (ULC).
  .1 CAN/ULC-S110-1986(R2001), Fire Tests for Air Ducts.

1.3 SUBMITTALS

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

.2 Product Data: submit WHMIS MSDS in accordance with Section 02 61 33 - Hazardous Materials for the following:
  .1 Thermal properties.
  .2 Friction loss.
  .3 Acoustical loss.
  .4 Leakage.
  .5 Fire rating.

.3 Samples: submit samples with product data of different types of flexible duct being used in accordance with Section 01 33 00 - Submittal Procedures.

1.4 QUALITY ASSURANCE

.1 Certification of Ratings:
  .1 Catalogue or published ratings to be those obtained from tests carried out by manufacturer or independent testing agency signifying adherence to Codes and Standards.

1.5 INDOOR AIR QUALITY (IAQ) MANAGEMENT PLAN

.1 During construction meet or exceed the requirements of SMACNA IAQ Guideline for Occupied Buildings under Construction.

2 Products

2.1 GENERAL

.1 Factory fabricated to CAN/ULC-S110.

.2 Pressure drop coefficients listed below are based on relative sheet metal duct pressure drop coefficient of 1.00.

.3 Flame spread rating not to exceed 25. Smoke developed rating not to exceed 50.

2.2 METALLIC – UNINSULATED

.1 Type 1: spiral wound flexible aluminum, as indicated.

.2 Performance:
  .1 Factory tested to 2.5 kPa without leakage.
  .2 Maximum relative pressure drop coefficient: 3.

2.3 METALLIC – INSULATED

.1 Type 2: spiral wound flexible aluminum with factory applied, 37 mm thick flexible glass fibre thermal insulation with vapour barrier and reinforced mylar/neoprene laminate or aluminum jacket, as indicated.

.2 Performance:
  .1 Factory tested to 2.5 kPa without leakage.
  .2 Maximum relative pressure drop coefficient: 3.
  .3 Thermal loss/gain: 0.94 W/m^2. degrees C mean or RSI 1.06 (R6).

2.4 NON-METALLIC – UNINSULATED

.1 Type 3: non-collapsible, coated mineral base fabric type, mechanically bonded to, and helically supported by, external steel wire, or band as indicated.

.2 Performance:
  .1 Factory tested to 2.5 kPa without leakage.
  .2 Maximum relative pressure drop coefficient: 3.

2.5 NON-METALLIC – INSULATED

.1 Type 4: non-collapsible, coated mineral base fabric type mechanically bonded to, and helically supported by, external steel wire with factory applied, 37 mm thick flexible mineral fibre thermal insulation with vapour barrier and reinforced mylar/neoprene laminate jacket, as indicated.

.2 Performance:
- .1 Factory tested to 2.5 kPa without leakage.
- .2 Maximum relative pressure drop coefficient: 3.

2.6 METALLIC ACOUSTIC INSULATED - LOW PRESSURE

.1 Type 5: Spiral wound, flexible perforated aluminum with factory applied 25 mm thick flexible mineral fibre thermal insulation and sleeved by aluminum foil/mylar laminate vapour barrier.

.2 Performance:
- .1 Factory tested to 2.5 kPa without leakage.
- .2 Maximum relative pressure drop coefficient: 3.

2.7 NON-METALLIC - ACOUSTIC INSULATED

.1 Type 7: non-collapsible, coated mineral base perforated fabric type helically supported by and mechanically bonded to steel wire with factory applied flexible mineral fibre acoustic insulation and encased in aluminum foil/mylar laminate vapour barrier.

.2 Performance:
- .1 Factory tested to 2.5 kPa without leakage.
- .2 Maximum relative pressure drop coefficient: 3.

3 Execution

3.1 DUCT INSTALLATION

.1 Install in accordance with: SMACNA.

END OF SECTION

1 General

1.1 SECTION INCLUDES

.1 Tubular in-line fans.
.2 Fan accessories.
.3 Roof curbs.
.4 Motors and Drives.

1.2 SUBMITTALS

.1 Section 01 33 00: Procedures for submittals.

.2 Shop Drawings: Indicate assembly, unit dimensions, weight loading, required clearances, construction details, field connection details, and electrical characteristics and connection requirements.

.3 Product Data:
  .1 Provide literature which indicates dimensions, weights, capacities, ratings, fan performance, gauges and finishes of materials, and electrical characteristics and connection requirements.
  .2 Provide data of filter media, filter performance data, filter assembly, and filter frames.
  .3 Provide fan curves with specified operating point clearly plotted.
  .4 Submit sound power level data for both fan outlet and casing radiation at rated capacity.
  .5 Submit electrical requirements for power supply wiring including wiring diagrams for interlock and control wiring, clearly indicating factory-installed and field-installed wiring.

1.3 SOURCE QUALITY CONTROL

.1 Fans used shall not decrease motor size, increase noise level, increase tip speed by more than 10 percent or increase inlet air velocity by more than 20 percent, from specified criteria; and capable of accommodating static pressure variations of plus or minus 10 percent.

1.4 OPERATION AND MAINTENANCE

.1 Submit operation and maintenance data to requirements of Section 01 78 00.

.2 Include instructions for lubrication, filter replacement, motor and drive replacement, spare parts lists, and wiring diagrams.

2 Products

2.1 TUBULAR INLINE FANS

.1 Wheel and Motor
  .1 Wheel shall be steel, non-overloading, centrifugal backward inclined, airfoil type. Blades shall be continuously welded to the backplate and deep spun inlet

shroud. Hubs shall be keyed and securely attached to the fan shaft. Wheel shall overlap an aerodynamic aluminum inlet cone to provide maximum performance and efficiency. Wheel shall be balanced in accordance with AMCA Standard 204-96, Balance Quality and Vibration Levels for Fans.

.2 Motor shall be heavy duty type with permanently lubricated sealed ball bearings and furnished at the specified voltage, phase and enclosure.

.2 Construction

.1 The fan shall be of welded and bolted construction utilizing corrosion resistant fasteners.

.2 Housing shall be minimum 14 gauge steel with integral inlet and outlet flanges.

.3 Adjustable motor plate shall utilize threaded studs for positive belt tensioning.

.4 Extended lube lines shall be furnished for lubrication of fan bearings.

.5 Unit shall bear an engraved aluminum nameplate.

.6 Nameplate shall indicate design CFM, static pressure, and maximum fan RPM. Unit shall be shipped in ISTA certified transit tested packaging.

.7 Shafts: Blower shaft shall be AISI C-1045 hot rolled and accurately turned, ground and polished. Shafting shall be sized for a critical speed of at least 125% of maximum RPM. Shaft to have key-away and protectively coated with lubricating oil.

.8 Bearings shall be designed and tested specifically for use in air handling applications. Construction shall be heavy duty regreasable ball or roller type in a cast iron pillow block housing selected for a minimum L50 life in excess of 200,000 hours at maximum cataloged operating speed.

.9 Steel fan components shall be complete with an electrostatically applied, baked polyester powder coating. Each component shall be subject to a five stage environmentally friendly wash system, followed by a minimum 2 mil thick baked powder finish. Paint must exceed 1,000 hour salt spray under ASTM B117 test method.

.10 Belts shall be oil and heat resistant, non-static type. Drives shall be precision machined cast iron type, keyed and securely attached to the wheel and motor shafts. Drives shall be sized for 150% of the installed motor horsepower. The variable pitch motor drive must be factory set to the specified fan RPM.

.11 Belt Guards: Fabricate to SMACNA Low Pressure Duct Construction Standards.

.3 Accessories

.1 Inlet/Outlet Screens: Galvanized steel welded grid.

.2 Access Doors: Shaped to conform to scroll with quick opening latches and gaskets.

.3 Scroll Drain: 15 mm steel pipe coupling welded to low point of fan scroll.

.4 Provide mounting base matched to fan.

.4 Certifications

.1 Fan shall be listed by Underwriters Laboratories (UL/cUL 705) for US and Canada. Fan shall bear the AMCA certified ratings seal for sound and air performance

3 Execution

3.1 PREPARATION

.1 Verify that electric power is available and of the correct characteristics (voltage and phase) prior to ordering pump.

3.2 INSTALLATION

.1 Install in accordance with manufacturer's instructions.

.2 Assemble high pressure packaged air units by bolting sections together. Isolate fan section with flexible duct connections.

.3 Install flexible connections between fan inlet and discharge ductwork. Ensure metal bands of connectors are parallel with minimum 25 mm flex between ductwork and fan while running.

.4 Install fan restraining snubbers as indicated. Flexible connectors shall not be in tension while running.

.5 Pipe scroll drains to nearest floor drain.

.6 Provide access to adjustable blade axial fan wheels for varying blade angle setting. Adjust blades for varying range of volume and pressure.

.7 Provide floor mounted axial fans with reinforced legs and ceiling suspended units with support brackets bolted to casing flange.

.8 When fan inlet or outlet is exposed, provide safety screen.

.9 Install unit on vibration isolators with static deflection of 50 mm. For smaller fans, vibration isolators to be as recommended by manufacturer.

.10 Set roof mounted fans on metal, self flashing curbs 200 mm minimum above roof. Provide acoustic insulation on duct to below roof line and one fan inlet plenum and drip pan for collecting condensation.

.11 Provide exhaust fans with multi-blade, rattle free, back draft damper with felt lines blades edges, bird screen, disconnect switch and curb caps.

.12 Supply and install sheaves as necessary for final air balancing.

.13 Do not operate fans for any purpose until ductwork is clean, filters in place, bearings lubricated, and fan has been test run under observation.

END OF SECTION

1 General

1.1 SUMMARY

.1 Section Includes:
- .1 Supply, return and exhaust grilles and registers, diffusers and linear grilles, for commercial and residential use.
- .2 Sustainable requirements for construction and verification.

1.2 SYSTEM DESCRIPTION

.1 Performance Requirements:
- .1 Catalogued or published ratings for manufactured items: obtained from tests carried out by manufacturer or those ordered by manufacturer from independent testing agency signifying adherence to Codes and Standards.

1.3 SUBMITTALS

.1 Product Data:
- .1 Submit manufacturer's printed product literature, specifications and datasheet in accordance with Section 01 33 00 - Submittal Procedures. Include product characteristics, performance criteria, and limitations.
  - .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 Indicate following:
  - .1 Capacity.
  - .2 Throw and terminal velocity.
  - .3 Noise criteria.
  - .4 Pressure drop.
  - .5 Neck velocity.

.2 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.

1.4 QUALITY ASSURANCE

.1 Air flow tests and sound level measurement shall be made in accordance with ANSI/ ASHRAE Standard 70.

.2 Manufacturer shall have published performance data.

.3 Manufacturer shall certify catalogued performance and ensure correct application of air outlet types.

1.5 JOB CONDITIONS

.1 Review requirements of outlets as to size, finish and type of mounting prior to submitting shop drawings and schedules of outlet.

.2 Positions indicated are approximate only. Check location of outlets and make necessary adjustment in position to conform with Architectural features, symmetry, performance, and lighting arrangement.

2 Products

2.1 GENERAL

.1 To meet capacity, pressure drop, terminal velocity, throw, noise level, neck velocity as indicated.

.2 Base air outlet application on space noise level, either by Noise Criteria (NC) curves or Room Criteria (RC) curves, as listed below:

.1 Offices NC 30

.3 Frames:

.1 Full perimeter gaskets.

.2 Plaster frames for diffusers, located in plaster surface.

.3 Concealed fasteners.

.4 Concealed manual volume control damper operators.

.5 Provide baffles to direct air away from walls, columns or other obstructions within the radius of diffuser operation.

.6 Provide anti-smudge frames or plaques on diffusers located in rough textured surfaces such as acoustical plaster.

.7 Refer to equipment schedule for specification of air outlets.

.8 Colour: as directed by Departmental Representative.

2.2 MANUFACTURED UNITS

.1 Grilles, registers and diffusers of same generic type, products of one manufacturer.

2.3 RETURN AND EXHAUST GRILLES AND REGISTERS

.1 Sidewall and ceiling exhaust grilles shall have streamlined blades, depth of which exceeds 20 mm spacing. Provide spring tension or other device to set blades. Provide units with horizontal face.

.2 Provide 25 mm narrow margin frame with countersunk screw holes.

.3 Fabricate of steel with 20 gauge minimum frames and 22 gauge minimum blades, steel and aluminum with 20 gauge minimum frame, or heavy aluminum extrusions.

.4 Provide exhaust grilles, with integral, gang-operated opposed blade dampers with removable key operator, operable from face, where indicated.

.5 Finish in factory baked enamel finish, colour by Departmental Representative.

2.4 GRID CORE RETURN AND EXHAUST GRILLES

.1 Fabricate fixed grilles of 13 mm x 13 mm x 13 mm louvres.

.2 Provide 32 mm margin frame with lay-in frame for suspended grid ceilings.

.3 Fabricate of aluminum.

.4 Provide exhaust grilles, where not individually connected to exhaust fans, with integral, gang-operated opposed blade dampers with removable key operator, operable from face, where indicated.

2.5 SQUARE PLAQUE DIFFUSER

.1 Diffuser shall consist of a precision formed back cone of one piece seamless construction which incorporates a round inlet collar of sufficient length for connecting rigid ductwork.

.2 Removable inner plaque assembly shall be incorporated that drops no more than 1/4" below the ceiling plane to assure proper air distribution performance.

.3 Sizes and mounting as detailed on drawings.

2.6 LINEAR SLOT DIFFUSER

.1 Linear slot diffuser complete with plenum assembly.

.2 Plenum assembly shall be constructed of zinc coated steel with 6 mm internal insulation.

.3 Plenum assembly shall have sloped shoulders for enhanced spread characteristics.

.4 Plenum assemblies shall be complete with side inlet.

.5 Sizes, slots and inlets as detailed on drawings.

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 in accordance with manufacturer’s instructions.

.2 Install with oval head, stainless steel screws in countersunk holes where fastenings are visible.

.3 Bolt grilles, registers and diffusers, in place, where indicated.

3.3 CLEANING

.1 Proceed in accordance with Section 01 74 11 - 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 SECTION INCLUDES

.1 Refrigerant piping and connections.
.2 Refrigerant specialties: moisture and liquid indicators, valves, strainers, check valves, pressure relief valves, filter-driers, solenoid valves, expansion valves, receivers, flexible connections.
.3 Reciprocating compressors.
.4 Air cooled condensing units.
.5 Controls and control connections.

1.2 QUALITY ASSURANCE

.1 Manufacturer: Company specializing in manufacture of refrigeration system components with three years documented experience.
.2 Equipment shall be certified in accordance with UL Standard 1995/CSA C22.2 No. 236, Safety Standard for Heating and Cooling Equipment
.3 Equipment and refrigeration system shall comply with ASHRAE 15, Safety Standard for Mechanical Refrigeration.
.4 System Seasonal Energy Efficiency Ratio/Energy Efficiency Ratio (SEER/EER) shall be equal to or greater than prescribed by ASHRAE 90.1, Energy Efficient Design of New Buildings except Low-Rise Residential Buildings.
.5 Units shall be safety certified by ETL and be ETL US and ETL Canada listed. Unit nameplate shall include the ETL/ETL Canada label.

1.3 SUBMITTALS

.1 Submit shop drawings to requirements of Section 01 33 00.

.2 Indicate general assembly of specialties, rated capacities, weights, accessories, electrical requirements, wiring diagrams (clearly indicate any and all field wiring requirements), dimensions, operating and shipping weights and loading, required clearances, and location and size of field connections. Include schematic layouts showing condenser, refrigeration compressors, cooling coils, refrigerant piping and accessories required for complete system.

.3 Submit design data indicating pipe sizing.

.4 Submit manufacturer's installation instructions under provisions of Section 01 33 00.

1.4 SUBMITTALS FOR INFORMATION

.1 Sections 01 33 00 and 01 78 10: Submission procedures.

.2 Manufacturer's Certificate: Certify that specified products meet or exceed specified requirements.

1.5 CLOSEOUT SUBMITTALS

.1 Section 01 33 00: Submission procedures.

1.6 PROJECT RECORD DOCUMENTS

.1 Submit documents to requirements of Section 01 78 10.

.2 Accurately record actual locations of equipment and refrigeration accessories on drawings.

1.7 OPERATION AND MAINTENANCE DATA

.1 Submit operation and maintenance data to requirements of Section 01 78 10.

.2 Include start-up instructions, maintenance data, parts lists, controls, and accessories.

1.8 WARRANTY

.1 Provide a 5 year warranty to Section 01 78 10 and CCDC 2 General Conditions.

.2 Warranty: Include coverage for refrigerant compressors and motors.

1.9 START-UP AND TESTING

.1 Supply initial charge of refrigerant and oil for each refrigeration system. Losses of oil or refrigerant prior to acceptance of equipment or due to defects covered under guarantee shall be replaced. Supply to the Owner, one complete charge of lubricating oil in addition to that placed in the system.

.2 Charge the system with refrigerant and test entire system for leaks after completion of installation. Repair leaks, put system into operation, and test equipment performance.

.3 Shut-down system if initial start-up testing takes place in winter and machines are to remain inoperative. Repeat start-up and testing operation at beginning of first cooling season.

.4 Provide cooling season start-up, winter season shut-down for first year of operation.

2 Products

2.1 REFRIGERANT

.1 Refrigerant shall be an HFC (hydroflourocarbon) matched to system, refer to equipment schedule for basis of design.

2.2 HERMETIC COMPRESSORS

.1 Construct hermetic reciprocating compressors with positive oil lubrication system, internal pressure relief valve, suction service valve, discharge muffler, installed in welded steel shell.

.2 Provide automatic capacity reduction equipment consisting of electrically actuated suction valve unloaders with replaceable solenoid valves.

.3 Provide variable speed rpm compressor motor, suction gas cooled with two winding thermostats providing overheating protection, with starter.

.4 Provide crankcase heater, energized continuously.

2.3 SEMI-HERMETIC COMPRESSORS

.1 Construct semi-hermetic (serviceable hermetic) reciprocating compressors with reversible, positive displacement, oil pump lubrication system spring loaded heads and replaceable cylinder liners, mesh suction inlet screen, and discharge service valves.

.2 Provide automatic capacity reduction equipment consisting of suction valve unloaders operated by oil pressure.

.3 Provide variable speed compressor motor, suction gas cooled with solid state sensor and electronic winding overheating protection, with starter.

.4 Provide crankcase heater energized continuously.

2.4 COMPRESSOR CONTROLS

.1 On compressor, mount steel control panel, containing power and control wiring, moulded case disconnect switch, factory wired with single point power connection.

.2 Provide across-the-line starter, non-recycling compressor overload, starter relay, control power transformer or terminal for controls power, terminal strip for connection to interface equipment. Provide manual reset current overload protection.

.3 Provide the following devices on control panel face:
- .1 Compressor run light.
- .2 Start-stop switch.
- .3 Control power fuse or circuit breaker.
- .4 Demand limit switch.
- .5 Elapsed time meter.
- .6 Crankcase heater start-up switch and light.

.4 Provide high discharge pressure switch, low suction pressure switch, and oil pressure switch safety controls arranged so that operating any one will shut down machine and require manual reset.

.5 Provide the following operating controls:
- .1 Multi-step suction pressure controller which activates cylinder unloaders.
- .2 Five minute off timer prevents compressor from short cycling.
- .3 Part winding start timer.
- .4 Periodic pump-out timer to pump down on high suction refrigerant pressure.

.6 Provide pre-piped gage board with pressure gages for suction and discharge refrigerant pressures, and oil pressure.

2.5 WALK-IN FREEZER COOLING UNIT

.1 General Description:
- .1 Condensing unit shall include compressors, air-cooled condenser coils, condenser fans, suction and liquid connection valves, and unit controls.
- .2 Condensing Unit shall be factory assembled and tested including leak testing of the coil and run testing of the completed unit. Run test report shall be supplied with the unit in the controls compartment's literature pocket.

.3 Units shall have decals and tags to indicate lifting and rigging, service areas and caution areas for safety and to assist service personnel.
.4 Unit components shall be labeled, including pipe stub outs, refrigeration system components and electrical and controls components.
.5 Installation, Operation and Maintenance manual shall be supplied within the unit.
.6 Laminated color-coded wiring diagram shall match factory installed wiring and shall be affixed to the interior of the control compartment's access door.
.7 Unit nameplate shall be provided in two locations on the unit, affixed to the exterior of the unit and affixed to the interior of the control compartment's access door.
.8 System to serve freezer with control temperature of -29 Deg.C (-20 Deg.F).

.2 Condensing Unit Construction:
.1 Unit shall be completely factory assembled, piped, wired and shipped in one section.
.2 Unit shall be specifically designed for intended application, indoor unit.
.3 Condenser coils shall be mechanically protected from physical damage by painted galvanized steel louvers (wire grille) covering the full area of the coil.
.4 Access to condenser coils, condenser fans, compressors, and electrical and controls components shall be through hinged access doors with quarter turn, zinc cast, lockable handles.
.5 Exterior paint finish shall be capable of withstanding at least 1,000 hours, with no visible corrosive effects, when tested in a salt spray and fog atmosphere in accordance with ASTM B 117-95 test procedure.
.6 Unit shall include a fork-liftable base.

.2 Evaporator Construction:
.1 High efficiency and high strength fan guard
.2 Hinged doors for service access.
.3 Internally enhanced tubing.
.4 Uniform air flow.
.5 Hot gas defrost with hot gas loop pan heater.
.6 Electrical and header service compartments.
.7 Liquid line solenoid valve wire harness factory installed.
.8 Schrader valve on suction header.
.9 Positive slope, hinged drain pan.
.10 Central drain connections (approximate).
.11 Universal drain fitting.
.12 Large 3/4” ID (3/4” MPT) drain hole.
.13 Factory installed expansion valve, solenoid valve and room thermostat.
.14 EC motors with factory control from factory thermostat.

.3 Electrical:
.1 Unit shall be provided with standard power block for connecting power to the unit.
.2 Control circuit transformer and wiring shall provide 24 VAC control voltage from the line voltage provided to the unit.
.3 Unit shall be provided with phase and brown out protection which shuts down all motors in the unit if the electrical phases are more that 10% out of balance on voltage, the voltage is more that 10% under design voltage, or on phase reversal

.4 Refrigeration System

.1 Compressors shall be scroll type with thermal overload protection and carry a 5 year non-prorated warranty, from the date of original equipment shipment from the factory.

.2 Compressors shall include stages of capacity control as indicated in equipment schedule.

.3 Unit shall include a variable speed EC motors on condenser for head pressure control.

.4 Compressors shall be mounted on base pan and can be accessed without affecting unit operation.

.6 Compressors shall be isolated from the base pan with the compressor manufacturer's recommended rubber vibration isolators, to reduce any transmission of noise from the compressors into the building area.

.7 Each refrigeration circuit shall be equipped with automatic reset low pressure and manual reset high pressure refrigerant safety controls, Schrader type service fittings on both the high pressure and low pressure sides, and service valves for liquid and suction connections. Liquid line filter driers shall be factory provided. Finished field installed refrigerant circuits shall include the low side cooling components, refrigerant, thermal expansion valve, liquid line, (insulated hot gas bypass line), (insulated hot gas line) and insulated suction line.

.8 Each compressor shall be equipped with a 5 minute off, delay timer to prevent compressor short cycling.

.9 Although installed indoors, the unit shall be capable of stable cooling operation to a minimum of 55°F outdoor temperature.

.5 Air Cooled Condenser:

.1 Condenser fans shall be vertical (horizontal) discharge, axial flow, direct drive fans.

.2 Fan motor shall be weather protected, single phase, direct drive, and open drip proof with inherent overload protection.

.3 Coils shall be designed for use with the HFC refrigerant being utilized and constructed of copper tubes with aluminum (copper) fins mechanically bonded to the tubes and aluminum end casings. Fin design shall be sine wave rippled.

.4 Coils shall be designed for a minimum of 10°F of refrigerant sub-cooling.

.5 Coils shall be helium leak tested.

.6 Provide expanded metal protective coil guard with lint screens.

.6 Controls

.1 Unit shall be provided with a terminal block for field installation of controls

.7 Factory Features

.1 Weatherproof electrical control box with compressor contactor and fused control circuit.

.2 High efficiency enhanced tube and fin condenser design.

.3 Receiver with fusible plug and liquid shut off valve

.4 Suction service valve

.5 Pre-formed copper tubing

.6 Liquid injection (low temp. models)

.7 Unit leak tested and shipped with helium holding charge.

.8 Fixed high pressure switch and adjustable low pressure control

.9 Receiver inlet and outlet shut off valve (2 fan units)

.10 Unit shall be provided with a terminal block for field installation of controls.

.11 Floating head pressure control system.

2.6 DEDICATED ROOM AIR CONDITIONING UNITS

.1 Integrated package: to CAN/CSA-C656.

.2 System type:
- .1 Air flow arrangement: as noted on equipment schedule
- .2 Cooling: direct expansion.
- .3 Condensing: air cooled.

.3 Cooling capacity, with fan heat extracted: based on environment of 22 degrees C dry bulb and 50% R.H. (plus or minus 1 degree C and 5% R.H.), with minimum supply air temperature of 14 degrees C.

.4 Unit capacity: as indicated:

.5 Cabinet:
- .1 Wall mounted, welded steel, unit construction, corrosion protected, 20 mm thick acoustic insulation, factory baked on external finish aesthetically compatible with typical computer and peripheral cabinets. Colour selected by Engineer.
- .2 Cabinet to house: cooling coil, fans, filters, unit environmental control system, motor starters or contactors and electrical disconnect switch.
- .3 Provide adequate access to components for servicing.
- .4 Corrosion protected welded structural steel floor stand having adjustable feet and locking device on corners, vibration isolators and compatible with raised floor system.
- .5 Fans: DWDI centrifugal, statically and dynamically balanced, direct drive, with self-aligning, permanently lubricated, 100,000 hours minimum life ball or roller bearings.
- .6 Fan Motors: Drip-proof permanently lubricated bearings for continuous duty, 40 degrees C maximum rise and variable pitch sheaves on belt driven systems.
- .7 Provide hail guards over fins.

.6 Compressors:
- .1 Semi hermetic type, minimum 2 required, with:
  - .1 Vibration isolators.
  - .2 Adjustable high and low pressure switches.
  - .3 Anti-slug device.
  - .4 Motor overload and over temperature protection pump down controls.
  - .5 Crank case heater.
  - .6 Compressor lead/lag switch.
  - .7 Refrigerant service valves.
  - .8 Capacity controls (variable speed compressor)

.7 Condenser:
- .1 Outdoor Air cooled: free standing, welded steel unit construction, corrosion protected.
  - .1 Circuited to provide separate refrigerant circuit for each compressor/evaporator combination.
  - .2 Aluminum fins, mechanically bonded to copper tubes, tested to 3.1 MPa.
  - .3 Propeller or centrifugal type fans. Direct drive.

.4 Electrical and control components housed in weather-tight access panels with electrical disconnect switch and control cable for control interconnection and designed for year round operation.
.5 Vibration isolation: providing at least 95% isolation efficiency.
.6 Capacity: to heat rejection capacity of 35 degrees C.
.7 Variable speed compressor for capacity control.

.8 Filters:
.1 Prefilters: Cleanable.
.2 Mounting: in corrosion resistant racks with service access.

.9 Refrigerant Piping, Valves, Fittings, and Accessories within unit
.1 To CSA B52.
.2 Include for each refrigerant circuit:
.1 Thermal expansion valve, external equalizing type.
.2 Combination filter-dryer.
.3 Solenoid valves.
.4 Liquid sight glass with moisture indicator.
.5 Suction line insulation: flexible elastomeric unicellar to ASTM C547, 12 mm minimum thickness.
.6 Liquid refrigerant receiver.

.10 Environmental Controls
.1 Solid state electronic control system.
.2 Front mounted operating panel with visual display.
.3 Panel to include following:
.1 Manual operation and adjustment:
.1 On-Off air conditioning system control.
.2 Room temperature set point, indicator and sensitivity adjustment controller.
.3 Alarm silencing switch for each alarm point.
.4 Alarm circuits test switch.
.2 Operational: Visual and Audible Alarm:
.1 Loss of air flow.
.2 Loss of liquid flow.
.3 High room temperature.
.4 Low room temperature.
.5 High head pressure.

.11 Refrigerant Charge
.1 Charge refrigerant system at factory, seal and test.
.2 Holding charge of refrigerant applied at factory.

.12 Capacity and Line Sizing
.1 Manufacturer and Mechanical Contractor shall ensure that system will operate at capacities indicated in equipment schedule despite distance from condensing units to indoor units and elevation change.
.2 Contractor shall ensure refrigerant liquid and suction lines are sized in accordance with manufacturer’s requirements for elevation change and distance between indoor and outdoor unit.

.3 Pipe distance is assumed to be 20m with an elevation change of 6m. Elevation change is included in pipe distance.

3 Execution

3.1 INSTALLATION

.1 Install equipment and specialties in accordance with manufacturer's instructions.

.2 Install piping to conserve building space and not interfere with use of space. Route piping in orderly manner, plumbing and parallel to building structure, and maintain gradient. Group piping whenever practical at common elevations and locations. Slope piping one percent in direction of oil return.

.3 Provide non-conducting dielectric connections when joining dissimilar metals.

.4 Install piping to allow for expansion and contraction without stressing pipe, joints, or connected equipment. Provide clearance for installation of insulation and access to valves and fittings.

.5 Locate expansion valve sensing bulb immediately downstream of evaporator on suction line. Provide external equalizer piping on expansion valves with refrigerant distributor connected to evaporator.

.6 Install flexible connectors at right angles to axial movement of compressor.

.7 Provide for connection to electrical service.

.8 Install units on rubber-in-shear vibration isolation.

3.2 APPLICATION

.1 Provide line sized liquid indicators in main liquid line leaving condenser or in liquid line leaving receiver.

.2 Provide line size strainer upstream of each automatic valve. Where multiple expansion valves with integral strainers are used install single main liquid line strainer.

.3 On steel piping systems provide strainer in suction line.

.4 Provide shut-off valve on each side of strainer.

.5 Provide permanent filter-driers in low temperature systems.

.6 Provide replaceable cartridge filter-driers vertically in liquid line adjacent to receivers with three valve bypass assembly to permit isolation of driers for servicing.

.7 Provide replaceable cartridge filter driers, with three valve bypass assembly. Provide permanent filter driers for each solenoid valve.

.8 Provide solenoid valves in liquid line of systems operating with single pump-out or pump-down compressor control, in liquid line of single or multiple evaporator systems, and in oil bleeder lines from flooded evaporators to stop flow of oil and refrigerant into the suction line when the system shuts down.

.9 Provide refrigerant charging (packed angle) valve connections in liquid line between receiver shut-off valve and expansion valve.

.10 Utilize flexible connectors at or near compressors where within piping configuration does not absorb vibration.

3.3 FIELD QUALITY CONTROL

.1 Check unit for damage before and after placement.

.2 Protect and cover units during construction.

.3 Field inspection and testing will be performed under provisions of Section 01 70 00.

.4 Prepare system for start-up by having manufacturer's factory trained representative supervise testing, dehydration and charging of machine. Do start-up including co-ordination on start-up of condensers.

.5 Prior to testing ensure that system is complete. Protect relief valves during test procedure. After completion of test, reconnect and make good piping connections and leak test entire system.

.6 Provide sufficient refrigerant, dry nitrogen and refrigeration oil for pressure and operational testing under manufacturer's supervision. Replace losses of refrigerant and oil.

.7 Pressure test system with dry nitrogen to 1470 kPa. Perform final tests at 92 kPa vacuum and 1470 kPa using halide torch or electronic leak detector. Test to no leakage.

.8 Provide initial and cooling season start-up, and winter season shut down during first year of operation, including routine servicing and check out.

.9 Supply service of factory trained representative to supervise testing, dehydration and charging of machine, start-up, and instruction on operation and maintenance to Owner.

.10 Manufacturer's Field Services:

- .1 Have manufacturer of products, supplied under this Section, review Work involved in the 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 Schedule site visits, to review Work, at stages listed:
  - .1 After delivery and storage of products, and when preparatory Work, or other Work, on which the Work of this Section depends, is complete but before installation begins.
  - .2 Once during progress of Work at 60% complete.
  - .3 Upon completion of the Work, after cleaning is carried out.
- .4 Obtain reports, within 3 days of review, and submit, immediately, to departmental representative.

END OF SECTION

1 General

1.1 SUMMARY

.1 Section Includes.
- .1 Methods and procedures for start-up, verification and commissioning, for building Energy Monitoring and Control System (EMCS) and includes:
  - .1 Start-up testing and verification of systems.
  - .2 Check out demonstration or proper operation of components.
  - .3 On-site operational tests.
  - .4 Cx Performance Tests and Verification.

1.2 DEFINITIONS

.1 For additional acronyms and definitions refer to Section 25 05 01 - EMCS: General Requirements.

.2 AEL: ratio between total test period less any system downtime accumulated within that period and test period.

.3 Downtime: results whenever EMCS is unable to fulfill required functions due to malfunction of equipment defined under responsibility of EMCS contractor. Downtime is measured by duration, in time, between time that Contractor is notified of failure and time system is restored to proper operating condition. Downtime not to include following:
- .1 Outage of main power supply in excess of back-up power sources, provided that:
  - .1 Automatic initiation of back-up was accomplished.
  - .2 Automatic shut-down and re-start of components was as specified.
- .2 Failure of communications link, provided that:
  - .1 Controller automatically and correctly operated in stand-alone mode.
  - .2 Failure was not due to failure of any specified EMCS equipment.
- .3 Functional failure resulting from individual sensor inputs or output devices, provided that:
  - .1 System recorded said fault.
  - .2 Equipment defaulted to fail-safe mode.
  - .3 AEL of total of all input sensors and output devices is at least 99% during test period.

1.3 DESIGN REQUIREMENTS

.1 Confirm with Departmental Representative that Design Criteria and Design Intents are still applicable.

.2 Commissioning personnel to be fully aware of and qualified to interpret Design Criteria and Design Intents.

1.4 SUBMITTALS

.1 Submittals in accordance with Section 01330 - Submittal Procedures.

.2 Final Report: submit report to Departmental Representative.
- .1 Include measurements, final settings and certified test results.
- .2 Bear signature of commissioning technician and supervisor
- .3 Report format to be approved by Departmental Representative before commissioning is started.

.4 Report to include complete point-to-point verification, including details on all corrective action taken and calibration.
.5 Revise "as-built" documentation, commissioning reports to reflect changes, adjustments and modifications to EMCS as set during commissioning and submit to Departmental Representative in accordance with Section 01 78 00 - Closeout Submittals.
.6 Recommend additional changes and/or modifications deemed advisable in order to improve performance, environmental conditions or energy consumption.
.7 Controls report to be submitted prior to implementation of witnessed Cx Performance Verification Tests.

1.5 CLOSEOUT SUBMITTALS

.1 Provide documentation, O&M Manuals, and training of O&M personnel for review of Departmental Representative before interim acceptance in accordance with Section 01 78 00 - Closeout Submittals.

1.6 COMMISSIONING

.1 Carry out commissioning under direction of Departmental Representative and in presence of Departmental Representative. Departmental Representative, at his discretion, may waive requirement for witnessing some of the Cx activities.

.2 Inform, and obtain approval from, Departmental Representative in writing at least 14 days prior to commissioning or each test. Indicate:
.1 Location and part of system to be tested or commissioned.
.2 Testing/commissioning procedures, anticipated results.
.3 Names of testing/commissioning personnel.

.3 Perform Cs tests as required, refer to attached Performance Verification Forms. Correct deficiencies, and re-test. When EMCS passes test, perform test on required sampling of systems in presence of Departmental Representative until satisfactory performance is obtained.

.4 Acceptance of tests will not relieve Contractor from responsibility for ensuring that complete systems meet every requirement of Contract.

1.7 COMPLETION OF COMMISSIONING

.1 Commissioning to be considered as satisfactorily completed when objectives of commissioning have been achieved and reviewed by Departmental Representative.

1.8 ISSUANCE OF FINAL CERTIFICATE OF COMPLETION

.1 Final Certificate of Completion will not be issued until receipt of written approval indicating successful completion of specified commissioning activities including receipt of commissioning documentation.

2 Products

2.1 EQUIPMENT

.1 Provide sufficient instrumentation to verify and commission the installed system. Provide two-way radios.

.2 Instrumentation accuracy tolerances: higher order of magnitude than equipment or system being tested.

.3 Independent testing laboratory to certify test equipment as accurate to within approved tolerances no more than 2 months prior to tests.

.4 Locations to be approved, readily accessible and readable.

.5 Application: to conform to normal industry standards.

3 Execution

3.1 PROCEDURES

.1 Test each system independently and then in unison with other related systems.

.2 Controls to perform point-to-point verification on entire EMCS (i.e. from screen to on-site device) and document on standard form. Form shall be reviewed and approved by Departmental Representative prior to conducting verification.

.3 Verify every sequence of operation. Identify every occasion where implemented sequence differs from specified and confirm acceptance of changes with Departmental Representative prior to witnessed Performance Verification Tests. Ensure that Performance Verification Tests are altered to suit such changes in squence.

.4 Debug system software.

.5 Optimize operation and performance of systems by fine-tuning PID values and modifying CDLs as required.

.6 Test full scale emergency evacuation and life safety procedures including operation and integrity of smoke management systems under normal and emergency power conditions as applicable.

.7 Retest required sampling in presence of Departmental Representative once system passes Controls Contractor’s verification.

3.2 SCHEDULE

.1 Contractor shall schedule start-up, check-out and Cx activities for each scheduled work area.

.2 Each scheduled work area shall be made fully functional before moving onto the next scheduled work area, including all Cx activities except the 30 day test.

.3 Refer to schedule for further information.

3.3 FIELD QUALITY CONTROL

.1 Pre-Installation Testing.

- .1 General: consists of field tests of equipment just prior to installation.
- .2 Testing may be on site or at Contractor's premises as approved by Departmental Representative.
- .3 Configure major components to be tested in same architecture as designed system. Include BECC equipment and 2 sets of Building Controller's including MCU's, LCU's, and TCU's.

.4 Equip each Building Controller with sensor and controlled device of each type (AI, AO, DI, DO).

.5 Additional instruments to include:

.1 DP transmitters.

.2 VAV supply duct SP transmitters.

.3 DP switches used for dirty filter indication and fan status.

.6 In addition to test equipment, provide inclined manometer, digital micro-manometer, milli-amp meter, source of air pressure infinitely adjustable between 0 and 500 Pa, to hold steady at any setting and with direct output to milli-amp meter at source and to BECC.

.7 After setting, test zero and span in 10 % increments through entire range while both increasing and decreasing pressure.

.8 Contractor to mark instruments tracking within 0.5% in both directions as "approved for installation".

.9 Transmitters above 0.5% error will be rejected.

.10 DP switches to open and close within 2% of setpoint.

.11 Be prepared to re-test as Departmental Representative witnesses.

.2 Completion Testing.

.1 General: test after installation of each part of system and after completion of mechanical and electrical hook-ups, to verify correct installation and functioning.

.2 Include following activities:

.1 Test and calibrate field hardware including stand-alone capability of each controller.

.2 Verify each A-to-D convertor.

.3 Test and calibrate each AI using calibrated digital instruments.

.4 Test each DI to ensure proper settings and switching contacts.

.5 Test each DO to ensure proper operation and lag time.

.6 Test each AO to ensure proper operation of controlled devices. Verify tight closure and signals.

.7 Test operating software.

.8 Test application software and provide samples of logs and commands.

.9 Verify each CDL including energy optimization programs.

.10 Debug software.

.11 Blow out flow measuring and static pressure stations with high pressure air at 700 kPa.

.12 Provide point verification list in table format including point identifier, point identifier expansion, point type and address, low and high limits and engineering units. Include space on commissioning technician and Departmental Representative. This document will be used in final startup testing.

.3 Final Startup Testing: Upon satisfactory completion of tests, perform system tests under direction of Departmental Representative and provide:

.1 Technical personnel capable of re-calibrating field hardware and modifying software.

.2 Detailed daily schedule showing items to be tested and personnel available.

.3 Departmental Representative's acceptance signature to be on executive and applications programs.

.4 Commissioning to commence during final startup testing.

.5 O&M personnel to assist in commissioning procedures as part of training.

.6 Commissioning to be supervised by qualified supervisory personnel and Departmental Representative.

.7 Commission systems considered as life safety systems before affected parts of the facility are occupied.

.8 Operate systems as long as necessary to commission entire project.
.9 Monitor progress and keep detailed records of activities and results.

.4 Final Operational Testing: to demonstrate that EMCS functions in accordance with contract requirements.
.1 Prior to beginning of 30 day test demonstrate that operating parameters (setpoints, alarm limits, operating control software, sequences of operation, trends, graphics and CDL's) have been implemented to ensure proper operation and operator notification in event of off-normal operation.
.1 Repetitive alarm conditions to be resolved to minimize reporting of nuisance conditions.
.2 Test to last at least 30 consecutive 24 hour days.
.3 Tests to include:
.1 Demonstration of correct operation of monitored and controlled points.
.2 Operation and capabilities of sequences, reports, special control algorithms, diagnostics, software.
.4 System will be accepted when:
.1 EMCS equipment operates to meet overall performance requirements. Downtime as defined in this Section must not exceed allowable time calculated for this site.
.2 Requirements of Contract have been met.
.5 In event of failure to attain specified AEL during test period, extend test period on day-to-day basis until specified AEL is attained for test period.
.6 Correct defects when they occur and before resuming tests.

.5 Departmental Representative to verify reported results.

3.4 ADJUSTING

.1 Final adjusting: upon completion of commissioning as reviewed by Departmental Representative, set and lock devices in final position and permanently mark settings.

3.5 DEMONSTRATION

.1 Demonstrate to Departmental Representative operation of systems including sequence of operations in regular and emergency modes, under normal and emergency conditions, start-up, shut-down interlocks and lock-outs in accordance with Section 01 79 00 - Demonstration and Training.

END OF SECTION

1 General

1.1 SUMMARY

.1 Section Includes:
- .1 General requirements for building Energy Monitoring and Control System (EMCS) that are common to NMS EMCS Sections.
- .2 Sustainable requirements for construction and verification.

1.2 REFERENCES

.1 American National Standards Institute (ANSI)/The Instrumentation, Systems and Automation Society (ISA).
- .1 ANSI/ISA 5.5-1985, Graphic Symbols for Process Displays.

.2 American National Standards Institute (ANSI)/ Institute of Electrical and Electronics Engineers (IEEE).
- .1 ANSI/IEEE 260.1-1993, American National Standard Letter Symbols Units of Measurement (SI Units, Customary Inch-Pound Units, and Certain Other Units).

.3 American Society of Heating, Refrigerating and Air-Conditioning Engineers, Inc. (ASHRAE).
- .1 ASHRAE STD 135-R2001, BACNET - Data Communication Protocol for Building Automation and Control Network.

.4 Canadian Standards Association (CSA International).
- .1 CAN/CSA-Z234.1-89(R1995), Canadian Metric Practice Guide.

.5 Consumer Electronics Association (CEA).
- .1 CEA-709.1-B-2002, Control Network Protocol Specification.

.6 Department of Justice Canada (Jus).
- .1 Canadian Environmental Assessment Act (CEAA), 1995, c. 37.
- .2 Canadian Environmental Protection Act (CEPA), 1999, c. 33.

.7 Electrical and Electronic Manufacturers Association (EEMAC).
- .1 EEMAC 2Y-1-1958, Light Gray Colour for Indoor Switch Gear.

.8 Health Canada/Workplace Hazardous Materials Information System (WHMIS).
- .1 Material Safety Data Sheets (MSDS).

.9 Transport Canada (TC).
- .1 Transportation of Dangerous Goods Act (TDGA), 1992, c. 34.

1.3 ACRONYMS AND ABBREVIATIONS

.1 Acronyms used in EMCS:
- .1 AEL - Average Effectiveness Level.
- .2 AI - Analog Input.
- .3 AIT - Agreement on International Trade.
- .4 AO - Analog Output.
- .5 BACnet - Building Automation and Control Network.
- .6 BC(s) - Building Controller(s).
- .7 BECC - Building Environmental Control Center.
- .8 CAD - Computer Aided Design.
- .9 CDL - Control Description Logic.
- .10 CDS - Control Design Schematic.

.11 COSV - Change of State or Value.
.12 CPU - Central Processing Unit.
.13 DI - Digital Input.
.14 DO - Digital Output.
.15 DP - Differential Pressure.
.16 ECU - Equipment Control Unit.
.17 EMCS - Energy Monitoring and Control System.
.18 HVAC - Heating, Ventilation, Air Conditioning.
.19 IDE - Interface Device Equipment.
.20 I/O - Input/Output.
.21 ISA - Industry Standard Architecture.
.22 LAN - Local Area Network.
.23 LCU - Local Control Unit.
.24 MCU - Master Control Unit.
.25 NAFTA - North American Free Trade Agreement.
.26 NC - Normally Closed.
.27 NO - Normally Open.
.28 OS - Operating System.
.29 O&M - Operation and Maintenance.
.30 OWS - Operator Work Station.
.31 PC - Personal Computer.
.32 PCI - Peripheral Control Interface.
.33 PCMCIA - Personal Computer Micro-Card Interface Adapter.
.34 PID - Proportional, Integral and Derivative.
.35 RAM - Random Access Memory.
.36 SP - Static Pressure.
.37 ROM - Read Only Memory.
.38 TCU - Terminal Control Unit.
.39 USB - Universal Serial Bus.
.40 UPS - Uninterruptible Power Supply.
.41 VAV - Variable Air Volume.

1.4 DEFINITIONS

.1 Point: may be logical or physical.
- .1 Logical points: values calculated by system such as setpoints, totals, counts, derived corrections and may include, but not limited to result of and statements in CDL's.
- .2 Physical points: inputs or outputs which have hardware wired to controllers which are measuring physical properties, or providing status conditions of contacts or relays which provide interaction with related equipment (stop, start) and valve or damper actuators.

.2 Point Name: composed of two parts, point identifier and point expansion.
- .1 Point identifier: comprised of three descriptors, "area" descriptor, "system" descriptor and "point" descriptor, for which database to provide 25 character field for each point identifier. "System" is system that point is located on.
  - .1 Area descriptor: building or part of building where point is located.
  - .2 System descriptor: system that point is located on.
  - .3 Point descriptor: physical or logical point description. For point identifier "area", "system" and "point" will be shortforms or acronyms. Database must provide 25 character field for each point identifier.
- .2 Point expansion: comprised of three fields, one for each descriptor. Expanded form of shortform or acronym used in "area", "system" and "point" descriptors is placed into appropriate point expansion field. Database must provide 32 character field for each point expansion.

.3 Bilingual systems to include additional point identifier expansion fields of equal capacity for each point name for second language.
.1 System to support use of numbers and readable characters including blanks, periods or underscores to enhance user readability for each of the above strings.

.3 Point Object Type: points fall into following object types:
.1 AI (analog input).
.2 AO (analog output).
.3 DI (digital input).
.4 DO (digital output).
.5 Pulse inputs.

.4 Symbols and engineering unit abbreviations utilized in displays: to ANSI/ISA S5.5.
.1 Printouts: to ANSI/IEEE 260.1.
.2 Refer also to Section 25 05 54- EMCS: Identification.

1.5 SYSTEM DESCRIPTION

.1 Modify existing Energy Management and Control System (EMCS) to suit system revisions. Existing system consists of the following elements:
.1 Microcomputer based Building Controls (BC) interfacing directly with sensors, actuators and environmental delivery systems (ie: HVAC units, heat exchangers, VAV boxes, etc.).
.2 A two (2) wire peer communication network to allow data exchanger from BC to BC and BC's to the Central Building management computer.
.3 A personal computer (PC) based central and associated operator station and software functioning as the primary operator interface for the EMCS.
.4 Electric and electronic controls for all items indicated on drawings and described hereinafter including dampers, valves, panels and electrical installation.
.5 Incidental electric wiring to connect control system to interlocks, etc.
.6 Air flow measurement.
.7 Work station graphics for each and every sequence of operation.
.8 System to utilize TCP/IP communication and existing single mode fibre network from Central Heating Plant to Forensic Lab. Fibre and switches by Owner.
.9 Revise existing controls where possible. New controls to match existing.
.10 Update graphic to suit revisions.

.2 Work covered by Division 25 consists of fully operational EMCS, including, but not limited to, following:
.1 Building Controllers.
.2 Control devices required to implement sequence of operation.
.3 Existing OWS(s).
.4 Data communications equipment necessary to effect EMCS data transmission system in building.
.5 Field control devices.
.6 Software/Hardware complete with full documentation.
.7 Complete operating and maintenance manuals.
.8 Training of personnel.
.9 Acceptance tests, technical support during commissioning, full documentation.
.10 Wiring interface co-ordination of equipment supplied by others.
.11 Miscellaneous work as specified in these sections and as indicated.

.3 Design Requirements:
.1 Design and provide conduit and wiring linking elements of system. As stated under 1.5.1.9.1, suitable existing wiring and conduit may be utilized in design and reused.

.2 Supply sufficient programmable controllers of types to meet project requirements. Quantity and points contents as reviewed by Departmental Representative prior to installation.
.3 Location of controllers as reviewed by Departmental Representative prior to installation.
.4 Provide utility power to EMCS where available.
.5 Metric references: in accordance with CAN/CSA Z234.1.

.4 Language Operating Requirements:
.1 Provide English operator selectable access codes.
.2 Use non-linguistic symbols for displays on graphic terminals wherever possible. Other information to be in English.
.3 Operating system executive: provide primary hardware-to-software interface specified as part of hardware purchase with associated documentation to be in English.
.4 System manager software: include in English system definition point database, additions, deletions or modifications, control loop statements, use of high level programming languages, report generator utility and other OS utilities used for maintaining optimal operating efficiency.
.5 Include, in English:
.1 Input and output commands and messages from operator-initiated functions, field related changes and alarms as defined in CDL's or assigned limits (i.e. commands relating to day-to-day operating functions and not related to system modifications, additions, or logic re-definements).
.2 Graphic "display" functions, point commands to turn systems on or off, manually override automatic control of specified hardware points. To be in English at specified OWS.
.3 Reporting function such as trend log, trend graphics, alarm report logs, energy report logs, maintenance generated logs.

1.6 COORDINATION

.1 All electrical low-voltage control wiring, including interlock wiring, required for the equipment supplied by Division 22, 23 and 25, except where otherwise noted, shall be supplied and installed by the Control Supplier. This includes all equipment being installed under the Chiller and Humidification Installation Package and all additional equipment being installed under this tender.

.2 All mechanical control wiring 50 volts or more shall be a minimum of #14 gauge wire. All mechanical control wiring less than 50 volts shall be minimum #18 gauge wire.

.3 All mechanical control wiring installed by the control supplier shall conform with the requirements of the local electrical authority and the specifications Division 26 Electrical.

.4 Electrical Contractor: Electrical shall provide the following:
.1 All power wiring to equipment.
.2 Existing 15 amp, 120V/60/1 phase fused power supply to each DDC control panel.
.3 Electrical Contractor shall be responsible for wiring of inline control devices on 120 Vac as indicated on drawings.

1.7 SUBMITTALS

.1 Make submittals in accordance with Section 01 33 00 - Submittal Procedures and 25 05 02 - EMCS: Shop Drawings, Product Data and Review Process.

.2 Quality Control:
- .1 Provide equipment and material from manufacturer's regular production, CSA certified, manufactured to standard quoted plus additional specified requirements.
- .2 Where CSA certified equipment is not available submit such equipment to inspection authorities for special inspection and approval before delivery to site.
- .3 Submit proof of compliance to specified standards with shop drawings and product data in accordance with Section 25 05 02 - EMCS: Shop Drawings, Product Data and Review Process. Label or listing of specified organization is acceptable evidence.
- .4 In lieu of such evidence, submit certificate from testing organization, approved by Departmental Representative, certifying that item was tested in accordance with their test methods and that item conforms to their standard/code.
- .5 For materials whose compliance with organizational standards/codes/specifications is not regulated by organization using its own listing or label as proof of compliance, furnish certificate stating that material complies with applicable referenced standard or specification.
- .6 Permits and fees: in accordance with general conditions of contract.
- .7 Existing devices intended for re-use: submit test report.

1.8 QUALITY ASSURANCE

.1 Have local office within Province staffed by trained personnel capable of providing instruction, routine maintenance and emergency service on systems,

.2 Have access to local supplies of essential parts and provide 7 year guarantee of availability of spare parts after obsolescence.

.3 Ensure qualified supervisory personnel continuously direct and monitor Work and attend site meetings.

1.9 EXISTING CONDITIONS - CONTROL COMPONENTS

.1 Utilize existing control wiring and conduit where possible.

.2 Inspect and test existing devices intended for re-use within 30 days of award of contract, and prior to installation of new devices.
- .1 Furnish test report within 40 days of award of contract listing each component to be re-used and indicating whether it is in good order or requires repair.
- .2 Failure to produce test report will constitute acceptance of existing devices by Contractor.

.3 Non-functioning items:
- .1 Provide with report specification sheets or written functional requirements to support findings.
- .2 Departmental Representative will repair or replace existing items judged defective yet deemed necessary for EMCS.

.4 Submit written request for permission to disconnect controls and to obtain equipment downtime before proceeding with Work.

.5 Assume responsibility for controls to be incorporated into EMCS after written receipt of approval from Departmental Representative.
- .1 Be responsible for items repaired or replaced by Departmental Representative.
- .2 Be responsible for repair costs due to negligence or abuse of equipment.
- .3 Responsibility for existing devices terminates upon final acceptance of EMCS.

.6 Remove existing controls not re-used or not required. Place in approved storage for disposition as directed.

2 Products

2.1 EQUIPMENT

.1 Control Network Protocol and Data Communication Protocol: to CEA 709.1 ASHRAE STD 135.

.2 Complete list of equipment and materials to be used on project and forming part of tender documents by adding manufacturer's name, model number and details of materials, and submit for approval.

2.2 ADAPTORS

.1 Provide adaptors between metric and imperial components.

3 Execution

3.1 MANUFACTURER'S RECOMMENDATIONS

.1 Installation: to manufacturer's recommendations.

3.2 PAINTING

.1 Painting: in accordance with Section 09 91 23 - Interior Painting, supplemented as follows:

- .1 Clean and touch up marred or scratched surfaces of factory finished equipment to match original finish.
- .2 Restore to new condition, finished surfaces too extensively damaged to be primed and touched up to make good.
- .3 Clean and prime exposed hangers, racks, fastenings, and other support components.
- .4 Paint unfinished equipment installed indoors to EEMAC 2Y-1.

END OF SECTION

1 General

1.1 SUMMARY

.1 Section Includes.
- .1 Methods and procedures for shop drawings submittals, preliminary and detailed review process including review meetings, for building Energy Monitoring and Control System (EMCS).

1.2 DEFINITIONS

.1 Acronyms and definitions: refer to Section 25 05 01 - EMCS: General Requirements.

1.3 DESIGN REQUIREMENTS

.1 Preliminary Design Review: to contain following contractor and systems information.
- .1 Location of local office.
- .2 Description and location of installing and servicing technical staff.
- .3 Location and qualifications of programming design and programming support staff.
- .4 List of spare parts.
- .5 Location of spare parts stock.
- .6 Names of sub-contractors and site-specific key personnel.
- .7 Sketch of site-specific system architecture.
- .8 Specification sheets for each item including memory provided, programming language, speed, type of data transmission.
- .9 Descriptive brochures.
- .10 Sample CDL and graphics (systems schematics).
- .11 Response time for each type of command and report.
- .12 Item-by-item statement of compliance.
- .13 Proof of demonstrated ability of system to communicate utilizing Proprietary Communications Protocol, BACnet or Lontalk.

1.4 SUBMITTALS

.1 Submittals in accordance with Section 01 33 00 - Submittal Procedures and coordinate with requirements in this Section.

.2 Submit preliminary design document within 30 working days after tender closing and before contract award, for review by Departmental Representative.

.3 Shop Drawings to consist of 10 hard copies of design documents, shop drawings, product data and software.

.4 Hard copy to be completely indexed and coordinated package to assure compliance with contract requirements and arranged in same sequence as specification and cross-referenced to specification section and paragraph number.

1.5 PRELIMINARY SHOP DRAWING REVIEW

.1 Submit preliminary shop drawings within 30 working days of award of contract and include following:
- .1 Specification sheets for each item. To include manufacturer's descriptive literature, manufacturer's installation recommendations, specifications, drawings, diagrams, performance and characteristic curves, catalogue cuts, manufacturer's name, trade name, catalogue or model number, nameplate data, size, layout, dimensions, capacity, other data to establish compliance.
- .2 Detailed system architecture showing all points associated with each controller including, signal levels, pressures where new EMCS ties into existing control equipment.
- .3 Spare point capacity of each controller by number and type.
- .4 Controller locations.
- .5 Auxiliary control cabinet locations.
- .6 Single line diagrams showing cable routings, conduit sizes, spare conduit capacity between control centre, field controllers and systems being controlled.
- .7 Valves: complete schedule listing including following information: designation, service, manufacturer, model, point ID, design flow rate, design pressure drop, required Cv, Valve size, actual Cv, spring range, pilot range, required torque, actual torque and close off pressure (required and actual).
- .8 Dampers: sketches showing module assembly, interconnecting hardware, operator locations, operator spring range, pilot range, required torque, actual torque.
- .9 Flow measuring stations: complete schedule listing designation, service, point ID, manufacturer, model, size, velocity at design flow rate, manufacturer, model and range of velocity transmitter.

1.6 DETAIL SHOP DRAWING REVIEW

.1 Submit detailed shop drawings within 60 working days after award of contract and before start of installation and include following:
- .1 Corrected and updated versions (hard copy only) of submissions made during preliminary review.
- .2 Wiring diagrams.
- .3 Piping diagrams and hook-ups.
- .4 Interface wiring diagrams showing termination connections and signal levels for equipment to be supplied by others.
- .5 Shop drawings for each input/output point, sensors, transmitters, showing information associated with each particular point including:
  - .1 Sensing element type and location.
  - .2 Transmitter type and range.
  - .3 Associated field wiring schematics, schedules and terminations.
  - .4 Complete Point Name Lists.
  - .5 Setpoints, curves or graphs and alarm limits (high and low, 3 types critical, cautionary and maintenance), signal range.
  - .6 Software and programming details associated with each point.
  - .7 Manufacturer's recommended installation instructions and procedures.
  - .8 Input and output signal levels or pressures where new system ties into existing control equipment.

.6 Control schematics, narrative description, CDL's fully showing and describing automatic and manual procedure required to achieve proper operation of project, including under complete failure of EMCS.
.7 Graphic system schematic displays of air and water systems with point identifiers and textual description of system, and typical floor plans as specified.
.8 Complete system CDL's including companion English language explanations on same sheet but with different font and italics. CDL's to contain specified energy optimization programs.
.9 Listing and example of specified reports.
.10 Listing of time of day schedules.
.11 Type and size of memory with statement of spare memory capacity.
.12 Full description of software programs provided.
.13 Sample of "Operating Instructions Manual" to be used for training purposes.
.14 Outline of proposed start-up and verification procedures. Refer to Section 25 01 11 - EMCS: Start-up, Verification and Commissioning.

1.7 QUALITY ASSURANCE

.1 Preliminary Design Review Meeting: Convene meeting within 45 working days of award of contract to:
.1 Undertake functional review of preliminary design documents, resolve inconsistencies.
.2 Resolve conflicts between contract document requirements and actual items (e.g.: points list inconsistencies).
.3 Review interface requirements of materials supplied by others.
.4 Review "Sequence of Operations".

.2 Contractor's programmer to attend meeting.

.3 Departmental Representative retains right to revise sequence or subsequent CDL prior to software finalization without cost to Departmental Representative.

2 Products

2.1 NOT USED

.1 Not Used.

3 Execution

3.1 NOT USED

.1 Not Used.

END OF SECTION

1 General

1.1 SUMMARY

.1 Section Includes.
  .1 Requirements and procedures for identification of devices, sensors, wiring tubing, conduit and equipment, for building Energy Monitoring and Control System (EMCS) Work and nameplates materials, colours and lettering sizes.

1.2 REFERENCES

.1 Canadian Standards Association (CSA International).
  .1 CSA C22.1-02, The Canadian Electrical Code, Part I (19th Edition), Safety Standard for Electrical Installations.

1.3 DEFINITIONS

.1 For acronyms and definitions refer to Section 25 05 01 - EMCS: General Requirements.

1.4 SYSTEM DESCRIPTION

.1 Language Operating Requirements: provide identification for control items in English.

1.5 SUBMITTALS

.1 Submittals in accordance with Section 01 33 00 - Submittal Procedures supplemented and modified by requirements of this Section.

.2 Submit to Departmental Representative for approval samples of nameplates, identification tags and list of proposed wording.

2 Products

2.1 NAMEPLATES FOR PANELS

.1 Identify by Plastic laminate, 3 mm thick, matt white finish, black core, square corners, lettering accurately aligned and engraved into core.

.2 Sizes: 25 x 67 mm minimum.

.3 Lettering: minimum 7 mm high, black.

.4 Inscriptions: machine engraved to identify function.

2.2 NAMEPLATES FOR FIELD DEVICES

.1 Identify by plastic encased cards attached by chain or plastic tie.

.2 Sizes: 50 x 100 mm minimum.

.3 Lettering: minimum 5 mm high produced from laser printer in black.

.4 Data to include: point name, point type, point address, associated controller, and description of service.

.5 Companion cabinet: identify interior components using plastic enclosed cards with point name and point address.

2.3 NAMEPLATES FOR ROOM SENSORS

.1 Identify by lamicoids using point identifier.

.2 Location: on sensor cover.

.3 Letter size: to suit, clearly legible.

2.4 WARNING SIGNS

.1 Equipment including motors, starters under remote automatic control: supply and install orange coloured signs warning of automatic starting under control of EMCS.

.2 Sign to read: "Caution: This equipment is under automatic remote control of EMCS".

2.5 WIRING

.1 Supply and install numbered tape markings on wiring at panels, junction boxes, splitters, cabinets and outlet boxes.

.2 Colour coding: to CSA C22.1. Use colour coded wiring in communications cables, matched throughout system.

.3 Power wiring: identify circuit breaker panel/circuit breaker number inside each EMCS panel.

2.6 CONDUIT

.1 Colour code EMCS conduit.

.2 Pre-paint box covers and conduit fittings.

.3 Coding: use fluorescent orange paint.

3 Execution

3.1 NAMEPLATES AND LABELS

.1 Ensure that manufacturer's nameplates, CSA labels and identification nameplates are visible and legible at all times.

3.2 EXISTING PANELS

.1 Correct existing nameplates and legends to reflect changes made during Work.

.2 Label all existing to specified standard.

END OF SECTION

1 General

1.1 SUMMARY

.1 Section Includes.
- .1 Requirements and procedures for warranty and activities during warranty period and service contracts, for building Energy Monitoring and Control System (EMCS).

.2 References.
- .1 Canada Labour Code (R.S. 1985, c. L-2)/Part I - Industrial Relations.
- .2 Canadian Standards Association (CSA International).
  - .1 CSA Z204-94(R1999), Guidelines for Managing Indoor Air Quality in Office Buildings.

1.2 DEFINITIONS

.1 BC(s) - Building Controller(s).

.2 OWS - Operator Work Station.

.3 For additional acronyms and definitions refer to Section 25 05 01 - EMCS: General Requirements.

1.3 SUBMITTALS

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

.2 Submit detailed preventative maintenance schedule for system components to Departmental Representative.

.3 Submit detailed inspection reports to Departmental Representative.

.4 Submit dated, maintenance task lists to Departmental Representative and include the following sensor and output point detail, as proof of system verification:
- .1 Point name and location.
- .2 Device type and range.
- .3 Measured value.
- .4 System displayed value.
- .5 Calibration detail
- .6 Indication if adjustment required,
- .7 Other action taken or recommended.

.5 Submit network analysis report showing results with detailed recommendations to correct problems found.

.6 Records and logs: in accordance with Section 01 78 00 - Closeout Submittals.
- .1 Maintain records and logs of each maintenance task on site.
- .2 Organize cumulative records for each major component and for entire EMCS chronologically.
- .3 Submit records to Departmental Representative, after inspection indicating that planned and systematic maintenance have been accomplished.

.7 Revise and submit to Departmental Representative in accordance with Section 01 78 00 - Closeout Submittals "As-built drawings" documentation and commissioning reports to reflect changes, adjustments and modifications to EMCS made during warranty period.

1.4 MAINTENANCE SERVICE DURING WARRANTY PERIOD

.1 Provide services, materials, and equipment to maintain EMCS for specified warranty period. Provide detailed preventative maintenance schedule for system components as described in Submittal article.

.2 Emergency Service Calls:
- .1 Initiate service calls when EMCS is not functioning correctly.
- .2 Qualified control personnel to be available during warranty period to provide service to "CRITICAL" components whenever required at no extra cost.
- .3 Furnish Departmental Representative with telephone number where service personnel may be reached at any time.
- .4 Service personnel to be on site ready to service EMCS within 2 hours after receiving request for service.
- .5 Perform Work continuously until EMCS restored to reliable operating condition.

.3 Operation: foregoing and other servicing to provide proper sequencing of equipment and satisfactory operation of EMCS based on original design conditions and as recommended by manufacturer.

.4 Work requests: record each service call request, when received separately on approved form and include:
- .1 Serial number identifying component involved.
- .2 Location, date and time call received.
- .3 Nature of trouble.
- .4 Names of personnel assigned.
- .5 Instructions of work to be done.
- .6 Amount and nature of materials used.
- .7 Time and date work started.
- .8 Time and date of completion.

.5 Provide system modifications in writing.
- .1 No system modification, including operating parameters and control settings, to be made without prior written approval of Departmental Representative.

.6 Back-up software.

2 Products

2.1 NOT USED

.1 Not Used.

3 Execution

3.1 FIELD QUALITY CONTROL

.1 Perform as minimum two major inspections (more often if required by manufacturer) per year; one at start of heating season and one at start of cooling season. Provide detailed written report to Departmental Representative as described in Submittal article.

.2 Perform inspections during regular working hours, 0800 to 1630 h, Monday through Friday, excluding statutory holidays.

.3 Following inspections are minimum requirements and should not be interpreted to mean satisfactory performance:
- .1 Perform calibrations using test equipment having traceable, certifiable accuracy at minimum 50% greater than accuracy of system displaying or logging value.
- .2 Check and Calibrate each field input/output device in accordance with Canada Labour Code - Part I and CSA Z204.
- .3 Provide dated, maintenance task lists, as described in Submittal article, as proof of execution of complete system verification.

.4 Minor inspections to include, but not limited to:
- .1 Perform visual, operational checks to BC's, peripheral equipment, interface equipment and other panels.
- .2 Check equipment cooling fans as required.
- .3 Review system performance with Departmental Representative to discuss suggested or required changes.

.5 Major inspections to include, but not limited to:
- .1 Minor inspection.
- .2 Clean OWS(s) peripheral equipment, BC(s), interface and other panels, micro-processor interior and exterior surfaces.
- .3 Check signal, voltage and system isolation of BC(s), peripherals, interface and other panels.
- .4 Verify calibration/accuracy of each input and output device and recalibrate or replace as required.
- .5 Run system software diagnostics as required.
- .6 Install software and firmware enhancements to ensure components are operating at most current revision for maximum capability and reliability.
  - .1 Perform network analysis and provide report as described in Submittal article.

.6 Rectify deficiencies revealed by maintenance inspections and environmental checks.

.7 Continue system debugging and optimization.

.8 Testing/verification of occupancy and seasonal-sensitive systems to take place during four (4) consecutive seasons, after facility has been accepted, taken over and fully occupied.
- .1 Test weather-sensitive systems twice: first at near winter design conditions and secondly under near summer design conditions.

END OF SECTION

1 General

1.1 SUMMARY

.1 Section Includes:
- .1 System requirements for Local Area Network (LAN) for Building Energy Monitoring and Control System (EMCS).

1.2 REFERENCES

.1 Canadian Standards Association (CSA International).
- .1 CSA T529-95(R2000), Telecommunications Cabling Systems in Commercial Buildings (Adopted ANSI/TIA/EIA-568-A with modifications).
- .2 CSA T530-99(R2004), Commercial Building Standard for Telecommunications Pathways and Spaces (Adopted ANSI/TIA/EIA-569-A with modifications).

.2 Institute of Electrical and Electronics Engineers (IEEE)/Standard for Information technology - Telecommunications and information exchange between systems - Local and metropolitan area networks - Specific requirements.
- .1 IEEE Std 802.3™-2002, Part 3: Carrier sense multiple access with collision detection (CSMA/CD) access method and physical layer specifications.

.3 Telecommunications Industries Association (TIA)/Electronic Industries Alliance (EIA)
- .1 TIA/EIA-568-March 2004, Commercial Building Telecommunications Cabling Standards Set, Part 1 General Requirements Part 2 Balanced Twisted-Pair Cabling Components Part 3 Optical Fiber Cabling Components Standard.
- .2 TIA/EIA-569-A-December 2001, Commercial Building Standard for Telecommunications Pathways and Spaces.

.4 Treasury Board Information Technology Standard (TBITS).
- .1 TBITS 6.9-2000, Profile for the Telecommunications Wiring System in Government Owned and Leased Buildings - Technical Specifications.

1.3 DEFINITIONS

.1 Acronyms and definitions: refer to Section 25 05 01 - EMCS - General Requirements.

1.4 SYSTEM DESCRIPTION

.1 Data communication network to link Operator Workstations and Master Control Units (MCU) in accordance with CSA T529, TIA/EIA-568, CSA T530, TIA/EIA-569-A and TBITS 6.9.
- .1 Provide reliable and secure connectivity of adequate performance between different sections (segments) of network.
- .2 Allow for future expansion of network, with selection of networking technology and communication protocols.

.2 Data communication network to include, but not limited to:
- .1 EMCS-LAN.
- .2 Network interface cards.

.3 Network management hardware and software.
.4 Network components necessary for complete network.
.5 Connections to Owner supplied single mode fibre using TCP/IP - ethernet.

1.5 DESIGN REQUIREMENTS

.1 EMCS Local Area Network (EMCS-LAN).
.1 High speed, high performance, local area network over which MCUs and OWSs communicate with each other directly on peer to peer basis in accordance with IEEE 802.3/Ethernet Standard.
.2 EMCS-LAN to: BacNet.
.3 Each EMCS-LAN to be capable of supporting at least 50 devices.
.4 Support of combination of MCUs and OWSs directly connected to EMCS-LAN.
.5 High speed data transfer rates for alarm reporting, quick report generation from multiple controllers, upload/download information between network devices. Bit rate to be 10 Megabits per second minimum.
.6 Detection and accommodation of single or multiple failures of either OWSs, MCUs or network media. Operational equipment to continue to perform designated functions effectively in event of single or multiple failures.
.7 Commonly available, multiple sourced, networking components and protocols to allow system to co-exist with other networking applications including office automation.

.2 Dynamic Data Access.
.1 LAN to provide capabilities for OWSs, either network resident or connected remotely, to access point status and application report data or execute control functions for other devices via LAN.
.2 Access to data to be based upon logical identification of building equipment.

.3 Network Medium.
.1 Network medium (inside building): shielded twisted cable, or fibre optic cable compatible with network protocol to be used within buildings.
.2 Network medium (from building to central Heating Plant): Utilize Owner supplied single mode fibre and TCP/IP communication.

2 Products

2.1 NOT USED

.1 Not Used.

3 Execution

3.1 NOT USED

.1 Not Used.

END OF SECTION

1 General

1.1 SUMMARY

.1 Section Includes:
  .1 Materials and installation for building automation controllers including:
    .1 Master Control Unit (MCU).
    .2 Local Control Unit (LCU).
    .3 Equipment Control Unit (ECU).
    .4 Terminal Control Unit (TCU).

1.2 REFERENCES

.1 American Society of Heating, Refrigeration and Air-Conditioning Engineers, Inc. (ASHRAE).
  .1 ASHRAE 2003, Applications Handbook, SI Edition.

.2 Canadian Standards Association (CSA International).
  .1 C22.2 No.205-M1983(R1999), Signal Equipment.

.3 Institute of Electrical and Electronics Engineers (IEEE).
  .1 IEEE C37.90.1-02, Surge Withstand Capabilities (SWC) Tests for Relays and Relay Systems Associated with Electric Power Apparatus.

.4 Public Works and Government Services Canada (PWGSC)/Real Property Branch/Architectural and Engineering Services.
  .1 MD13800-September 2000, Energy Management and Control Systems (EMCS) Design Manual. English: ftp://ftp.pwgsc.gc.ca/rps/docentre/mechanical/me214-e.pdf

1.3 DEFINITIONS

.1 Acronyms and definitions: refer to Section 25 05 01 - EMCS: General Requirements.

1.4 SYSTEM DESCRIPTION

.1 General: Network of controllers comprising of MCU('s), LCU('s), ECU('s) or TCU('s) to be provided to support building systems and associated sequence(s) of operations as detailed in these specifications.
  .1 Provide sufficient controllers to meet intents and requirements of this section.
  .2 Controller quantity, and point contents to be approved by Departmental Representative at time of preliminary design review.

.2 Controllers: stand-alone intelligent Control Units.
  .1 Incorporate programmable microprocessor, non-volatile program memory, RAM, power supplies, as required to perform specified functions.
  .2 Incorporate communication interface ports for communication to LANs to exchange information with other Controllers.
  .3 Capable of interfacing with operator interface device.
  .4 Execute its logic and control using primary inputs and outputs connected directly to its onboard input/output field terminations or slave devices, and without need to interact with other controller. Secondary input used for reset such as outdoor air temperature may be located in other Controller(s).
    .1 Secondary input used for reset such as outdoor air temperature may be located in other Controller(s).

1.5 DESIGN REQUIREMENTS

.1 To include:
- .1 Scanning of AI and DI connected inputs for detection of change of value and processing detection of alarm conditions.
- .2 Perform On-Off digital control of connected points, including resulting required states generated through programmable logic output.
- .3 Perform Analog control using programmable logic, (including PID) with adjustable dead bands and deviation alarms.
- .4 Control of systems as described in sequence of operations.
- .5 Execution of optimization routines as listed in this section.

.2 Field Termination and Interface Devices:
- .1 To: CSA C22.2 No.205.
- .2 Electronically interface sensors and control devices to processor unit.
- .3 Include, but not be limited to, following:
  - .1 Programmed firmware or logic circuits to meet functional and technical requirements.
  - .2 Power supplies for operation of logics devices and associated field equipment.
  - .3 Lockable wall cabinet.
  - .4 Required communications equipment and wiring (if remote units).
  - .5 Leave controlled system in "fail-safe" mode in event of loss of communication with, or failure of, processor unit.
  - .6 Input Output interface to accept as minimum AI, AO, DI, DO functions as specified.
  - .7 Wiring terminations: use conveniently located screw type or spade lug terminals.
- .4 AI interface equipment to:
  - .1 Convert analog signals to digital format with 10 bit analog-to-digital resolution.
  - .2 Provide for following input signal types and ranges:
    - .1 4 - 20 mA;
    - .2 0 - 10 V DC;
    - .3 100/1000 ohm RTD input.
  - .3 Meet IEEE C37.90.1 surge withstand capability.
  - .4 Have common mode signal rejection greater than 60 dB to 60 Hz.
  - .5 Where required, dropping resistors to be certified precision devices which complement accuracy of sensor and transmitter range specified.
- .5 AO interface equipment:
  - .1 Convert digital data from controller processor to acceptable analog output signals using 8 bit digital-to-analog resolution.
  - .2 Provide for following output signal types and ranges:
    - .1 4 - 20 mA.
    - .2 0 - 10 V DC.
  - .3 Meet IEEE C37.90.1 surge withstand capability.
- .6 DI interface equipment:
  - .1 Able to reliably detect contact change of sensed field contact and transmit condition to controller.
  - .2 Meet IEEE C37.90.1 surge withstand capability.
  - .3 Accept pulsed inputs up to 2 kHz.

.7 DO interface equipment:
- .1 Respond to controller processor output, switch respective outputs. Each DO hardware to be capable of switching up to 0.5 amps at 24 V AC.
- .2 Switch up to 5 amps at 220 V AC using optional interface relay.

.3 Controllers and associated hardware and software: operate in conditions of 0 degrees C to 44 degrees C and 20% to 90% non-condensing RH.

.4 Controllers (MCU, LCU): mount in wall mounted cabinet with hinged, keyed-alike locked door.
- .1 Provide for conduit entrance from top, bottom or sides of panel.
- .2 ECUs and TCUs to be mounted in equipment enclosures or separate enclosures.
- .3 Mounting details as approved by Departmental Representative for ceiling mounting.

.5 Cabinets to provide protection from water dripping from above, while allowing sufficient airflow to prevent internal overheating.

.6 Provide surge and low voltage protection for interconnecting wiring connections.

1.6 SUBMITTALS

.1 Make submittals in accordance with Section 01 33 00 - Submittal Procedures and Section 25 05 02 - EMCS: Shop Drawings, Product Data and Review Process.
- .1 Submit product data sheets for each product item proposed for this project.

1.7 MAINTENANCE PROCEDURES

.1 Provide manufacturers recommended maintenance procedures for insertion into Manuals.

2 Products

2.1 MASTER CONTROL UNIT (MCU)

.1 General: primary function of MCU is to provide co-ordination and supervision of subordinate devices in execution of optimization routines such as demand limiting or enthalpy control.

.2 Include high speed communication LAN Port for Peer to Peer communications with OWS(s) and other MCU level devices.
- .1 MCU must support Proprietary Protocol, BACnet.

.3 MCU local I/O capacity as follows:
- .1 MCU I/O points as allocated in I/O Summary Table referenced in MD13800.
- .2 LCUs may be added to support system functions.

.4 Central Processing Unit (CPU).
- .1 Processor to consist of minimum 16 bit microprocessor capable of supporting software to meet specified requirements.
- .2 CPU idle time to be more than 30% when system configured to maximum input and output with worst case program use.
- .3 Minimum addressable memory to be at manufacturer's discretion but to support at least performance and technical specifications to include but not limited to:

.1 Non-volatile EEPROM to contain operating system, executive, application, sub-routine, other configurations definition software. Tape media not acceptable.

.2 Battery backed (72 hour minimum capacity) RAM (to reduce the need to reload operating data in event of power failure) to contain CDLs, application parameters, operating data or software that is required to be modifiable from operational standpoint such as schedules, setpoints, alarm limits, PID constants and CDL and hence modifiable on-line through operator panel or remote operator's interface. RAM to be downline loadable from OWS.

.4 Include uninterruptible clock accurate to plus or minus 5 secs/month, capable of deriving year/month/day/hour/minute/second, with rechargeable batteries for minimum 72 hour operation in event of power failure.

.5 Local Operator Terminal (OT): Provide OT for each MCU unless otherwise specified in Section 25 90 01 - EMCS: Site Requirements, Applications and System Sequences of Operation.

.1 Mount access/display panel in MCU or in suitable enclosure beside MCU as approved by Departmental Representative.

.2 Support operator's terminal for local command entry, instantaneous and historical data display, programs, additions and modifications.

.3 Display simultaneously minimum of 16 point identifiersto allow operator to view single screen dynamic displays depicting entire mechanical systems. Point identifiers to be in English.

.4 Functions to include, but not be limited to, following:

.1 Start and stop points.

.2 Modify setpoints.

.3 Modify PID loop parameters.

.4 Override PID control.

.5 Change time/date.

.6 Add/modify/start/stop weekly scheduling.

.7 Add/modify setpoint weekly scheduling.

.8 Enter temporary override schedules.

.9 Define holiday schedules.

.10 View analog limits.

.11 Enter/modify analog warning limits.

.12 Enter/modify analog alarm limits.

.13 Enter/modify analog differentials.

.5 Provide access to real and calculated points in controller to which it is connected or to other controller in network. This capability not to be restricted to subset of predefined "global points" but to provide totally open exchange of data between OT and other controller in network.

.6 Operator access to OTs: same as OWS user password and password changes to automatically be downloaded to controllers on network.

.7 Provide prompting to eliminate need for user to remember command format or point names. Prompting to be consistent with user's password clearance and types of points displayed to eliminate possibility of operator error.

.8 Identity of real or calculated points to be consistent with network devices. Use same point identifier as at OWS's for access of points at OT to eliminate cross-reference or look-up tables.

2.2 LOCAL CONTROL UNIT (LCU)

.1 Provide multiple control functions for typical built-up and package HVAC systems, hydronic systems and electrical systems.

.2 Minimum of 16 I/O points of which minimum be 4 AOs, 4 AIs, 4 DIs, 4 DOs.

.3 Points integral to one Building System to be resident on only one controller.

.4 Microprocessor capable of supporting necessary software and hardware to meet specified requirements as listed in previous MCU article with following additions:
- .1 Include minimum 2 interface ports for connection of local computer terminal.
- .2 Design so that shorts, opens or grounds on input or output will not interfere with other input or output signals.
- .3 Physically separate line voltage (70V and over) circuits from DC logic circuits to permit maintenance on either circuit with minimum hazards to technician and equipment.
- .4 Include power supplies for operation of LCU and associated field equipment.
- .5 In event of loss of communications with, or failure of, MCU, LCU to continue to perform control. Controllers that use defaults or fail to open or close positions not acceptable.
- .6 Provide conveniently located screw type or spade lug terminals for field wiring.

2.3 TERMINAL/EQUIPMENT CONTROL UNIT (TCU/ECU)

.1 Microprocessor capable of supporting necessary software and hardware to meet TCU/ECU functional specifications.
- .1 TCU/ECU definition to be consistent with those defined in ASHRAE HVAC Applications Handbook section 45.

.2 Controller to communicate directly with EMCS through EMCS LAN and provide access from EMCS OWS for setting occupied and unoccupied space temperature setpoints, flow setpoints, and associated alarm values, permit reading of sensor values, field control values (% open) and transmit alarm conditions to EMCS OWS.

2.4 SOFTWARE

.1 General.
- .1 Include as minimum: operating system executive, communications, application programs, operator interface, and systems sequence of operation - CDL's.
- .2 Include "firmware" or instructions which are programmed into ROM, EPROM, EEPROM or other non-volatile memory.
- .3 Include initial programming of Controllers, for entire system.

.2 Program and data storage.
- .1 Store executive programs and site configuration data in ROM, EEPROM or other non-volatile memory.
- .2 Maintain CDL and operating data including setpoints, operating constants, alarm limits in battery-backed RAM or EEPROM for display and modification by operator.

.3 Programming languages.
.1 Program Control Description Logic software (CDL) using English like or graphical, high level, general control language.
.2 Structure software in modular fashion to permit simple restructuring of program modules if future software additions or modifications are required. GO TO constructs not allowed unless approved by Departmental Representative.

.4 Operator Terminal interface.
.1 Operating and control functions include:
.1 Multi-level password access protection to allow user/manager to limit workstation control.
.2 Alarm management: processing and messages.
.3 Operator commands.
.4 Reports.
.5 Displays.
.6 Point identification.

.5 Pseudo or calculated points.
.1 Software to provide access to value or status in controller or other networked controller in order to define and calculate pseudo point. When current pseudo point value is derived, normal alarm checks must be performed or value used to totalize.
.2 Inputs and outputs for process: include data from controllers to permit development of network-wide control strategies. Processes also to permit operator to use results of one process as input to number of other processes (e.g. cascading).

.6 Control Description Logic (CDL):
.1 Capable of generating on-line project-specific CDLs which are software based, programmed into RAM or EEPROM and backed up to OWS. Owner must have access to these algorithms for modification or to be able to create new ones and to integrate these into CDLs on BC(s) from OWS.
.2 Write CDL in high level language that allows algorithms and interlocking programs to be written simply and clearly. Use parameters entered into system (e.g. setpoints) to determine operation of algorithm. Operator to be able to alter operating parameters on-line from OWS and BC(s) to tune control loops.
.3 Perform changes to CDL on-line.
.4 Control logic to have access to values or status of points available to controller including global or common values, allowing cascading or inter-locking control.
.5 Energy optimization routines including enthalpy control, supply temperature reset, to be LCU or MCU resident functions and form part of CDL.
.6 MCU to be able to perform following pre-tested control algorithms:
.1 Two position control.
.2 Proportional Integral and Derivative (PID) control.
.7 Control software to provide ability to define time between successive starts for each piece of equipment to reduce cycling of motors.
.8 Provide protection against excessive electrical-demand situations during start-up periods by automatically introducing time delays between successive start commands to heavy electrical loads.
.9 Power Fail Restart: upon detection of power failure system to verify availability of Emergency Power as determined by emergency power transfer switches and analyze controlled equipment to determine its appropriate status under

Emergency power conditions and start or stop equipment as defined by I/O Summary. Upon resumption of normal power as determined by emergency power transfer switches, MCU to analyze status of controlled equipment, compare with normal occupancy scheduling, turn equipment on or off as necessary to resume normal operation.

.7 Event and Alarm management: use management by exception concept for Alarm Reporting. This is system wide requirement. This approach will insure that only principal alarms are reported to OWS. Events which occur as direct result of primary event to be suppressed by system and only events which fail to occur to be reported. Such event sequence to be identified in I/O Summary and sequence of operation. Examples of above are, operational temperature alarms limits which are exceeded when main air handler is stopped, or General Fire condition shuts air handlers down, only Fire alarm status shall be reported. Exception is, when air handler which is supposed to stop or start fails to do so under event condition.

.8 Energy management programs: include specific summarizing reports, with date stamp indicating sensor details which activated and or terminated feature.

.1 MCU in coordination with subordinate LCU, TCU, ECU to provide for the following energy management routines:

.1 Time of day scheduling (Occupied and Unoccupied).
.2 Calendar based scheduling.
.3 Holiday scheduling.
.4 Temporary schedule overrides.
.5 Optimal start stop.
.6 Night setback control.
.7 Differential Enthalpy (economizer) switchover.
.8 Fan speed/flow rate control..

.2 Programs to be executed automatically without need for operator intervention and be flexible enough to allow customization.

.3 Apply programs to equipment and systems as specified or requested by the Departmental Representative.

.9 Function/Event Totalization: features to provide predefined reports which show daily, weekly, and monthly accumulating totals and which include high rate (time stamped) and low rate (time stamped) and accumulation to date for month.

.1 MCUs to accumulate and store automatically run-time for binary input and output points.

.2 MCU to automatically sample, calculate and store consumption totals on daily, weekly or monthly basis for user-selected analog or binary pulse input-type points.

.3 MCU to automatically count events (number of times pump is cycled off and on) daily, weekly or monthly basis.

.4 Totalization routine to have sampling resolution of 1 min or less for analog inputs.

.5 Totalization to provide calculations and storage of accumulations up to 99,999.9 units (eg. kWH, litres, tonnes, etc.).

.6 Store event totalization records with minimum of 9,999,999 events before reset.

.7 User to be able to define warning limit and generate user-specified messages when limit reached.

2.5 LEVELS OF ADDRESS

.1 Upon operator's request, EMCS to present status of any single 'point', 'system' or point group, entire 'area', or entire network on printer or OWS as selected by operator.

.1 Display analog values digitally to 1 place of decimals with negative sign as required.

.2 Update displayed analog values and status when new values received.

.3 Flag points in alarm by blinking, reverse video, different colour, bracketed or other means to differentiate from points not in alarm.

.4 Updates to be change-of-value (COV)-driven or if polled not exceeding 2 second intervals.

2.6 POINT NAME SUPPORT

.1 Controllers (MCU, LCU) to support PWGSC point naming convention as defined in Section 25 05 01 - EMCS: General Requirements.

3 Execution

3.1 LOCATION

.1 Location of Controllers to be approved by Departmental Representative.

3.2 INSTALLATION

.1 Install Controllers in secure locking enclosures as indicated and as directed by Departmental Representative.

.2 Provide necessary power from local 120 V branch circuit panel for equipment.

.3 Install tamper locks on breakers of circuit breaker panel.

.4 Use uninterruptible Power Supply (UPS) and emergency power when equipment must operate in emergency and co-ordinating mode.

END OF SECTION

1 General

1.1 SUMMARY

.1 Section Includes:
  .1 Control devices integral to the Building Energy Monitoring and Control System (EMCS): transmitters, sensors, controls, meters, switches, transducers, dampers, damper operators, valves, valve actuators, and low voltage current transformers.

1.2 REFERENCES

.1 American National Standards Institute (ANSI).
  .1 ANSI C12.7-1993(R1999), Requirements for Watthour Meter Sockets.
  .2 ANSI/IEEE C57.13-1993, Standard Requirements for Instrument Transformers.
.2 American Society for Testing and Materials International, (ASTM).
  .1 ASTM B148-97(03), Standard Specification for Aluminum-Bronze Sand Castings.
.3 National Electrical Manufacturer's Association (NEMA).
  .1 NEMA 250-03, Enclosures for Electrical Equipment (1000 Volts Maximum).
.4 Air Movement and Control Association, Inc. (AMCA).
  .1 AMCA Standard 500-D-98, Laboratory Method of Testing Dampers For Rating.
.5 Canadian Standards Association (CSA International).
  .1 CSA-C22.1-02, Canadian Electrical Code, Part 1 (19th Edition), Safety Standard for Electrical Installations.

1.3 DEFINITIONS

.1 Acronyms and Definitions: refer to Section 25 05 01 - EMCS: General Requirements.

1.4 SUBMITTALS

.1 Submit shop drawings and manufacturer's installation instructions in accordance with Section 25 05 02 - EMCS: Submittals and Review Process.

.2 Pre-Installation Tests.
  .1 Submit samples at random from equipment shipped, as requested by Departmental Representative, for testing before installation. Replace devices not meeting specified performance and accuracy.

.3 Manufacturer's Instructions:
  .1 Submit manufacturer's installation instructions for specified equipment and devices.

1.5 EXISTING CONDITIONS

.1 Cutting and Patching: in accordance with Section 01 73 03 - Execution Requirements supplemented as specified herein.

.2 Repair surfaces damaged during execution of Work.

.3 Turn over to Departmental Representative existing materials removed from Work not identified for re-use.

2 Products

2.1 GENERAL

.1 Control devices of each category to be of same type and manufacturer.

.2 External trim materials to be corrosion resistant. Internal parts to be assembled in watertight, assembly.

.3 Operating conditions: 0 - 32 degrees C with 10 - 90% RH (non-condensing) unless otherwise specified.

.4 Terminations: use standard conduit box with slot screwdriver compression connector block unless otherwise specified.

.5 Transmitters and sensors to be unaffected by external transmitters including walkie talkies.

.6 Account for hysteresis, relaxation time, maximum and minimum limits in applications of sensors and controls.

.7 Outdoor installations: use weatherproof construction in NEMA 4 enclosures.

.8 Devices installed in user occupied space not exceed Noise Criteria (NC) of 35. Noise generated by any device must not be detectable above space ambient conditions.

.9 Range: including temperature, humidity and pressure, as indicated in I/O summary in Section 25 90 01 - EMCS: Site Requirements, Applications and System Sequences of Operation.

2.2 TEMPERATURE SENSORS

.1 General: except for room sensors to be resistance or thermocouple type to following requirements:

- .1 RTD's: 100 or 1000 ohm at 0 degrees C (plus or minus 0.2 ohms) platinum element with strain minimizing construction, 3 integral anchored leadwires. Coefficient of resistivity: 0.00385 ohms/ohm degrees C.
- .2 Sensing element: hermetically sealed.
- .3 Stem and tip construction: copper or type 304 stainless steel.
- .4 Time constant response: less than 3 seconds to temperature change of 10 deg.C.
- .5 Immersion wells: NPS 1/2, stainless steel spring loaded construction, with heat transfer compound compatible with sensor. Insertion length as indicated.

.2 Room temperature sensors and display wall modules.

- .1 Temperature sensing and display wall module.
  - .1 LCD display to show space temperature and temperature setpoint.
  - .2 Buttons for occupant selection of temperature setpoint.
  - .3 Button for occupancy override to switch to occupied mode outside occupied hours of operation for EMCS controlled period of time.
  - .4 Jack connection for plugging in laptop personal computer contractor supplied zone terminal unit and/or contractor supplied palm compatible handheld device for access to zone bus.
  - .5 Integral thermistor sensing element 10,000 ohm at 24 degrees.
  - .6 Accuracy 0.2 degrees C over range of 0 to 70 degrees C.
  - .7 Stability 0.02 degrees C drift per year.
  - .8 Separate mounting base for ease of installation.

.3 Duct temperature sensors:
- .1 General purpose duct type: suitable for insertion into ducts at various orientations, insertion length 460 mm or as indicated.
- .2 Averaging duct type: incorporates numerous sensors inside assembly which are averaged to provide one reading. Minimum insertion length 6000 mm. Bend probe at field installation time to 100 mm radius at point along probe without degradation of performance.

.4 Outdoor air temperature sensors:
- .1 Use existing.

2.3 TEMPERATURE TRANSMITTERS

.1 Requirements:
- .1 Input circuit: to accept 3-lead, 100 or 1000 ohm at 0 degrees C, platinum resistance detector type sensors.
- .2 Power supply: 24 V DC into load of 575 ohms. Power supply effect less than 0.01 degrees C per volt change.
- .3 Output signal: 4 - 20 mA into 500 ohm maximum load.
- .4 Input and output short circuit and open circuit protection.
- .5 Output variation: less than 0.2% of full scale for supply voltage variation of plus or minus 10 %.
- .6 Combined non-linearity, repeatability, hysteresis effects: not to exceed plus or minus 0.5% of full scale output.
- .7 Maximum current to 100 or 1000 ohm RTD sensor: not to exceed 25 mA.
- .8 Integral zero and span adjustments.
- .9 Temperature effects: not to exceed plus or minus 1.0% of full scale/50 degrees C.
- .10 Long term output drift: not to exceed 0.25 % of full scale/6 months.
- .11 Transmitter ranges: select narrowest range to suit application from following:
  - .1 Minus 50 degrees C to plus 50 degrees C, plus or minus 0.5 degrees C.
  - .2 0 to 100 degrees C, plus or minus 0.5 degrees C.
  - .3 0 to 50 degrees C, plus or minus 0.25 degrees C.
  - .4 0 to 25 degrees C, plus or minus 0.1 degrees C.
  - .5 10 to 35 degrees C, plus or minus 0.25 degrees C.

2.4 PRESSURE TRANSDUCERS

.1 Requirements:
- .1 Combined sensor and transmitter measuring pressure.
  - .1 Internal materials: suitable for continuous contact with industrial standard instrument air, compressed air, water, steam, as applicable.
- .2 Output signal: 4 - 20 mA into 500 ohm maximum load.
- .3 Output variations: less than 0.2 % full scale for supply voltage variations of plus or minus 10 %.
- .4 Combined non-linearity, repeatability, and hysteresis effects: not to exceed plus or minus 0.5 % of full scale output over entire range.
- .5 Temperature effects: not to exceed plus or minus 1.5 % full scale/ 50 degrees C.
- .6 Over-pressure input protection to at least twice rated input pressure.
- .7 Output short circuit and open circuit protection.
- .8 Accuracy: plus or minus 1% of Full Scale.

2.5 DIFFERENTIAL PRESSURE TRANSMITTERS

.1 Requirements:
- .1 Internal materials: suitable for continuous contact with industrial standard instrument air, compressed air, water, steam, as applicable.
- .2 Output signal: 4 - 20 mA into 500 ohm maximum load.
- .3 Output variations: less than 0.2 % full scale for supply voltage variations of plus or minus 10%.
- .4 Combined non-linearity, repeatability, and hysteresis effects: not to exceed plus or minus 0.5 % of full scale output over entire range.
- .5 Integral zero and span adjustment.
- .6 Temperature effects: not to exceed plus or minus 1.5 % full scale/ 50 degrees C.
- .7 Over-pressure input protection to at least twice rated input pressure.
- .8 Output short circuit and open circuit protection.
- .9 Unit to have 12.5 mm N.P.T. conduit connection. Enclosure to be integral part of unit.

2.6 STATIC PRESSURE SENSORS

.1 Requirements:
- .1 Multipoint element with self-averaging manifold.
  - .1 Maximum pressure loss: 160 Pa at 10 m/s. (Air stream manifold).
- .2 Accuracy: plus or minus 1 % of actual duct static pressure.

2.7 STATIC PRESSURE TRANSMITTERS

.1 Requirements:
- .1 Output signal: 4 - 20 mA linear into 500 ohm maximum load.
- .2 Calibrated span: not to exceed 150 % of duct static pressure at maximum flow.
- .3 Accuracy: 0.4% of span.
- .4 Repeatability: within 0.5 % of output.
- .5 Linearity: within 1.5 % of span.
- .6 Deadband or hysteresis: 0.1% of span.
- .7 External exposed zero and span adjustment.
- .8 Unit to have 12.5 mm N.P.T. conduit connection. Enclosure to be integral part of unit

2.8 VELOCITY PRESSURE SENSORS

.1 Requirements:
- .1 Multipoint static and total pressure sensing element with self-averaging manifold with integral air equalizer and straightener section.
- .2 Maximum pressure loss: 37 Pa at 1000 m/s.
- .3 Accuracy: plus or minus 1 % of actual duct velocity.

2.9 VELOCITY PRESSURE TRANSMITTERS

.1 Requirements:
- .1 Output signal: 4 - 20 mA linear into 500 ohm maximum load.
- .2 Calibrated span: not to exceed 125% of duct velocity pressure at maximum flow.
- .3 Accuracy: 0.4 % of span.
- .4 Repeatability: within 0.1 % of output.
- .5 Linearity: within 0.5 % of span.
- .6 Deadband or hysteresis: 0.1% of span.
- .7 External exposed zero and span adjustment.
- .8 Unit to have 12.5 mm N.P.T. conduit connection. Enclosure to be integral part of unit.

2.10 ELECTROMECHANICAL RELAYS

.1 Requirements:
- .1 Double voltage, DPDT, plug-in type with termination base.
- .2 Coils: rated for 120V AC or 24V DC. Other voltage: provide transformer.
- .3 Contacts: rated at 5 amps at 120 V AC.
- .4 Relay to have visual status indication

2.11 SOLID STATE RELAYS

.1 General:
- .1 Relays to be socket or rail mounted.
- .2 Relays to have LED Indicator
- .3 Input and output Barrier Strips to accept 14 to 28 AWG wire.
- .4 Operating temperature range to be -20 degrees C to 70 degrees C.
- .5 Relays to be CSA Certified.
- .6 Input/output Isolation Voltage to be 4000 VAC at 25 degrees C for 1 second maximum duration.
- .7 Operational frequency range, 45 to 65 HZ.

.2 Input:
- .1 Control voltage, 3 to 32 VDC.
- .2 Drop out voltage, 1.2 VDC.
- .3 Maximum input current to match AO (Analog Output) board.

.3 Output.
- .1 AC or DC Output Model to suit application.

2.12 CONTROL DAMPERS

.1 Reuse existing dampers.

2.13 ELECTRONIC CONTROL DAMPER ACTUATORS

.1 Requirements:
- .1 Direct mount proportional type as indicated.
- .2 Spring return for "fail-safe" in Normally Open or Normally Closed position as indicated.
- .3 Operator: size to control dampers against maximum pressure and dynamic closing/opening pressure, whichever is greater.
- .4 Power requirements: 5 VA maximum at 24 V AC.
- .5 Operating range: 0 - 10 V DC or 4 - 20 mA DC.
- .6 For VAV box applications floating control type actuators may be used.
- .7 Damper actuator to drive damper from full open to full closed in less than 120 seconds.

2.14 CONTROL VALVES

.1 Body: globe style, characterized ball.
- .1 Flow characteristic as indicated on control valve schedule: linear, equal percentage.
- .2 Flow factor (KV) to be based on 15% of total system pressure drop but not to exceed 10' of head across valve.
- .3 Normally open or normally closed, as indicated.
- .4 Two or three port, as indicated.
- .5 Leakage rate ANSI class IV, 0.01% of full open valve capacity.
- .6 Packing easily replaceable.

.7 Stem, stainless steel.
.8 Plug and seat, stainless steel, brass.
.9 Disc, replaceable, material to suit application.
.10 NPS 2 and under:
  .1 Screwed National Pipe Thread (NPT) tapered female connections.
  .2 Valves to ANSI Class 250, valves to bear ANSI mark.
  .3 Rangeability 50:1 minimum.
.11 NPS 2½ and larger:
  .1 Flanged connections.
  .2 Valves to ANSI Class 250 as indicated, valves to bear ANSI mark.
  .3 Rangeability 100:1 minimum.

2.15 ELECTRONIC / ELECTRIC VALVE ACTUATORS

.1 Requirements:
  .1 Construction: steel, cast iron, aluminum.
  .2 Control signal: 0-10V DC or 4-20 mA DC.
  .3 Positioning time: to suit application. 90 sec maximum.
  .4 Fail to normal position as indicated.
  .5 Scale or dial indication of actual control valve position.
  .6 Size actuator to meet requirements and performance of control valve specifications.
  .7 For interior and perimeter terminal heating and cooling applications floating control actuators are acceptable.
  .8 Minimum shut-off pressure: refer to control valve schedule.
  .9 Two position or modulating as indicated in sequence of operation.

2.16 PANELS

.1 Free-standing or wall mounted enamelled steel cabinets with hinged and key-locked front door.

.2 Multiple panels as required to handle requirements with additional space to accommodate 25% additional capacity as required by Departmental Representative without adding additional cabinets.

.3 Panels to be lockable with same key.

2.17 WIRING

.1 In accordance with Section 26 27 10 - Modular Wiring System, 26 27 26 - Wiring Devices.

.2 For wiring under 70 volts use FT6 rated wiring where wiring is not run in conduit. Other cases use FT4 wiring.

.3 Wiring must be continuous without joints.

.4 Sizes:
  .1 Field wiring to digital device: #18AWG stranded twisted pair.
  .2 Analog input and output: shielded #18 stranded twisted pair.

2.18 DUCT AIRFLOW STATION

.1 Provide where indicated and/or scheduled airflow traverse elements capable of continuously monitoring the fan or duct air volumes they serve.

.2 The airflow measurement station shall consist of multiple airflow elements, factory mounted and pre-piped in a casing designed for flanged connection to the ductwork.

.3 Accuracy: within 2% of actual flow.

.4 Material:
.1 Elements: 6063-T5 anodized aluminum (standard)
.2 Casings: 16 ga G90 galvanized steel (standard)

.5 Rated operating conditions: Up to 350 Deg.F and 0-100% humidity.

.6 Instrument Connections: ¼" compression, suitable for use with thermoplastic or copper tubing; thermoplastic tubing requires the use of tubing inserts, which shall be supplied with the fittings.

.7 Each element shall be designed and built to comply with, and provide results in accordance with, accepted practice for duct system traversing as defined in the ASHRAE Handbook of Fundamentals, AMCA publication #203, as well as the Industrial Ventilation Handbook. The number of sensing ports on each element, and the quantity of elements utilized at each installation, shall comply with ASHRAE Standard #111 for equal area duct traversing.

.8 Each airflow measuring element shall contain multiple total and static pressure sensing ports placed along the leading edge of the cylinder. The static pressure chamber shall incorporate dual offset static taps on opposing sides of the averaging chamber, so as to be insensitive to flow angle variations of as much as ± 20 degrees in the approaching airstream.

.9 The airflow traverse elements shall be capable of producing steady, non-pulsating signals of true total and static pressure, with an accuracy of 2% of actual flow for operating velocities as low as 100 feet per minute (fpm). Signal amplifying sensors requiring flow correction (K factors) for field calibration are not acceptable.

.10 The airflow traverse elements shall not induce a measurable pressure drop, greater than 0.18 inch at 4,000 fpm. The units shall have a self-generated sound rating of less than NC40 and the sound level within the duct shall not be amplified, nor shall additional sound be generated.

.11 The probes shall be manifolded together in a 16 gauge galvanized steel duct section with 90 degree undrilled flanges, fabricated to the duct size, and shall contain multiple airflow traverse elements interconnected as herein before described.

.12 Where primary flow elements are located outside of the manufacturer's published installation guidelines the manufacturer shall be consulted, and approve of any special configurations, such as air equalizers and/or additional and strategically placed measuring points, as may be required.

.13 Where the stations are installed in insulated ducts, the airflow passage of the station shall be the same size as the inside airflow dimension of the duct. Station flanges shall be sized to facilitate matching connecting ductwork.

.14 Airflow station dimensions shall match associated ductwork.

.15 Design is based on Paragon Controls Inc. Model FE-1500.

3 Execution

3.1 INSTALLATION

.1 Install equipment, components so that manufacturer's and CSA labels are visible and legible after commissioning is complete.

.2 Install field control devices in accordance with manufacturers recommended methods, procedures and instructions.

.3 Temperature transmitters, humidity transmitters, current-to-pneumatic transducers, solenoid air valves, controllers, relays: install in NEMA I enclosure or as required for specific applications. Provide for electrolytic isolation in cases when dissimilar metals make contact.

.4 Support field-mounted panels, transmitters and sensors on pipe stands or channel brackets.

.5 Fire stopping: provide space for fire stopping in accordance with Section 07 84 00 - Firestopping. Maintain fire rating integrity.

.6 Electrical:
- .1 Complete installation in accordance with Section 26 05 01 - Common Work Results - Electrical.
- .2 Modify existing starters to provide for EMCS as indicated in I/O Summaries and as indicated.
- .3 Refer to electrical control schematics included as part of control design schematics in Section 25 90 01 - EMCS: Site Requirements Applications and Systems Sequences of Operation. Trace existing control wiring installation and provide updated wiring schematics including additions, deletions to control circuits for review by Departmental Representative before beginning Work.
- .4 Terminate wires with screw terminal type connectors suitable for wire size, and number of terminations.
- .5 Install communication wiring in conduit.
  - .1 Provide complete conduit system to link Building Controllers, field panels and OWS(s).
  - .2 Conduit sizes to suit wiring requirements and to allow for future expansion capabilities specified for systems.
  - .3 Maximum conduit fill not to exceed 40%.
  - .4 Design drawings do not show conduit layout.
- .6 Do not run exposed conduits in normally occupied spaces unless otherwise indicated or unless impossible to do otherwise. Departmental Representative to review before starting Work. Wiring in mechanical rooms, wiring in service rooms and exposed wiring must be in conduit.

3.2 TEMPERATURE SENSORS

.1 Stabilize to ensure minimum field adjustments or calibrations.

.2 Readily accessible and adaptable to each type of application to allow for quick easy replacement and servicing without special tools or skills.

.3 Outdoor installation:
- .1 Protect from solar radiation and wind effects by non-corroding shields.
- .2 Install in NEMA 4 enclosures.

.4 Duct installations:
- .1 Do not mount in dead air space.
- .2 Locate within sensor vibration and velocity limits.
- .3 Securely mount extended surface sensor used to sense average temperature.
- .4 Thermally isolate elements from brackets and supports to respond to air temperature only.
- .5 Support sensor element separately from coils, filter racks.

.5 Averaging duct type temperature sensors.
- .1 Install averaging element horizontally across the ductwork starting 300 mm from top of ductwork. Each additional horizontal run to be no more than 300 mm from one above it. Continue until complete cross sectional area of ductwork is covered. Use multiple sensors where single sensor does not meet required coverage.
- .2 Wire multiple sensors in series for low temperature protection applications.
- .3 Wire multiple sensors separately for temperature measurement.
- .4 Use software averaging algorithm to derive overall average for control purposes.

.6 Thermowells: install for piping installations.
- .1 Reuse existing wells.
- .2 Thermowell to restrict flow by less than 30%.
- .3 Use thermal conducting paste inside wells.

3.3 PANELS

.1 Arrange for conduit and tubing entry from top, bottom or either side.

.2 Wiring and tubing within panels: locate in trays or individually clipped to back of panel.

.3 Identify wiring and conduit clearly.

3.4 IDENTIFICATION

.1 Identify field devices in accordance with Section 25 05 54 - EMCS: Identification.

3.5 TESTING AND COMMISSIONING

.1 Calibrate and test field devices for accuracy and performance in accordance with Section 25 01 11 - EMCS: Start-up, Verification and Commissioning.

END OF SECTION

Part 1 - General

1.1 SUMMARY

.1 Section Includes:
1. Sequence of Operation for each system, which the EMCS must accomplish in full.

1.2 REFERENCES

.1 Public Works and Government Services Canada (PWGSC) / Real Property Branch / Architectural and Engineering Services.
1. MD13800-September 2000, Energy Management and Control Systems (EMCS) Design Manual. English: ftp://ftp.pwgsc.gc.ca/rps/docentre/mechanical/me214-e.pdf

1.3 SEQUENCING

.1 Present sequencing of operations for systems, in accordance with MD13800 - Energy Management and Control Systems (EMCS) Design Manual.

Part 2 - Products

2.1 NOT USED

.1 Not Used.

Part 3 - Execution

3.1 SEQUENCE OF OPERATION

.1 The Energy Management Routines stated as a requirement of the EMCS under Section 25 30 01 EMCS: Building Controls, Item 2.4.8 shall be incorporated under each and every Sequence of Operation to which they apply. Controls Contractor shall write energy management routines into Sequence of Operation submitted for review. This includes, but is not limited to, the following:
- .1 Optimal Start/Stop: To be incorporated for each and every system being scheduled through the EMCS. Optimal start/stop to include recovery time from night setback.
- .2 Night Setback Control: To be incorporated for each and every comfort heating and cooling systems that are operational through unoccupied periods.
- .3 Night Purge: Air handling unit to incorporate differential enthalpy controlled night purge sequence to precool building when conditions permit.

.2 <u>Radiant Ceiling Panel</u>:
- .1 Schedule of Operation:
  - .1 EMCS shall schedule occupied/unoccupied zone control with AHU-1 schedule. Initial schedule shall be as follows:
    Occupied Monday – Friday: 7:00 AM – 5:00 PM
- .2 Temperature Control:
  - .1 Unit shall be controlled by EMCS. Wall sensor to be stainless steel plate sensor in washrooms and adjustable sensor in other areas.

.2 Adjustable sensors shall have a midpoint setpoint with a space adjustable slider to increase and decrease setpoint by an operator adjustable amount, initially set to 1.5 Deg.C. The midpoint shall reset between an adjustable summer setpoint, initially set to 24 Deg.C and an adjustable winter setpoint, initially set to 22 Deg.C. Reset shall be based on the following:

Outdoor Temperature	Setpoint
26 Deg.C. and above	Summer Setpoint (24 Deg. C.)
16 Deg.C. and below	Winter Setpoint (21 Deg.C.)

.3 On a call for heat, EMCS shall open the two position, two-way valve. Valve shall close once space is satisfied.

.3 Operator Work Station: The operator will be able to view and/or modify the following:

.1 Space temperature
.2 Space temperature setpoint
.3 Night setback summer setpoint
.4 Night setback winter setpoint

.3 Zone Control Sequence A (Meeting Space):

.1 EMCS shall schedule occupied/unoccupied zone control. Initial schedule shall be as follows:

Occupied Monday – Friday: 7:00 AM – 5:00 PM

.2 Occupant override on thermostat shall permit occupied operation during scheduled unoccupied periods for an adjustable time period between 1 and 3 hours, initially set to 2 hours.

.3 Temperature Setpoint:

.1 Temperature shall be controlled from a wall mounted thermostat with an EMCS median room temperature setpoint and an occupant adjustable slider EMCS controlled median setpoint shall reset based on OAT. Reset parameters shall all be adjustable and shall be initially set to the following:

Outdoor Temperature	Setpoint
26 Deg.C. and above	24 Deg.C.
16 Deg.C. and below	21 Deg.C.

.2 EMCS shall control limit on occupancy adjustment, initially set to +/- 3 Deg.C (adjustable parameter).

.3 EMCS shall incorporate night setback during unoccupied periods. During such periods, the EMCS shall disable the adjustable slider and control the space to the night setback temperature, as follows:

Winter Night Set Back = 18 Deg.C. (adjustable parameter)
Summer Night Set Back = 26 Deg.C. (adjustable parameter)

.4 Spaces with multiple thermostats in operation shall control to average setpoint between all thermostats in space.

.4 Airflow Control:

.1 Supply valves shall maintain supply airflow at minimum according to occupied or unoccupied mode at all times except where temperature control requires airflow to increase. All supply valves controlled from the same thermostat shall modulate equally between minimum and maximum airflow.

.2 All exhaust air valves in the space shall modulate from minimum to maximum, as required to maintain air flow offset between total supply air and total exhaust air. During unoccupied mode, all exhaust air valves shall be closed.

.3 For each separately controlled space, EMCS shall show each valve and associated points, summation of airflow for all supply valves in space, summation of airflow for all exhaust valves in space, and airflow offset setpoint.

.5 Temperature Control - Heating:

.1 The terminal unit airflow, reheat valve, and radiant panel modulate in sequence to maintain room temperature setpoint. Temperature setpoint is determined from the EMCS controlled median temperature and the occupant adjustable space offset.

.2 Where present, radiant panels shall be the first stage of heat. During the first stage of heat the reheat coil two-way modulating valve shall modulate to maintain discharge air temperature at 2 Deg.C. below room temperature setpoint. Radiant panel modulating two-way valves shall modulate to maintain space temperature.

.3 Where radiant panels are not present or if the radiant panel is unable to maintain setpoint, the discharge air temperature setpoint shall gradually increase to maximum while maintaining minimum airflow. Maximum discharge air setpoint shall be initially set to 7 Deg.C. above room setpoint.

.4 If the radiant panel and reheat coil at maximum discharge temperature and minimum airflow are unable to maintain setpoint, the EMCS shall modulate supply air valves to increase airflow.

.5 Radiant panels shall be locked out during summer operation, when ambient temperature is above summer flag.

.6 Temperature Control - Cooling:

.1 The terminal unit airflow and reheat valve modulate in sequence to maintain room temperature setpoint. Temperature setpoint is determined from the EMCS controlled median temperature and the occupant adjustable space offset.

.2 Where present, radiant panels shall be off (valve closed) on a call for cooling.

.3 At minimum air flow, the reheat valve shall modulate to maintain discharge air temperature at 2 Deg.C. below room setpoint. Discharge air temperature shall reset down to suit space cooling demand.

.4 Once the reheat valve is closed, a call for more cooling shall enable airflow to increase from minimum to maximum to suit space demand.

.7 Override Mode:

.1 If the occupancy override button is activated during unoccupied periods then the EMCS shall revert to occupied control for that space for the duration of the override period. Override period to be adjustable between 30 minutes and 180 minutes, initially set to 120 minutes.

.8 Graphics: The operator will be able to view and/or modify the following:

1. Each air valve Air Flow
2. Each air valve Air Flow set point (occupied/unoccupied minimum and maximum)
3. Each air valve Damper Position
4. Room Temperature
5. Room Temperature Occupant offset
6. EMCS Room Temperature Median Setpoint
7. Occupancy adjustment limits
8. Each Reheat Valve Position
9. Each Radiant Panel valve Position
10. Total supply air flow
11. Total Exhaust airflow

12. Total airflow offset
13. Maximum discharge air temperature above room setpoint
14. Occupancy override period

.9 Alarm Conditions: The following alarms will not shut the system off:
1. Discharge air temperature alarm (Air valve discharge air temperature is 5 deg.C above AHU-1 discharge air temperature when reheat valve is closed), 5 minute delay.

.4 Zone Control Sequence B (Enclosed Office/Common Space):

.1 EMCS shall schedule occupied/unoccupied zone control. Initial schedule shall be as follows:

Occupied Monday – Friday: 7:00 AM – 5:00 PM

.2 Occupant override on thermostat shall permit occupied operation during scheduled unoccupied periods for an adjustable time period between 1 and 3 hours, initially set to 2 hours.

.3 Temperature Setpoint:

.1 Temperature shall be controlled from a wall mounted thermostat with an EMCS median room temperature setpoint and an occupant adjustable slider EMCS controlled median setpoint shall reset based on OAT. Reset parameters shall all be adjustable and shall be initially set to the following:

Outdoor Temperature	Setpoint
26 Deg.C. and above	24 Deg.C.
16 Deg.C. and below	21 Deg.C.

.2 EMCS shall control limit on occupancy adjustment, initially set to +/- 3 Deg.C. (adjustable parameter).

.3 EMCS shall incorporate night setback during unoccupied periods. During such periods, the EMCS shall disable the adjustable slider and control the space to the night setback temperature, as follows:

Winter Night Set Back = 18 Deg.C. (adjustable parameter)
Summer Night Set Back = 26 Deg.C. (adjustable parameter)

.4 Spaces with multiple thermostats in operation shall control to average setpoint between all thermostats in space.

.4 Airflow Control:

.1 Supply valves shall maintain supply airflow at minimum according to occupied or unoccupied mode at all times except where temperature control requires airflow to increase. All supply valves controlled from the same thermostat shall modulate equally between minimum and maximum airflow.

.2 All exhaust air valves in the space shall modulate from minimum to maximum, as required to maintain air flow offset between total supply air and total exhaust air. During unoccupied mode, all exhaust air valves shall be closed.

.3 For each separately controlled space, EMCS shall show each valve and associated points, summation of airflow for all supply valves in space, summation of airflow for all exhaust valves in space, and airflow offset setpoint.

.5 Temperature Control - Heating:

.1 The terminal unit airflow, reheat valve, and radiant panel modulate in sequence to maintain room temperature setpoint. Temperature setpoint is determined from the EMCS controlled median temperature and the occupant adjustable space offset.

.2 Where present, radiant panels shall be the first stage of heat. During the first stage of heat the reheat coil two-way modulating valve shall modulate to maintain discharge air temperature at 2 Deg.C. below room temperature setpoint. Radiant panel two-position two-way valves shall open on a call for heat and close once space is satisfied.

.3 Where radiant panels are not present or if the radiant panel is unable to maintain setpoint, the discharge air temperature setpoint shall gradually increase to maximum while maintaining minimum airflow. Maximum discharge air setpoint shall be initially set to 7 Deg.C. above room setpoint.

.4 If the radiant panel and reheat coil at maximum discharge temperature and minimum airflow are unable to maintain setpoint, the EMCS shall modulate supply air valves to increase airflow.

.6 Temperature Control - Cooling:

.1 The terminal unit airflow and reheat valve modulate in sequence to maintain room temperature setpoint. Temperature setpoint is determined from the EMCS controlled median temperature and the occupant adjustable space offset.

.2 Where present, radiant panels shall be off (valve closed) on a call for cooling.

.3 At minimum air flow, the reheat valve shall modulate to maintain discharge air temperature at 2 Deg.C. below room setpoint. Discharge air temperature shall reset down to suit space cooling demand.

.4 Once the reheat valve is closed, a call for more cooling shall enable airflow to increase from minimum to maximum to suit space demand.

.7 Override Mode:

.1 If the occupancy override button is activated during unoccupied periods then the EMCS shall revert to occupied control for that space for the duration of the override period. Override period to be adjustable between 30 minutes and 180 minutes, initially set to 120 minutes.

.8 Graphics: The operator will be able to view and/or modify the following:

1. Each air valve Air Flow
2. Each air valve Air Flow set point (occupied/unoccupied minimum and maximum)
3. Each air valve Damper Position
4. Room Temperature
5. Room Temperature Occupant offset
6. EMCS Room Temperature Median Setpoint
7. Occupancy adjustment limits
8. Each Reheat Valve Position
9. Each Radiant Panel valve Position
10. Total supply air flow
11. Total Exhaust airflow
12. Total airflow offset
13. Maximum discharge air temperature above room setpoint
14. Occupancy override period

.9 Alarm Conditions: The following alarms will not shut the system off:
1. Airflow offset alarm (cannot maintain desired airflow offset), 5 minute delay
2. Discharge air temperature alarm (Air valve discharge air temperature is 5 deg.C above AHU-1 discharge air temperature when reheat valve is closed), 5 minute delay

.5 Zone Control Sequence C (Office Space with Common Exhaust):

.1 EMCS shall schedule occupied/unoccupied zone control. Initial schedule shall be as follows:
Occupied Monday – Friday: 7:00 AM – 5:00 PM

.2 Occupant override on thermostat shall permit occupied operation during scheduled unoccupied periods for an adjustable time period between 1 and 3 hours, initially set to 2 hours.

.3 Zone Temperature Setpoint:

.1 Temperature in each zone shall be controlled from a wall mounted thermostat with an EMCS median room temperature setpoint and an occupant adjustable slider EMCS controlled median setpoint shall reset based on OAT. Reset parameters shall all be adjustable and shall be initially set to the following:

Outdoor Temperature	Setpoint
26 Deg.C. and above	24 Deg.C.
16 Deg.C. and below	21 Deg.C.

.2 EMCS shall control limit on occupancy adjustment, initially set to +/- 3 Deg.C. (adjustable parameter).

.3 EMCS shall incorporate night setback during unoccupied periods. During such periods, the EMCS shall disable the adjustable slider and control the space to the night setback temperature, as follows:
Winter Night Set Back = 18 Deg.C. (adjustable parameter)
Summer Night Set Back = 26 Deg.C. (adjustable parameter)

.4 Spaces with multiple thermostats in operation shall control to average setpoint between all thermostats in space.

.4 Airflow Control:

.1 Supply valve for each zone shall maintain supply airflow at minimum according to occupied or unoccupied mode at all times except where temperature control requires airflow to increase. All supply valves controlled from the same thermostat shall modulate equally between minimum and maximum airflow.

.2 The exhaust air control valve shall modulate from minimum to maximum as required to track the summation of associated supply valves less a pressurization offset. Offset to be adjustable, initially set to 10% of total supply. During unoccupied mode, exhaust damper shall be closed.

.3 For each separately controlled zone, EMCS shall show components operating in zone. A separate graphic shall show exhaust damper and associated supply valves including summation of airflows. .

.5 Temperature Control - Heating:

.1 The terminal unit airflow, reheat valve, and radiant panel modulate in sequence to maintain room temperature setpoint. Temperature setpoint is determined from the EMCS controlled median temperature and the occupant adjustable space offset.

.2 Where present, radiant panels shall be the first stage of heat. During the first stage of heat the reheat coil two-way modulating valve shall modulate to maintain discharge air temperature at 2 Deg.C. below room temperature setpoint. Radiant panel two-position two-way valves shall open on a call for heat and close once space is satisfied.

.3 Where radiant panels are not present or if the radiant panel is unable to maintain setpoint, the discharge air temperature setpoint shall gradually increase to maximum while maintaining minimum airflow. Maximum discharge air setpoint shall be initially set to 7 Deg.C. above room setpoint.

.4 If the radiant panel and reheat coil at maximum discharge temperature and minimum airflow are unable to maintain setpoint, the EMCS shall modulate supply air valves to increase airflow.

.6 Temperature Control - Cooling:

.1 The terminal unit airflow and reheat valve modulate in sequence to maintain room temperature setpoint. Temperature setpoint is determined from the EMCS controlled median temperature and the occupant adjustable space offset.

.2 Where present, radiant panels shall be off (valve closed) on a call for cooling.

.3 At minimum air flow, the reheat valve shall modulate to maintain discharge air temperature at 2 Deg.C. below room setpoint. Discharge air temperature shall reset down to suit space cooling demand.

.4 Once the reheat valve is closed, a call for more cooling shall enable airflow to increase from minimum to maximum to suit space demand.

.7 Override Mode:

.1 If the occupancy override button is activated during unoccupied periods then the EMCS shall revert to occupied control for that space for the duration of the override period. Override period to be adjustable between 30 minutes and 180 minutes, initially set to 120 minutes.

8. Graphics: The operator will be able to view and/or modify the following:

1. Each air valve Air Flow
2. Each air valve Air Flow set point (occupied/unoccupied minimum and maximum)
3. Each air valve Damper Position
4. Each zone Temperature
5. Each zone Temperature Occupant offset
6. EMCS Zone Temperature Median Setpoint
7. Occupancy adjustment limits
8. Each Reheat Valve Position
9. Each Radiant Panel valve Position
10. Total supply air flow (summation of all supply valves associated with common exhaust)
11. Common Exhaust airflow (airflow through airflow station at damper)
12. Total airflow offset (difference between supply and exhaust)
12. Total airflow offset setpoint (difference between supply and exhaust)
13. Maximum discharge air temperature above room setpoint
14. Occupancy override period

.9 Alarm Conditions: The following alarms will not shut the system off:

1. Airflow offset alarm (cannot maintain desired airflow offset), 5 minute delay

2. Discharge air temperature alarm (Air valve discharge air temperature is 5 deg.C above AHU-1 discharge air temperature when reheat valve is closed), 5 minute delay

.6 Terminal Control Sequence D (Laboratory Spaces):

.1 EMCS shall schedule occupied/unoccupied zone control. Initial schedule shall be as follows:

Occupied Monday - Friday: 7:00 AM - 5:00 PM

.2 Occupant override on thermostat shall permit occupied operation during scheduled unoccupied periods for an adjustable time period between 1 and 3 hours, initially set to 2 hours.

.3 Temperature Setpoint:

.1 Temperature shall be controlled from a wall mounted thermostat with an EMCS median room temperature setpoint and an occupant adjustable slider EMCS controlled median setpoint shall reset based on OAT. Reset parameters shall all be adjustable and shall be initially set to the following:

Outdoor Temperature	Setpoint
26 Deg.C. and above	24 Deg.C.
16 Deg.C. and below	21 Deg.C.

.2 EMCS shall control limit on occupancy adjustment, initially set to +/- 3 Deg.C. (adjustable parameter).

.3 EMCS shall incorporate night setback during unoccupied periods. During such periods, the EMCS shall disable the adjustable slider and control the space to the night setback temperature, as follows:

Winter Night Set Back = 18 Deg.C. (adjustable parameter)
Summer Night Set Back = 26 Deg.C. (adjustable parameter)

.4 Airflow Control:

.1 Laboratory airflow control system shall use volumetric offset control to maintain room pressurization. The control unit shall maintain a constant design offset between the sum of the room's total exhaust and make-up/supply air flows. This offset shall be field adjustable and represents the volume of air which will enter (or exit) the room from the corridor or adjacent spaces. Supply air valves, exhaust air valves, fume hoods, canopy exhausts, bench exhausts and associated dedicated exhaust fans operating within each lab shall maintain the total room exhaust airflow and total supply air flow at minimum according to occupied or unoccupied mode, except when the temperature control requires more airflow.

.2 The laboratory airflow offset between supply and exhaust shall be maintained at all times. When the temperature control requires more supply air flow, the exhaust airflow shall track the increase in supply airflow to maintain the room offset.

.3 Air valves noted as variable volume shall modulate from minimum to maximum to maintain room airflow offsets and as required to meet temperature control.

.4 Air valves noted as constant volume shall modulate to maintain a constant air volume in accordance with the occupied and unoccupied constant volume setpoint.

.5 The EMCS shall monitor the operation of exhaust systems not provided with air flow stations (fume hoods and bio-safety cabinets). When these systems are enabled, the EMCS shall utilize the site verified constant volume air flow for each system in its room exhaust air flow calculation.

.5 Temperature Control - Heating:

.1 The terminal unit airflow, reheat valves, and radiant panel modulate in sequence to maintain room temperature setpoint. Temperature setpoint is determined from the EMCS controlled median temperature and the occupant adjustable space offset.

.2 Where present, radiant panels shall be the first stage of heat. During the first stage of heat the reheat coil two-way modulating valve shall modulate to maintain discharge air temperature at 2 Deg.C. below room temperature setpoint. Radiant panel two-position two-way valves shall open on a call for heat and close once space is satisfied.

.3 Where radiant panels are not present or if the radiant panel is unable to maintain the desired space temperature, the discharge air temperature setpoint shall gradually increase to maximum while maintaining minimum airflow. Note that minimum airflow in the lab space can be either the room airflow minimum or the room offset from the summation of exhaust devices and valves operating at any given moment. Maximum discharge air setpoint shall be initially set to 7 Deg.C. above room setpoint.

.4 If the radiant panel in combination with the reheat coil at maximum discharge temperature and minimum airflow are unable to maintain the space setpoint, the EMCS shall permit the room airflow to increase.

.6 Temperature Control - Cooling:

.1 The terminal unit airflow and reheat valve modulate in sequence to maintain room temperature setpoint. Temperature setpoint is determined from the EMCS controlled median temperature and the occupant adjustable space offset.

.2 Radiant panels, when present, shall be off (valve closed) on a call for cooling.

.3 At minimum air flow, the reheat valve shall modulate to maintain discharge air temperature at 2 Deg.C. below room setpoint. Discharge air temperature shall reset down to suit space cooling demand.

.4 Once the reheat valve is closed, a call for more cooling shall enable airflow to increase from minimum to maximum to suit space demand.

.7 Fume Hood Control (Switch Enabled):

.1 When ambient temperatures are above fume hood summer/winter flag, initially set to 5 Deg.C., the existing fume hood exhaust fan switch shall enable fan operation. When ambient temperatures are below fume hood summer/winter flag, the fume hood exhaust fan shall operate continuously.

.2 At start up, the EMCS shall open the motorized isolation damper before starting the exhaust fan.

.3 The EMCS shall monitor and control the following fume hood points:

1. Fume hood exhaust switch position(start/stop)
2. Fume hood exhaust fan start/stop/status
3. Exhaust fan proof (output to VSP panel)
4. Fan failure alarm (output to VSP panel)
5. Power On Indication (output to VSP panel)

.9 Fume Hood Control (No Switch):
- .1 The fume hood exhaust fan shall operate continuously.
- .2 At start up, the EMCS shall open the motorized isolation damper before starting the exhaust fan.
- .3 The EMCS shall monitor and control the following fume hood points:
  1. Fume hood exhaust fan start/stop/status, alarm
  2. Exhaust fan proof (output to VSP panel)
  3. Fan failure alarm (output to VSP panel)
  4. Power On Indication (output to VSP panel)

.10 Override Mode:
- .1 If the temperature sensor override button is activated during unoccupied periods then the EMCS shall revert to occupied control for that space for the duration of the override period. Override period to be adjustable between 30 minutes and 180 minutes, initially set to 120 minutes.

.11 Graphics: The operator will be able to view and/or modify the following:
1. Each air valve Air Flow
2. Each air valve Air Flow set point (occupied/unoccupied minimum and maximum)
3. Each air valve Damper Position
4. Room Temperature
5. Room Temperature Occupant offset
6. EMCS Room Temperature Median Setpoint
7. Each Reheat Valve Position
8. Each Radiant Panel valve Position
9. Total supply air flow
10. Total Exhaust airflow
11. Total airflow offset
12. Schedule
13. All fume hood panel points, start/stop/status and alarm
14. All exhaust fans associated with constant pressure exhaust, fan status

.12 Alarm Conditions: The following alarms will not shut the system off:
1. Airflow offset alarm (cannot maintain desired airflow offset)
2. Discharge air temperature alarm (Air valve discharge air temperature is 5 deg.C above AHU-1 discharge air temperature when reheat valve is closed)

.7 Dedicated Air Conditioning Units (AC-1/CU-1):
- .1 Each dedicated air conditioning unit shall operate from a local programmable thermostat matched to the air conditioning unit.
- .2 Install and wire controls associated with AC unit.
- .3 The EMCS shall monitor space temperature from stainless steel sensor (separate from ACU temperature sensor) and alarm on high limit.
- .4 The Facility Management System shall monitor and address all points required to meet sequence of operation, including but not limited to the following:
  - Space temperature
  - Space temperature high limit (initially set to 26 Deg.C.)

.5 Air Handling Unit #2 – Room 158:

.1 Schedule of Operation:

.1 EMCS shall schedule occupied/unoccupied operation. Fan system shall be enabled during occupied periods and off during unoccupied periods. Initial schedule shall be as follows:

Occupied Monday B Friday: 7:00 AM B 5:00 PM

.2 Occupant override on thermostat shall permit occupied operation during scheduled unoccupied periods

.2 Fan Control:

.1 System shall run on occupied schedule and during unoccupied mode when space temperature falls below unoccupied heating setpoint.

.2 Once fan SF2 is started the variable speed drive shall ramp up from 20 to full flow in 2% increments every 30 seconds. SF2 fan speed shall maintain the SF2 air flow at 300 l/s > EF31 air flow. SF2 variable speed drive is overridden and slowed down when discharge static pressure is above 1250 Pascal.

.3 EF31 fan motor shall start with SF-2.

.3 Temperature Control:

.1 The supply air temperature set point is reset based on new adjustable thermostat space temperature setpoint.

.4 Heating Control:

.1 The EMCS shall modulate the preheat valves HC2-CVA and HC2-CVB in sequence to maintain AHU-2 supply air temperature setpoint. When heating, cooling coil valves shall be closed.

.2 Heating Pump P7 shall enable when the outside air temperature is below P7_OAT_START set point (5°C) and stop when outside air temperature rises 2°C above P7_OAT_START set point (7°C). or on a call for heat.

.3 Control valves HC2_CVA & HC2_CVB shall modulate in sequence to maintain discharge air temperature setpoint;

.4 EMCS shall override both control valves in a staged fashion to maintain a minimum heating coil discharge air temperature of 2°C at all times. Temperature shall be measured at freeze stat.

.5 To reduce starts, during unoccupied heating the unit shall run on a call for heat to bring space temperature 2 Deg.C above unoccupied heating setpoint before shutting down.

.5 Cooling Control:

.1 The EMCS shall modulate the economizer dampers and cooling valves CC2-CVA and CC2-CVB in sequence to maintain AHU-2 supply air temperature setpoint. When cooling, heating control valves shall be closed.

.6 Damper Control:

.1 The EMCS shall modulate the economizer dampers to maintain minimum ventilation or to provide free cooling when conditions permit.

.2 During unoccupied mode, dampers shall be set to recirculate 100%.

.3 Upon occupied start dampers shall slowly modulate to occupied setpoint.

.3 During mechanical heating or cooling, dampers shall maintain the minimum ventilation rate as determined with the air balancer.

.4 During “free cooling” dampers shall modulate to maintain S/A discharge to cool space.

.8 Humidity Control:

.1 The EMCS shall communicate with humidifier HUM-2 on board controls to maintain desired exhaust air humidity setpoint. When AHU-2 air flow is less than 2000 L/s or OAT is above humidification limit, initially set to 12 deg.C., the humidifier shall be off. When AHU2 airflow is greater than 2000 l/s humidifiers hall modulate to maintain the exhaust air humidity set point (Exhaust Fan 31). Exhaust air humidity set point is reset based on OAT as shown below;

Outside Air Temperature	Supply Air Temperature Setpoint
-20 Deg.C.	20 %
10 Deg.C.	35%

.2 Supply air discharge humidity high limit controller shall override the exhaust air humidity setpoint control and maintain discharge air humidity in AHU2 at 75% RH.

.3 EMCS shall monitor alarms from humidifier controllers.

*Humidification valves disabled at 0%

.9 Protection:

.1 A manually reset low temperature freeze stat (3°C set point) is located downstream of the heating coil and will shut down the supply fans, close the outside air dampers and the heating coil valves will modulate to maintain the heating coil discharge air temperature.

.12 Operator Work Station: The operator will be able to view and/or modify the following:

1. Supply Fan SF-2: Start, Stop, Status, Speed, alarm, VSD fault, VSD speed feedback.
2. Supply Fan SF2 airflow (Flow measuring station FMS-6)
3. Supply Fan SF-2 discharge static pressure
4. Supply Fan SF-2 discharge static pressure high limit setpoint
5. AHU-2 Outside air damper position
6. Outside air damper endswitch condition.
7. Exhaust Fan EF-31: Start, Stop, Status.
8. Freezestat alarm setpoint
9. Freezestat / preheat coil discharge temperature
10. AHU-2 supply air discharge air temperature
11. AHU-2 supply air discharge air temperature setpoint (reset schedule)
12. Filter Bank 3 differential pressure
13. Filter Bank 3 differential pressure service setpoint
14. Filter Bank 4 differential pressure
15. Filter Bank 4 differential pressure service setpoint
16. Heating Coil 2 control valve A (HC2-CVA - 1/3 valve) position
17. Heating Coil 2 control valve B (HC2-CVB - 2/3 valve) position
18. Heating coil HC-2 pump P-7: Start, Stop, Status, Alarm.
19. Heating Coil HC-2 entering water temperature
20. Heating Coil HC-2 leaving water temperature
21. Cooling Coil 2 control valve A (CC2-CVA) position
22. Cooling Coil 2 leaving water temperature
23. Humidifier Status (HUM-2)
24. Humidifier Service (HUM-2)
25. Humidifier Alarm (HUM-2)
26. Humidifier Demand Signal (HUM-2)

27. Humidifier Enable (HUM-2)
28. Humidifier exhaust air relative humidity (HUM-2)
29. Humidifier exhaust air relative humidity setpoint (HUM-2) (reset schedule)
30. Humidifier supply air relative humidity (HUM-2)
31. Humidifier supply air relative humidity high limit setpoint (HUM-2)

.13 Alarm Conditions:

.1 The following system alarms will shut the system down:

1. Freeze stat trip (Mechanical)- manual reset, initially set to 2 deg.c., 5 minute delay
2. EF31 supply fan failure: 3 minute delay
3. EF31 damper end switch alarm: 3 minute delay
4. EF31 variable speed drive fault: 1 minute delay
5. SF2 supply fan failure: 3 minute delay
6. SF2 damper end switch alarm: 3 minute delay
7. SF2 variable speed drive fault: 1 minute delay

.2 The following alarms will not shut the system down:

1. Heat recovery coil high temperature >25°C: 1 minute delay
2. Filter 3 differential pressure >100pascals: 5 minute delay
3. Filter 4 differential pressure >200pascals: 5 minute delay
4. Heating coil leaving air temperature >25°C or <-40°C: 1 minute delay
5. SF2 high static pressure >2000 Pascal: 1 minute delay
6. Supply air temperature >30°C or < 5°C: 1 minute delay
7. SF1 flow measuring station >6200 l/s: 1 minute delay
8. Heat recovery mixed water temperature >40°C or <0°C: 1 minute delay
9. Exhaust air humidity >70%RH or <10%RH: 1 minute delay
10. SF2 supply air humidity alarm >90%RH or <-10%RH: 1 minute delay
11. P7 heating pump failure: 3 minute delay
12. P23 heat reclaim coil pump failure: 3 minute delay
13. SF2 room temperature: >28°C or < 15°C: 1 minute delay
14. SF2 maintenance runtime exceeded >720hrs
15. P7 maintenance runtime exceeded >720hrs
16. P23 heat reclaim coil pump maintenance runtime exceeded >720hrs
17. Filter 5 differential pressure >100pascals: 5 minute delay
18. Filter 6 differential pressure >350pascals: 5 minute delay
19. EF31 flow measuring station alarm
20. EF31 maintenance runtime alarm
21. HUM-2 Fault / Alarm
22. HUM-2 Service Required Alarm

.14 Non-Standard Operating Mode - Loss of Power:

1. The EMCS will not operate during a power failure/on UPS, diesel back up.
2. Supply fan do not operate.
3. All dampers go to normal fail-safe position, closed.
4. All heating valves open.

.8 Commissioning:

.1 Point to Point verification:

.1 EMCS Contractor shall prepare a check sheet that includes all points for all functions of the EMCS. Check sheet shall include sensor calibration.

.2 The Contractor shall complete the check sheet for all items and functions, including failure modes, of the CMS. Once complete, each page shall be signed and dated by the person responsible for conducting the point to point verification. Modifications following initial documentation shall be signed and dated individually. Submit to Department Representative for review one month prior to Performance Verification testing.

.2 Provide all necessary specialist labour, materials and tools to demonstrate to the Departmental Representative that the EMCS has been commissioned and is operating in compliance with the contract, including verifying sequence of operation as specified with all approved modifications during construction.

.3 PV forms shall be used for checks, running dynamic tests and adjustments carried out on equipment and systems to ensure correct operation and that they operate efficiently and function independently and interactively with other systems as intended with project requirements. Sample Performance Verification Forms are attached for review. The Contractor will develop the required final project-specific commissioning forms in electronic format with the Departmental Representative. Final forms will include any and all modifications to sequence of operation as a result of site conditions and/or accepted modifications during construction.

.4 The Contractor shall verify the operation of each and every system and fill out the appropriate PV forms. The Departmental Representative and the Contractor shall retest a sampling of systems and components to verify commissioning testing and associated documentation is complete and accurate. Provide manpower and instrumentation to re-verify based on the following sampling rate:

1. Non-critical Terminal Units (supply valves, exhaust valves, radiant panels, unit heaters, force flows, etc.): 30% of reported results.

END OF SECTION

Part 1 General

1.1 SECTION INCLUDES

.1 This Section covers items common to Sections of Electrical Contractor. This section supplements requirements of Division 00 – Procurement and Contracting Requirements, Division 01 – General Requirements, Division 02 – Existing Conditions.

.2 Provide complete and fully operational electrical systems with facilities and services to meet requirements described herein, as shown on the drawings, and in complete accord with applicable codes and ordinances.

.3 Only those items that are specifically indicated as not in contract (N.I.C.) will be omitted.

.4 Contract documents of Divisions 26, 27, and 28 are diagrammatic and approximately to scale, unless detailed otherwise. They establish scope, material and installation quality, and are not detailed installation instructions.

.5 Follow manufacturers' recommended installation details and procedures for equipment supplemented by details given herein and on plans subject to approval of the Consultant.

.6 Examine all drawings to ensure that work under this Division can be properly installed without interference.

.7 Where discrepancies, ambiguities, obvious omissions or errors have been made in drawings and specifications, it shall be the responsibility of the contractor to clarify same prior to tender closing. No allowance will be made after contract award for any expense incurred by him for having to adjust his work to properly conform.

1.2 REFERENCES

.1 The Electrical Contractor shall be bound by industry standards, as interpreted by the Consultant, whether or not specifically referenced in this document. Comply with Electrical Protection Act and rules and regulations made pursuant thereto, including the Canadian Electrical Code. Also, comply with applicable standards of the following:

.1 CSA C22.1-2012, Canadian Electrical Code, Part 1.
.2 Electrical and Electronic Manufacturers Association of Canada (EEMAC).
.3 National Electrical Manufacturers Association (NEMA).
.4 National Building Code 2010 (NBC 2010)
.5 National Fire Protection Association (NFPA)
.6 Institute of Electrical and Electronic Engineers (IEEE).
.7 Audio Engineering Society (AES).
.8 Other Applicable CSA and UL approvals.

1.3 CODES AND STANDARDS

.1 The electrical installation shall comply with all SaskPower requirements and regulations.

.2 In the event of any inspection authority requesting deviation from the design, notify the Consultant and obtain approval before proceeding with any change.

.3 In no instance, shall the standard established by the drawings and specification be reduced by any code or ordinance. All references to codes and standards shall be to the latest edition.

1.4 CARE, OPERATION AND START-UP

.1 Instruct operating personnel in the operation, care and maintenance of systems, system equipment and components.

.2 Connect to equipment furnished in other Divisions and by Owner including start-up and test.

.3 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.

.4 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 all aspects of its care and operation.

1.5 VOLTAGE RATINGS

.1 Operating voltages: to CAN3-C235-83

.2 Motors, electric heating, control and distribution devices and equipment to operate satisfactorily at 60 Hz within normal operating limits established by above standard. Equipment to operate in extreme operating conditions established in above standard without damage to equipment.

1.6 PERMITS, FEES AND INSPECTION

.1 Submit to SaskPower necessary number of drawings and specifications for examination and approval prior to commencement of work.

.2 Pay associated fees.

.3 Notify Consultant of changes required by Electrical Inspection Department prior to making changes.

.4 Furnish Certificates of Acceptance from Electrical Inspection Department and authorities having jurisdiction on completion of work to Consultant.

1.7 MATERIALS AND EQUIPMENT

.1 Provide materials and equipment in accordance with Section 01 61 00 - Common Product Requirements.

.2 All goods and materials shall be new and carry CSA approval seal. Equipment and material shall be CSA certified. Where there is no alternative to supplying equipment which is not

CSA certified, obtain special approval from the Consultant and the Electrical Inspection Department.

.3 All fire alarm equipment shall carry ULC approval seal.

.4 No deviation from specified materials shall be allowed, except where alternative materials have been specifically accepted in writing.

.5 Where materials are not directly specified by catalogue number and manufacturer's name, a high industry specification grade product shall be provided. The Consultant shall be the sole judge of whether this standard is being met.

.6 All references to known standard specifications shall mean and intend the latest edition of such specifications.

.7 Each major component of equipment shall have manufacturer's name, address, catalogue and serial number in a conspicuous place.

.8 Upon request, provide a complete list of all materials and their manufacture. The contractor will be required to use the materials indicated. Changes in manufactures at a future date will not be acceptable.

.9 Factory assemble panels and component assemblies.

1.8 WORKMANSHIP

.1 All work under this Division shall be executed in a workmanlike and substantial manner, neat in its mechanical appearance and arrangement.

.2 A competent representative shall constantly supervise the work of this Division from beginning to completion and final acceptance. So far as possible, the same supervisor and workmen shall be employed throughout the project's duration.

.3 Material and workmanship not meeting the standard intended and required by this specification shall, upon instruction from the Consultant, be properly replaced without further charge or consideration.

1.9 ELECTRICAL DRAWINGS

.1 They indicate the general location and route of conduit and cable to be installed. Conduit shall be installed in coordination with other services. These include both new and existing services. Prior to excavation anywhere on site, arrange to have all existing services marked. Where space is indicated for future equipment or plant use, leave space clear.

.2 Install equipment generally in locations and routes shown, close to building structure with minimum interference with other services or free space. Remove and replace improperly installed equipment to the satisfaction of the Consultant at no extra cost.

.3 Ceiling and floor outlet symbols are scaled to centre line of symbol; symbol does not indicate the size or shape. Mounting height shall be measured to the lowest point on ceiling mounted equipments, and above finished surface for wall mounted equipment.

.4 Wall outlets are scaled to the perpendicular centre line of the symbol. Mounting heights for all wall mounted outlets shall be measured to the horizontal centre line.

.5 Where outlets are mounted in masonry walls, outlets should be mounted to the nearest coursing line.

1.10 WORK PROVIDED FOR OTHER DIVISIONS

.1 Provide information as to exact size and location of all required concrete bases, housekeeping pads and curbs required for the installation of equipment of Divisions 26, 27, and 28.

.2 Provide information as to the location and exact size of all openings through floors and walls.

.3 Provide information as to the location and exact size of all equipment supports required within walls, and roof support structure.

.4 Provide electrical connections, circuit protection and disconnect devices for all equipment supplied by other Divisions, including the Owners. Provide motor starters, disconnect switches, thermal switches, etc., for motors supplied by mechanical contractor. Special control equipment being supplied by mechanical contractor shall be installed and wired by that contractor.

1.11 WORK PROVIDED BY OTHER DIVISIONS

.1 All concrete bases, housekeeping pads and curbs required for the installation of equipment of Divisions 26, 27, and 28.

.2 Installation and framing of all openings in walls or floors larger than 150 mm diameter, or rectangular, with one dimension greater than 150 mm.

.3 Openings in millwork for electrical outlets and conduits.

.4 Painting of all panelboard and communication panel trims to match colour scheme where exposed in finished areas.

.5 Firestopping shall be the responsibility of the General Contractor.

1.12 WORK NOT PROVIDED BY THIS DIVISION

.1 Control wiring below 50V for Mechanical Contractor equipment beyond terminal section of each motor control centre, unless specifically indicated otherwise.

1.13 COORDINATION WITH OTHER DIVISIONS

.1 Cooperate fully with the Consultant and other trades of electrically operated equipment to ensure proper arrangement of and provision for all electrical equipment.

.2 Where outlets or equipment may affect architectural or site treatment desired, contact Consultant and for instructions or detailed drawings.

.3 Refer to other Divisions including mechanical, millwork, kitchen equipment, owner supplied equipment, etc, for electrical work in connection with these drawings and specifications.

.4 Location of lighting outlets and receptacles in mechanical or equipment rooms and similar areas shall be finalized during construction to give optimum arrangement. The Consultant shall approve final location before installation.

.5 Supply and install all motor connections, including starters and overload protection and disconnecting devices at motors where required. All motor driven equipment shall be provided with a lockable disconnecting device within line of site of the motor to be disconnected.

.6 Supply and install complete wiring requirements for full voltage in-line devices on single phase equipment such as thermostats, multi-speed switches for unit heaters, force flows, cabinet heaters, etc.

.7 Cutting of openings for electrical outlets in millwork and other similar types of custom-made equipment shall be done by the supplier of this equipment.

.8 Check other Divisions to ensure that suitable provisions have been provided for all motors. It is possible that some motors may vary in size, numbers and characteristics, depending on the equipment manufacturer's specific requirements. Any variations in this regard will not constitute cause for further consideration. The mechanical coordination schedule supplied on the drawings shall be updated with nameplate specifications.

.9 Assume full responsibility for layout of this work and for any damage caused the Owner or other Divisions by improper location or carrying out of this work.

.10 Before commencing work, examine the work of other Divisions, and report at once any defects or interference affecting the work under this Division, or the guarantee of same.

.11 Location of lighting outlets and receptacles in mechanical or equipment rooms and similar areas shall be finalized during construction to give optimum arrangement. The Consultant shall approve final location before installation.

.12 Allow for all hoisting and setting of material and equipment.

1.14 OWNER SUPPLIED EQUIPMENT

.1 Connect all electrically operated equipment supplied by the Owner, as designated on the drawings.

.2 Reconnect all existing electrical services from new and existing electrical sources modified by the work of this contract.

1.15 INSPECTION AND TESTING

.1 During construction and up to final acceptance, make accessible any equipment or wiring for inspection purposes.

.2 All electrically operating equipment shall be left as a complete installation in perfect operating condition, and receive final test in the presence of the Consultant.

.3 Ensure that all power circuitry is properly tested and meets the CSA Ground Resistance Requirements. For any 600 volt systems, a 600 volt megger or hi-pot procedures shall be used for all such tests. Provide documentation for each test within maintenance/commissioning manuals.

.4 On the request of the Consultant, a staff supervisor shall be made available to assist in this inspection work.

.5 At the completion of the installation, voltage tests shall be conducted in the presence of the Consultant. Transformer taps shall be adjusted, and any other corrective measures implemented to assure the proper operation of all electrical equipment. Provide documentation for each test within maintenance/commissioning manuals.

.6 Acceptance tests and commissioning shall be conducted for systems and/or equipment where indicated in the specifications and other standards referenced herein.

.7 Acceptance tests shall meet requirements as required by manufacturer, as outlined in ANSI – NETA 2007 and additional requirements described on drawings and specified herein. All tests shall be documented as per ANSI – NETA 2007 standards and shall include testing results, testing date, testing technician and representative present.

.8 Acceptance tests shall be made up of the following:

.1 Shop Drawing Information Sheets
.2 Static Review Check Sheets
.3 Performance Verifications Sheets
.4 Manufacturer Commissioning and Report
.5 Manufacturer Test Reports, Factory and On Site where required
.6 Test Results not forming part of the Static Review Checks Sheets
.7 Owner / Consultant Demonstration Sheets
.8 Training

.9 Certification of all acceptance tests and commissioning shall be submitted to the Consultant for approval. Tests not conducted to the satisfaction of the Consultant shall be repeated, and no further costs will be considered. Written documentation bearing name and signature of Contractor, Consultant and Owner's personnel present during acceptance tests shall be included in certification reports. Provide for a minimum of twelve (12) hours across three (3) separate meetings with Consultant and Owner for review of acceptance test sheets.

1.16 SHOP DRAWINGS

.1 Submit shop drawings, where specifically called for, or as requested. Shop drawings shall show detailed dimensional and technical information, and shall properly describe each piece of equipment. Where applicable, shop drawings shall include complete schematics and wiring diagrams. These shop drawings shall be sufficiently detailed to permit the Owner's technicians to trouble-shoot and repair the equipment. Equipment shall not be ordered and/or fabricated until shop drawings have been reviewed by the Consultant. Shop Drawings shall include, but not be limited to the following Sections on systems and equipment:

.1 26 05 36 - Cable Trays

.2 26 27 26 - Wiring Devices

.3 26 28 21 - Moulded Case Circuit Breakers

.4 26 50 00 – Lighting

.2 Review of shop drawings shall be for general design, arrangement and appearance only. This Division shall check and correct, if necessary, all manufacturers' drawings before submitting, and shall so indicate on each copy, along with a dated approval stamp. All shop drawings must bear an approval stamp and be signed by the Contractor. This review does not relieve this Division from the responsibility for the final installation being correct in all detail, and fully acceptable to the Consultant. Refer to each section for further shop drawing information.

.3 Refer to General Conditions of the Contract.

.4 Provide nine (9) printed copies and one PDF copy for each Section. Each shop drawing shall be complete with a cover page with the following information:

.1 Specification Section and name

.2 Project name, Owner's name and address

.3 Number of pages in submittal

.4 Contractor and Supplier's name and contact information

.5 Approval stamps with room for Consultant's stamp

.5 Shop drawings for complementary systems and/or equipment shall be submitted at the same time. Partial submittals of related equipment will be rejected or held until all other related shop drawing information has been submitted (i.e. submit all shop drawings for power equipment at the same time). Submittals of shop drawings that are incomplete will be rejected.

1.17 CHANGES

.1 Refer to General and Supplemental Conditions.

.2 Submit complete itemized breakdowns of all extras, deletions, and changes to the Consultant. Breakdown shall include quantities, unit costs and extensions. If requested, support claim by certified copies of supplier's invoices.

.3 The right is reserved to move equipment 3000 mm from location shown without further charge or consideration, provided that such re-location is requested prior to finish being applied.

1.18 CONSULTANT PRICES

.1 Electrical progress claims shall be made on Contractor Progress Report #ES110 provided by the Consultant. A copy of this Progress Report is attached for reference. The Electrical contract price shall be broken down into thirteen (13) parts to facilitate assessment of work done and material supplied. This progress claim shall be submitted simultaneously to the General Contractor and the Consultant, the latter case in duplicate. Refer to General Conditions.

.2 The breakdown shall indicate labour and material to the nearest dollar. Overhead, profit and job expense shall be apportioned to all parts. The breakdown shall be as follows:

.1 Main services
.2 Distribution/Panels
.3 Conduit and boxes
.4 Wire and cable
.5 Motor control
.6 Wiring devices
.7 Lighting fixtures and lamps
.8 Communications systems
.9 Security Systems
.10 Fire Alarm System
.11 Specials
.12 Miscellaneous - 8% maximum
.13 Extras and credits. (Extras in excess of $1,000 shall be broken down into the above points on a separate ES110 sheet)

1.19 OPERATING INSTRUCTIONS AND SERVICE MANUALS

.1 Upon completion of the installation, provide two (2) complete and comprehensive identical hard copy sets of operating and maintenance manuals. Provide one (1) Portable Document Format (PDF) electronic copy of the maintenance manual.

.2 The Consultant shall review the operating and maintenance manuals and approve same prior to the manuals being sent to the Owner.

.3 The operating and maintenance manuals shall include but not be limited to the following information when applicable in the project:

.1 Certification reports.
.2 Documentation indicating Owner’s receipt of operating instructions.
.3 Complete list of all materials turned over to the Owner c/w receipts for same.
.4 Shop drawings properly indexed and contained in suitably sized binders.
.5 Schematic drawings for all systems indexed and contained in suitably sized envelopes or attached efficiently in the above binders.
.6 Catalogue brochures for light fixtures, panelboards, switches, receptacles, fuses, etc.
.7 All final settings of equipment that has user adjustable settings.
.8 Certificate of Owner’s training.
.9 Acceptance Testing and Commissioning reports.

The above information shall be bound in binders as noted in specifications. Incomplete or poorly reproduced manuals will be rejected.

.4 Maintain, on a daily basis, a complete set of marked-up prints as as-built drawings that show in complete detail the final arrangement and location of all electrical components and the interconnecting wiring.

.5 All riser conduits (size and routing), panel feeds (size and routing), conduit runs (size and routing) and main communications (size and routing) shall be marked on plans. These are to be maintained in a neat and substantial manner, so as to properly and fully illustrate the way in which the installation has been completed.

.6 All equipment locations such as fire alarm signal boosters, cable termination boxes, signal amplifiers, network switches, door controllers, etc shall be identified on the drawings as to their location and quantity (if more than one exists at that particular location).

.7 The Owner's personnel shall be instructed in the operation and maintenance of the following equipment to the satisfaction of the Owner as per the standards referenced herein.

Section No.	Description	Hours
26 50 00	Lighting	1

.8 The above instructions shall be given by personnel experienced in the operation of the particular system or equipment. Each item or type of equipment, and all controls, shall be operated in the presence of the Owner's personnel to ensure their understanding of equipment function and individual working parts. The Owner reserves the right to set the period or periods during which the instruction shall be given. The contractor shall submit a program of instruction for approval by the Owner.

.9 Operating and maintenance manuals shall include written documentation bearing name and signature of Owner's personnel who received the above instructions. Contractor shall allow for all training to be completed in a minimum of two sessions. One session at substantial completion, and one session within three months of turning over the system.

.10 Operating and maintenance manuals, as well as all Owner instructions, shall be complete before substantial completion (as outlined by the Builders' Lien Act) will be considered. Also, preliminary maintenance manuals must be submitted prior to 70% completion. No further progress payments will be permitted until these preliminary maintenance manuals have been submitted and approved.

1.20 STORAGE AND PROTECTION

.1 Maintain and protect all work provided under this Division. Store all materials within a protected enclosure to prevent exposure to weather or construction dirt.

.2 Protect all finished and unfinished work of this and other divisions from damage during the course of construction. Cover floors and other surfaces, if necessary. Any damaged work or finishes shall be repaired or replaced without further charge to the Owner.

1.21 WARRANTY

.1 All materials and workmanship shall be guaranteed for a period of one year from date of substantial completion.

.2 Properly repair and replace all defective work and other work which becomes defective during the term of warranty.

.3 Service on equipment or systems critical to the Owner's operation shall be provided on an emergency basis which may necessitate overtime and service outside of normal working hours. The contractor shall ensure that all suppliers comply with this requirement.

1.22 ELECTRIC MOTORS, EQUIPMENT AND CONTROLS

.1 Supplier and installer responsibility is indicated in Motor, Control and Equipment Schedule on electrical drawings and related mechanical responsibility is indicated on Mechanical Equipment Schedule on mechanical drawings.

.2 Control wiring and conduit is provided by the Electrical Contractor except for conduit, wiring and connections below 50 V which are related to control systems specified in Division 15 and shown on mechanical drawings.

1.23 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 indoor switchboards and distribution enclosures light grey ASA 61.

.2 Clean and touch up surfaces of shop-painted equipment scratched or marred during shipment or installation, to match original paint.

.3 Clean and prime exposed non-galvanized hangers, racks and fastenings to prevent rusting.

1.24 ABBREVIATIONS

.1 Abbreviations used in this specification are common to and in general use within the related trades.

1.25 EQUIPMENT IDENTIFICATION

.1 Nameplates shall be provided on each new piece of electrical equipment, including, receptacle coverplates, power panels, distribution panels, lighting panels, transformers, disconnect switches, contactors, telephone panels, miscellaneous systems and panels.

.2 Nameplates for each new electrical panel shall indicate panel designation, mains voltage and panel and circuit number from which this panel is fed.

.3 Nameplates for new disconnects and contactors shall indicate equipment being controlled, and voltage.

.4 Nameplates for new terminal cabinets shall indicate system and voltage and load of area served.

.5 Nameplates for Normal Power Equipment shall be made from black-white-black Lamecoid with bevelled edges and white engraved letters. Nameplates shall be fastened with self tapping metal screws to equipment in a conspicuous location. Flush mounted panels shall have nameplate located on front of panel behind hinged door.

.6 Typical identification standards shall be used for new equipment throughout the project as follows:

.1 Receptacle coverplates shall be identified with an engraved Lamecoid plate secured to the coverplate as follows:

.1 Circuit number in 4 mm high letters

.2 White Lamecoid label for circuits fed from normal power, red Lamecoid label for circuits fed from emergency power, and blue Lamecoid label for circuits fed from UPS power.

.2 Lighting, receptacle and power panels shall each be identified with an engraved Lamecoid plate secured to top interior trim as:

Panel 202	10 mm high lettering
120/208 volts	6 mm high lettering
Fed from	6 mm high lettering

.3 Each panel shall be supplied with a directory card holder welded to inside of door, complete with a neatly typewritten list showing information as follows:

Panelboard name	202
Panel voltage	120/208 volts

Circuit Number	Description	Load
1	Lighting Room 200 (Main Area)	1200W
2	Receptacles Room 200 (Main Area)	6-15A
3	Room 220	1/3 H.P. Fan

Spaces and spares shall be left blank so as to facilitate future description. Also, existing panels where adjustments have been made in the circuitry shall be field checked in their entirety and new updated directory cards shall be provided.

.4 List shall be covered with a 1 mm thick clear plastic sheet to protect it.

.5 Other cabinets and plywood back boards for low voltage systems, such as signals and communications, shall be identified as panelboards with a directory showing circuit numbers and room locations, plus a blank for "Remarks", as well as a Lamecoid plate designation panel name.

EXAMPLE: if cabinet is for telephone

.....TP - 2nd floor

.6 Equipment not listed above, such as incoming service cables, communicating cables, switchgear, transformers, disconnects, motors, instruments, fire alarm and control panels, shall be identified in a similar manner, showing name and number of the equipment, voltage and load information.

.7 Feeder pull boxes and junction boxes shall be identified with waterproof ink, showing feeder or system concerned. Conduit entering junction boxes for communications systems shall be identified with the room number that each conduit serves.

.8 A small dab of paint shall be applied to inside of each outlet box, pull box and panel as it is installed, using colour code as follows:

Red	-	Fire Alarm System
Yellow	-	Security, Alarm Systems, Card Access
Green	-	Telephone/IT Computer Systems

The outside of the box shall also be identified in this way so as to readily determine the system within the conduit system. The cover of each junction box for branch circuits shall describe the voltage being used by means of a waterproof ink.

.9 No colour code is required for regular lighting and power circuits, but voltage class shall be displayed on all pull boxes and panels.

.10 Junction boxes in furred ceilings shall be colour identified on both inside and outside.

.11 Connections in equipment shall be made Phase 'A', 'B', 'C', from left to right when viewing wiring from front or accessible direction.

.12 Colour coding shall be carried through from incoming utility supply down to and including panels, and shall be as follows:

.1 Incoming utility service lines shall be identified by Red - Phase 'A'; Black - Phase 'B'; Blue - Phase 'C'; with colour coded PVC tape.

.2 Switchgear buswork in each switchboard and unit substation cubicle shall be banded with 3M tape identified in accordance with service lines colour coding. In addition, where neutral bus is introduced, it shall be banded white. Ground bus shall be banded green.

.3 Feeder and sub-feeder bus or conductors shall be banded as above.

.4 Lighting and power panels shall conform to the Canadian Electrical Code, and shall have main bus banded with tape as follows:

Red	-	Phase 'A'
Black	-	Phase 'B'
Blue	-	Phase 'C'
White	-	Neutral
Green	-	Ground

.13 The circuits controlled by all light switches shall be neatly printed with waterproof ink on the side of the switch outlet box so that the panel and circuit number are clearly legible when the coverplate is removed. It shall not be necessary to remove the switch from the outlet box in order to read the panel or circuit number.

1.26 WIRING IDENTIFICATION

.1 Identify wiring with permanent indelible identifying markings, either numbered or coloured plastic tapes, on both ends of phase conductors of feeders and branch circuit wiring.

.2 Maintain phase sequence and colour coding throughout.

.3 Colour code: to CSA C22.1.

.4 Use colour coded wires in communication cables, matched throughout system.

1.27 CONDUIT AND CABLE IDENTIFICATION

.1 Colour code conduits, boxes and metallic sheathed cables.

1.28 WIRING TERMINATIONS

.1 Lugs, terminals, screws used for termination of wiring to be suitable for either copper or aluminum conductors.

1.29 MANUFACTURERS AND CSA LABELS

.1 Visible and legible, after equipment is installed.

1.30 WARNING SIGNS

.1 As specified and to meet requirements of Electrical Inspection Department and Owner.

.2 Decal signs, minimum size 175 x 250 mm.

1.31 LOCATION OF OUTLETS

.1 Locate outlets in accordance with drawings and specifications.

.2 Do not install outlets back-to-back in wall; allow minimum 150 mm horizontal clearance between boxes.

.3 Change location of outlets at no extra cost or credit, providing distance does not exceed 3000 mm, and information is given before installation.

.4 Locate light switches on latch side of doors. Locate disconnect devices in mechanical and electrical on latch side of door.

1.32 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 or as noted on drawings.

.1 Local switches: 1200 mm.

.2 Wall receptacles:

.1 General: 450 mm.

.2 Above top of counters or counter splash backs: 150 mm.

.3 In mechanical rooms: 1400 mm.

.3 Fire alarm stations: 1200 mm.

.4 Fire alarm horn/strobe: 2100 mm.

1.33 LOAD BALANCE

.1 All lighting panels, distribution centres, motor control centres and main switchboards shall be load balanced such that the maximum variation between the two worst phases does not exceed 5%.

.2 Measure phase current to panelboards with normal loads (lighting) operating at time of acceptance. Adjust branch circuit connections as required to obtain best balance of current between phases and record changes.

.3 Measure phase voltages at loads and adjust transformer taps to within 2% of rated voltage of equipment.

.4 Submit, at completion of work, report listing phase and neutral currents on panelboards, dry-core transformers and motor control centres, operating under normal load. State hour and date on which each load was measured, and voltage at time of test.

1.34 CONDUIT AND CABLE INSTALLATION

.1 Install conduit and sleeves prior to pouring of concrete. Sleeves through concrete: 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 to be embedded or plastered over, neatly and close to building structure so furring can be kept to minimum.

.4 All conduit and tray sealing shall be the responsibility of the Electrical Contractor.

1.35 TEMPORARY AND TRIAL USAGE

.1 Temporary and trial usage by the Owner, or the Contractor, of any of the electrical apparatus or equipment, or any work or materials supplied under this Division before final completion and written acceptance, is not to be construed as evidence of acceptance of same by the Owner.

.2 Temporary and trial usage may be made as soon as this Division deems the work sufficiently advanced for making a complete and thorough test of same, and that no claim may be made for the injury to or the breaking of any part of such work which may be so used, whether caused by weakness or inaccuracy of structural parts, or by defective material or workmanship of any kind.

.3 Lighting shall not be used for temporary or trial usage without prior approval of the owner and consultant sign off. If temporary lighting is required for the duration of the project, only construction lamps marked with a permanent ink on the lamp may be used. Evidence of marking will be requested by the consultant. Any fixtures used for temporary or trail usage shall be relamped and cleaned. Evidence of cleaning and relamping will be required by the consultant.

1.36 TEMPORARY LIGHT AND POWER

.1 The General Contractor shall be responsible for all temporary light and power provisions. Refer to General Conditions.

1.37 MATERIAL TO BE TURNED OVER TO THE OWNER

.1 All equipment that is being removed or replaced shall be stockpiled as per Owner's request. The owner may deem that the equipment shall be disposed. All disposal and removal is the responsibility of the contractor.

.2 Materials as indicated in various sections of this specification shall be turned over to the Owner. These materials shall include, but not be limited to the following:

.1 Obtain a signed receipt for each item turned over to the Owner. Include receipts in the operating and maintenance manuals.

1.38 SITE EXAMINATION

.1 The contractor shall visit the existing site during the tendering period to familiarize himself with the construction conditions and electrical work provided to date. The contractor shall thoroughly satisfy himself that the work contained in these drawings and specifications can be carried out and that all costs have been included in the tender submitted.

1.39 CUTTING AND PATCHING

.1 Should any cutting or repairing of either unfinished or finished work be required, the contractor shall employ the particular trade whose work is involved, to do such cutting and patching, and shall pay for any resulting costs.

.2 All holes within buildings shall be fire stopped when penetrating a fire rated structure.

1.40 PAINTING

.1 All iron or steel structures fabricated and installed by Divisions 26, 27, and 28 for supporting panels, starters, conduit or other equipment, shall be wire brushed and given one coat of lead chromate paint primer before being set into place. After all equipment is installed and piping complete, this iron work shall be given two coats of ASA #61 enamel to match the panel or structure being supported or in the colour specified for the product.

.2 All pull boxes, wireways, gutters, etc., fabricated for Divisions 26, 27, and 28, shall be given a coat of lead chromate primer and two coats of ASA #61 enamel before installation to match equipment finish.

.3 All panels and pull boxes that are set in finished walls or ceilings shall have approved flush covers that shall be prime coated with lead chromate paint, and left for the painting division to paint in with the surrounding wall or ceiling finishes. Panel trims and pull box covers to be painted with the cover removed from the wall so that it can be easily installed or removed without damaging the surrounding paint finish.

.4 All electrical equipment shall be finished with an ASA #61 enamel, the colour of which shall be grey, unless otherwise specified.

.5 When installation is complete, all scratches and defects to the paint finishes shall be properly touched up, and where necessary, entire paint surfaces shall be re-done.

1.41 MATERIAL SAFETY DATA AND HAZARDOUS MATERIALS

.1 The Contractor shall provide material safety data sheets on all materials prior to shipping materials to site. These data sheets shall be submitted in triplicate to the Owner.

.2 The Contractor shall coordinate and provide necessary information for the Owner's "Work Place Hazardous Material Information System".

1.42 SCHEDULING OF WORK AND DEMOLITION

.1 Refer also to Division 1 specifications.

.2 The contractor shall make a thorough study of the main distribution and communications systems to ensure the method required to maintain all existing building services during the construction period. All changeovers shall be done during a period of the day found satisfactory to the Owner.

.3 All outages shall be less than two (2) hours in duration. The contractor shall submit the method and procedure of all changeovers for approval by the Consultant and the Owner a minimum of fifteen (15) working days in advance. The Contractor shall anticipate all power outages and change-over to be performed during weekends.

.4 The existing data and voice communication systems, building security system and fire alarm system shall be maintained in a fully operational state while modifications and additions to the systems are installed. Outages of minimal duration possible shall be permitted for the purpose of cutting over new portions of the system.

.5 All outages of systems shall be carried out at dates and times approved by the Owner.

.6 After the modifications to the existing data and voice communications systems, building security system and fire alarm system are complete, any unused portions of the existing systems shall be removed.

.7 Division 26 shall be responsible for the demolition of all existing lighting, electrical systems, communication systems and fire alarm system within the renovation areas. All abandoned conduit, wire and cable (existing conditions and as a result of the renovation work) shall be removed.

.8 All existing power and communication cabling that is found to be abandoned or becomes abandoned within the renovation area, shall be completely removed within the renovation space, as well as back to the source or origin.

All salvaged materials shall remain the property of the Owner, unless otherwise noted, and shall be stockpiled as per the Owner's instructions. The salvageable materials shall be removed for the purpose of reuse, and shall be returned as per the Owner's instructions.

.9 Refer to the overall project schedule for further scheduling requirements.

1.43 LEAD ABATEMENT WORK

.1 The area within the main floor renovation will involve lead abatement work as part of this project. Refer to Specification Section 01 11 00 for the summary of work and rooms affected.

.2 The lead abatement contractor shall be responsible for cleaning existing light fixtures in the rooms noted in Section 01 11 00 prior to their removal as part of the demolition. The electrical contractor shall coordinate the required work with the general contractor and lead abatement contractor, and shall disconnect all existing branch circuitry to these areas prior to the lead abatement work.

Part 2 Products

2.1 NOT USED

.1 Not Used.

Part 3 Execution

3.1 NOT USED

.1 Not Used.

END OF SECTION

CONTRACTOR PROGRESS REPORT ES110

Ritenburg & Associates Ltd.
Consult ng Electrical Eng neers

#200–2222 ALBERT STREET – REGINA, SASK. S4P 2V2
Phone: (306) 569–1303 Fax: (306) 569–1307

ELECTRICAL PROGRESS CLAIM No. _____
DATE _____ 20____
PROJECT _____
ELECTRICAL CONTRACTOR _____
GENERAL CONTRACTOR _____
PRIME CONSULTANT _____
SUBMITTED BY _____

REVIEWED BY: _____
DATE: _____ 20____

RECOMMENDED PAYMENT AS SHOWN ☐ AS CORRECTED ☐ REJECTED ☐

* Cross out if not applicable	TOTAL CONTRACT		COMPLETE TO DATE		THIS PROGRESS	
	MATERIAL	LABOR	MATERIAL	LABOR	MATERIAL	LABOR
A. MAIN SERVICE *HV, Duct Bank, Trans–formers, Switchboards						
B. DISTRIBUTION / PANELS *Distribution Centres, Dry Type Transformers, Fuses						
C. CONDUIT AND BOXES *Tray						
D. WIRE AND CABLE *Bus Duct						
E. MOTOR CONTROL						
F. WIRING DEVICES *Dimmers, Pac Poles, Low Voltage Switching, Cover–plates						
G. LIGHTING FIXTURES & LAMPS						
H. ALARM SYSTEMS *Fire, Security, Signal, Medical						
I. COMMUNICATIONS SYSTEMS *Intercom, Nurses' Call, Data/Telephones						
J. SPECIALS *Emergency Generator, Lightning Protection CCTV, UPS, Trench Duct						
K. MISCELLANEOUS – 8% Maximium						
L. EXTRAS & CREDITS (List price changes seperately, use separate sheet if necessary)						
TOTAL						

SUMMARY TOTAL	Contract $	To Date $	This Progress
	Contract GST $	To Date GST $	This Prog GST $
	Total Amount	Less Holdback	Less Holdback
		Net Amount	Net Amount

% COMPLETE _____

Part 1 General

1.1 GENERAL REQUIREMENTS

.1 The General Conditions of Contract, Division 01 General Requirements and all Addenda thereto form an integral part of and must be read in conjunction with the requirements of this Section.

.2 Cooperate and coordinate with the requirements of other units of work specified in other Sections.

1.2 REFERENCES

.1 The Electrical Contractor shall be bound by industry standards, as interpreted by the Consultant, whether or not specifically referenced in this document. Comply with Electrical Protection Act and rules and regulations made pursuant thereto, including the Canadian Electrical Code. Also, comply with applicable standards of the following:

.1 CSA C22.1-2012, Canadian Electrical Code, Part 1.

.2 Electrical and Electronic Manufacturers Association of Canada (EEMAC).

.3 National Electrical Manufacturers Association (NEMA).

.4 National Building Code 2010 (NBC 2010)

.5 National Fire Protection Association (NFPA)

.6 Institute of Electrical and Electronic Engineers (IEEE).

.7 Audio Engineering Society (AES).

.8 Other Applicable CSA and UL approvals.

1.3 SHOP DRAWINGS AND PRODUCT DATA

.1 Submit shop drawings in accordance with:

.1 Section 01 33 00 - Submittal Procedures

.2 26 05 01 – Common Work Results

.2 Shop drawings shall include but not be limited to device types, cable types, and special mounting details.

1.4 WASTE MANAGEMENT AND DISPOSAL

.1 Meet requirements of Section 01 74 19 - Waste Management and Disposal.

.2 Collect and separate waste for reuse, recycling, and other waste diversion strategies in accordance with Waste Management Plan.

Part 2 Products

2.1 MATERIALS

.1 Pressure type wire connectors: with current carrying parts of copper sized to fit copper conductors as required.

.2 Fixture type splicing connectors: with current carrying parts of copper sized to fit copper conductors #10 AWG or less.

.3 Bushing stud connectors: to EEMAC 1Y-2 to consist of:

- .1 Connector body and stud clamp for round copper conductors.
- .2 Clamp for round copper conductors.
- .3 Stud clamp bolts.
- .4 Sized for conductors as indicated.

.4 Clamps or connectors for armoured cable, aluminum sheathed cable, mineral insulated cable, flexible conduit, non-metallic sheathed cable as required.

Part 3 Execution

3.1 INSTALLATION

.1 Remove insulation carefully from ends of conductors and:

- .1 Apply coat of zinc joint compound on aluminum conductors prior to installation of connectors.
- .2 Install mechanical pressure type connectors and tighten screws with appropriate compression tool recommended by manufacturer. Installation shall meet secureness tests in accordance with CSA C22.2No.65.
- .3 Install fixture type connectors and tighten. Replace insulating cap.
- .4 Install bushing stud connectors in accordance with NEMA.

END OF SECTION

PART 1 General

1.1 GENERAL REQUIREMENTS

.1 The General Conditions of Contract, Division 01 General Requirements and all Addenda thereto form an integral part of and must be read in conjunction with the requirements of this Section.

.2 Cooperate and coordinate with the requirements of other units of work specified in other Sections.

1.2 RELATED SECTIONS

.1 Section 26 05 20 - Wire and Box Connectors - 0 - 1000 V.

1.3 REFERENCES

.1 The Electrical Contractor shall be bound by industry standards as interpreted by the Consultant, whether or not specifically referenced in this document. Comply with Electrical Protection Act and rules and regulations made pursuant thereto, including the Canadian Electrical Code. Also, comply with applicable standards of the following:

.1 CSA C22.1-12, Canadian Electrical Code, Part 1, 2012
.2 Electrical and Electronic Manufacturers Association of Canada (EEMAC).
.3 National Electrical Manufacturers Association (NEMA).
.4 National Building Code 2010 (NBC 2010)
.5 National Fire Protection Association (NFPA)
.6 Institute of Electrical and Electronic Engineers (IEEE)
.7 Audio Engineering Society (AES)
.8 CSA C22.2 No. 0.3-96, Test Methods for Electrical Wires and Cables
.9 CAN/CSA-C22.2 No. 131-M89(R1994), Type TECK 90 Cable
.10 Other Applicable CSA and UL approvals.

1.4 SHOP DRAWINGS AND PRODUCT DATA

.1 Submit shop drawings in accordance with:
.1 Section 01 33 00 - Submittal Procedures
.2 Section 26 05 01 – Common Work Results

.2 Shop drawings shall include manufacturer of the cable indicating type, voltage rating, ampacity, conductor and insulation level.

1.5 PRODUCT APPROVALS

.1 Manufacturers' and model numbers named in these specifications indicate an acceptable technical standard of performance and are not intended to be exclusive. Products submitted as alternates must result in a control system that meets or exceeds all technical performance criteria as described.

.2 Products proposed as alternatives to those specified, shall only be considered if submitted for approval no later than 15 working days before tender close. Submit alternates, for approval, as one complete listing. Provide complete product specification sheets with request for approval.

.3 The Bidder must provide a complete list of primary system products offered with their bid.

1.6 WASTE MANAGEMENT AND DISPOSAL

.1 Meet requirements of Section 01 74 19 - Waste Management and Disposal.

.2 Collect and separate waste for reuse, recycling, and other waste diversion strategies in accordance with Waste Management Plan.

PART 2 Products

2.1 BUILDING WIRES

.1 All conductors shall be copper, minimum No. 12 gauge, unless specifically noted otherwise.

.2 Conductors shall be rated as follows:

.1 #12 AWG to #8 AWG: minimum 600V RW90 XPLE

.2 #6 AWG and larger: minimum 1000V RW90 XPLE

.3 Conductors from motor to variable frequency drives, and from variable frequency drive to source: minimum 1000V RW90 XPLE

.4 Wiring in channel back of fluorescent fixtures shall be 600 volt Type GTF or TEW.

.5 Circuit conductors: copper, size as indicated.

.3 Size, grade of insulation, voltage and manufacturer's name shall be marked at regular intervals.

.4 1000V RWU90 XLPE conductors may be substituted for 1000V RW90 XLPE conductors provided that the conduit size is sized in accordance with the Canadian Electrical Code.

.5 Wiring for feeders 100 amps or larger may be NUAL aluminum and shall be installed only where specifically noted on the drawings.

.6 Conductor utilized in conduit run under slab on grade or in underground conduit shall be Type ‘RWU-90’.

.7 Wire shall be as manufactured by Alcan, BICC General Wire, Nexans or Superior Essex.

2.2 TECK CABLE

.1 Cable: to CAN/CSA-C22.2 No. 131.

.2 Conductors:

.1 Grounding conductor: copper.

.2 Circuit conductors: copper, size as indicated.

.3 Insulation:

.1 Chemically cross-linked thermosetting polyethylene rated type RW90, 600V to 1000V as noted above.

.4 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.

.3 Threaded rods: 6 mm dia. to support suspended channels.

.5 Connectors:

.1 Watertight, approved for TECK cable.

.6 Teck Cable as manufactured by Alcan, BICC General Wire, Nexans or Superior Essex.

2.3 ARMOURED CABLE

.1 Conductors: insulated, copper, size as indicated

.2 Type: AC90

.3 Armour: interlocking type fabricated from galvanized steel strip.

.4 Type: ACWU90

.5 Conductors:

.1 Grounding conductor: copper.

.2 Circuit conductors: copper, size as indicated.

2.4 FIRE RATED CABLES

.1 Conductors: Solid bare soft-annealed copper, single or multi-conductors sized as indicated.

.2 Insulation:

.1 Mineral Insulated Cable: Compressed powered magnesium oxide to form compact homogeneous mass throughout entire length of cable

.2 MC Cable: Ceramifiable silicon insulation

.3 Overall covering:

.1 Mineral Insulated Cable: Annealed seamless copper sheath, Type MI rated 600-volt.

.2 MC Cable: Ceramifiable silicon rubber bedding layer

.4 Cable and Terminations Temperature Ratings: 90°C, 600 Volt

.5 Outer Jacket:

.1 Mineral Insulated Cable: None required

.2 MC Cable: Continuously welded and corrugated copper armour

.6 Fire Rating: Certified to UL 2196 “Tests for Fire Resistvie Cable” to meet two hour rating and listed by Underwriters Laboratories of Canada.

.7 Manufacturers

.1 Mineral Insulated Cable manufactured by Pyrotenax

.2 MC 2-hour rated power cable manufactured by VITALink MC

.8 Terminations/Connectors:

.1 All mineral insulated metal sheathed cables shall be terminated and spliced with compression type connectors, as recommended and supplied by the cable manufacturer. The connectors shall satisfy the bonding and grounding requirements at the supply end.

.2 VITALink MC Cables: Use brass MC Connectors suitable for corrugated copper sheath cable as manufactured by one of the following:

Copper Crouse-Hinds ‘TMC’ series

Hubbell Killark Electric ‘MCR’ series

Thomas & Betts ‘STE’ series

.9 Alternative construction methods in lieu of the specified fire rated cables will not be accepted.

PART 3 Execution

3.1 INSTALLATION OF BUILDING WIRES

.1 All 120/208 volt receptacle and lighting circuits that exceed 30 metres in length from the panel shall be fed with #10 AWG conductors.

.2 All branch circuit conductors shall be sized to limit the voltage drop to a maximum of 3% based on the circuit load of 80% of the circuit protective device.

.3 Termination for #8 AWG and larger shall be by means of approved solderless connector lug. For parallel conductors, a common lug with separate termination for each conductor shall be employed.

.4 Conductor splices shall be made in accordance with specifications. Provide sufficient length for joint remake, and no less than 200 mm spare length. On through wiring, leave 300 mm loop.

.5 Wiring in cabinets, pull boxes, panels and junction boxes shall be neatly trained and held with nylon cable ties.

.6 Conductors shall be tag identified where passing through junction boxes.

3.2 INSTALLATION OF TECK CABLE 0 -1000 V

.1 Install cables.

.2 Group cables wherever possible on channels unless specifically noted otherwise.

.3 Terminate cables in accordance with Section 26 05 20 - Wire and Box Connectors - 0-1000V.

.4 All cables shall be terminated and spliced with suitable compression type connectors, as recommended by the cable manufacturer. The connectors shall satisfy the bonding and grounding requirements at the supply end.

.5 All cables shall be single conductor and copper, unless otherwise specified.

.6 All cable shall be rated for 1000 volts, insulated with cross-linked polyethylene and rated for operation at 90 degrees C. Cable shall have a FT4 rated outer jacket.

.7 All cable shall meet the CSA requirements for cold bend and impact testing at minus 40 degrees C.

.8 All cable shall be protected by a corrugated aluminum sheath or by interlocked aluminum armour. PVC jackets shall be required on all metallic sheathed cables.

.9 The jackets shall meet the FT4 flame spread requirements and be identified on the P.V.C. jacket.

.10 All cables shall be installed in accordance with the manufacturers recommendations, in suitable cable tray as specified within the specifications.

.11 The cables shall be terminated at the supply end on a non-ferrous metallic plate and at the load end on a non-metallic rigid fibre board plate. The cable sheaths shall be bonded at the supply end only.

.12 All cable installed in cable tray shall be installed at one diameter spacing.

.13 When single conductor cables are direct earth buried they shall be spaced 150 mm apart.

3.3 INSTALLATION OF ARMOURED CABLES

.1 Group cables wherever possible.

.2 Armoured cabling may only be installed for motor connections, lighting runs from ceiling to junction boxes, or where noted on plans.

.3 Terminate cables in accordance with Section 26 05 20 - Wire and Box Connectors – 0 - 1000V.

.4 Conductors: insulated, copper, size as indicated.

.5 Type: AC90 - Armour: interlocking type fabricated from aluminum strip.

.6 Type: ACWU90 - jacket over armour meeting requirements of Vertical Tray Fire Test of CSA C22.2 No. 0.3 with maximum flame travel of 1.2 m.

.7 Connectors: as required.

.8 Multi conductor cables shall be color coded during manufacture. Single conductor cables shall be color coded adhesive colour coding tape. The tape shall be applied for a minimum of 75mm at all terminations. Cables shall not be painted under any condition. Color coding shall be as follows:

Phase 'A' – RED	Neutral - WHITE
Phase 'B' – BLACK	Ground – GREEN or Bare
Phase 'C' – BLUE	

3.4 INSTALLATION OF FIRE RATED CABLES

.1 Cables shall be shipped from the manufacturer with ends temporarily sealed against moisture egress. Cable shall be stored in a clean dry location.

.2 When cables are cut in the field, the end shall be sealed by means of standards sealing compound and PVC tape.

.3 Installation of fire rated cables shall be in accordance with the manufacturer's installation instructions.

.4 Bending:

.1 Mineral Insulated Cable: no less than six (6) times the cable diameter for cable not more than 250 MCM.

.2 MC Fire Rated Cable: as per manufacturer's requirements.

.5 Pulling: In accordance with the manufacturer's installation instructions.

.6 Splicing: In field splices will not be accepted.

.7 Exposed or surface installations;

.1 Secure direct to fire rated building structure

.2 Straps: Stainless steel or copper straps

.3 Steel struts or Cable Tray: Aluminum or other materials not acceptable.

.8 Fire rated cables shall not contact sprinkler lines, EMT conduit or rigid steel conduit. Do not support fire rated cables to sprinkler lines and conduit.

.9 Use of nylon cable ties to support fire rated cables will not be accepted.

.10 Through wall or floor penetrations:

.1 Install sleeve to protect cable.

.2 Apply approved fire stopping of all penetrations.

.11 Support 2-hour rated cables at 1 meter intervals (maximum) for both horizontal and vertical runs. Run parallel to building lines.

.12 Make cable terminations by using factory-made kits.

.13 At cable terminations, use thermoplastic sleeving over bare conductors.

.14 Where cables are buried in cast concrete or masonry, sleeve for entry and exit of cables.

.15 Do not splice cables.

END OF SECTION

Part 1 General

1.1 GENERAL REQUIREMENTS

.1 The General Conditions of Contract, Division 01 General Requirements and all Addenda thereto form an integral part of and must be read in conjunction with the requirements of this Section.

.2 Cooperate and coordinate with the requirements of other units of work specified in other Sections.

1.2 REFERENCES

.1 The Electrical Contractor shall be bound by industry standards, as interpreted by the Consultant, whether or not specifically referenced in this document. Comply with Electrical Protection Act and rules and regulations made pursuant thereto, including the 2012 Canadian Electrical Code. Also, comply with applicable standards of the following:

.1 CSA C22.1-2012, Canadian Electrical Code, Part 1.
.2 Electrical and Electronic Manufacturers Association of Canada (EEMAC).
.3 National Electrical Manufacturers Association (NEMA).
.4 National Building Code 2010 (NBC 2010)
.5 National Fire Protection Association (NFPA)
.6 Institute of Electrical and Electronic Engineers (IEEE).
.7 Audio Engineering Society (AES).
.8 Other Applicable CSA and UL approvals.

1.3 SHOP DRAWINGS AND PRODUCT DATA

.1 Submit shop drawings in accordance with:

.1 Section 01 33 00 - Submittal Procedures
.2 Section 26 05 01 – Common Work Results

.2 Shop drawings shall include but not be limited to connectors used, specialty ground bars, etc.

1.4 PRODUCT APPROVALS

.1 Manufacturers' and model numbers named in these specifications indicate an acceptable technical standard of performance and are not intended to be exclusive. Products submitted as alternates must result in a control system that meets or exceeds all technical performance criteria as described.

.2 Products proposed as alternatives to those specified, shall only be considered if submitted for approval no later than 15 working days before tender close. Submit alternates, for approval, as one complete listing. Provide complete product specification sheets with request for approval.

.3 The Bidder must provide a complete list of primary system products offered with their bid.

□

1.5 WASTE MANAGEMENT AND DISPOSAL

.1 Meet requirements of Section 01 74 19 - Waste Management and Disposal.

.2 Collect and separate waste for reuse, recycling, and other waste diversion strategies in accordance with Waste Management Plan.

Part 2 Products

2.1 EQUIPMENT

.1 Clamps for grounding of conductor: size as required to electrically conductive underground water pipe.

.2 All ground rods shall be 20 mm diameter by 3000 mm long, copper clad.

.3 Grounding conductors: bare stranded copper.

.4 Insulated grounding conductors: green

.5 Ground bus: copper, complete with insulated supports, fastenings, connectors.

.6 Non-corroding accessories necessary for grounding system, type, size, material as indicated, including but not necessarily limited to:

- .1 Grounding and bonding bushings.
- .2 Protective type clamps.
- .3 Bolted type conductor connectors.
- .4 Thermit welded type conductor connectors.
- .5 Bonding jumpers, straps.
- .6 Pressure wire connectors.

.7 All ground conductors shall be bare or insulated, stranded, medium hard drawn copper wire. All insulated ground wires shall be green.

.8 Exposed copper shall be cleaned to a bright surface, and shall be finished with two coats of clean, insulating varnish.

.9 Connect ground conductor to copper water pipe at least twice (minimum 40 mm diameter), utilizing a Burndy Type GAR pipe clamp. Provide jumper across water meter.

.10 All connections to the ground bus or risers shall be thermowelded, or shall utilize the Burndy Hy-Ground compression connections. Clamp type connections shall only be allowed to individual pieces of equipment.

.11 Where bonds are covered with soil, the conductors are to be coated with anti-corrosion compound "Kopr-Shield" (Thomas & Betts Co.) before compression connector is applied. All bonding shall be done with 'C' tap and lug compression connectors.

□

Part 3 Execution

3.1 INSTALLATION GENERAL

.1 Electrical equipment and wiring shall be grounded in accordance with the Canadian Electrical Code, and local inspection authority's rules and regulations.

.2 All metallic raceways and conduits for communications, cable and conductors shall be grounded.

.3 All motors with flexible connections shall have separate ground wire run bridging the flexible connections. This ground wire shall be run from the motor back to the nearest junction box or motor control centre where the termination can be readily inspected. Insulation for this wire shall be green.

.4 Lay-in trays and feeder conduits shall be connected to the ground bus.

.5 All panel feeds at 208 volt shall include a building network ground conductor.

.6 All grounding conductors outside the electrical rooms and closets shall be insulated and installed in conduits, unless otherwise noted.

.7 Install connectors in accordance with manufacturer's instructions.

.8 Protect exposed grounding conductors from mechanical injury.

.9 Use mechanical connectors for grounding connections to equipment provided with lugs.

.10 Install bonding wire for flexible conduit, connected at both ends to grounding bushing, solderless lug, clamp or cup washer and screw. Neatly cleat bonding wire to exterior of flexible conduit.

.11 Install flexible ground straps for bus duct enclosure joints, where such bonding is not inherently provided with equipment.

.12 Structural steel and metal siding to ground by welding copper to steel.

.13 Make grounding connections in radial configuration only, with connections terminating at single grounding point. Avoid loop connections unless indicated otherwise.

.14 Use mechanical connectors for grounding connections to equipment provided with lugs.

.15 Soldered joints not permitted.

.16 Install separate ground conductor to outdoor lighting standards.

.17 Make grounding connections in radial configuration only. Avoid loop connections.

.18 Bond single conductor, metallic armoured cables to cabinet at supply end, and provide non-metallic entry plate at load end.

□

3.2 SYSTEM AND CIRCUIT GROUNDING

.1 Install system and circuit grounding connections to neutral of secondary systems.

3.3 EQUIPMENT GROUNDING

.1 Install grounding connections to typical equipment included in, but not necessarily limited to following list. Service equipment, duct systems, frames of motors, starters, control panels, structure steel work, and distribution panels.

3.4 COMMUNICATION SYSTEMS

.1 Install grounding connections for all communication and security systems as per manufacturer's recommendations

3.5 FIELD QUALITY CONTROL

.1 Perform tests in accordance with Section 26 05 01 - Common Work Results - Electrical.

.2 Perform tests before energizing electrical system.

.3 Disconnect ground fault indicator during tests.

.4 All grounding conductors outside the electrical rooms and closets shall be insulated and installed in conduits, unless otherwise noted.

.5 Connections to equipment shall be made with, bronze or copper bolts and connectors.

.6 Equipment grounds shall be connected to the building grounding network. All non-current carrying metallic parts of equipment shall be connected to the ground network.

END OF SECTION

□

Part 1 General

1.1 GENERAL REQUIREMENTS

.1 The General Conditions of Contract, Division 01 General Requirements and all Addenda thereto form an integral part of and must be read in conjunction with the requirements of this Section.

.2 Cooperate and coordinate with the requirements of other units of work specified in other Sections.

1.2 REFERENCES

.1 The Electrical Contractor shall be bound by industry standards, as interpreted by the Consultant, whether or not specifically referenced in this document. Comply with Electrical Protection Act and rules and regulations made pursuant thereto, including the 2012 Canadian Electrical Code. Also, comply with applicable standards of the following:

.1 CSA C22.1-2012, Canadian Electrical Code, Part 1.
.2 Electrical and Electronic Manufacturers Association of Canada (EEMAC).
.3 National Electrical Manufacturers Association (NEMA).
.4 National Building Code 2010 (NBC 2010)
.5 National Fire Protection Association (NFPA)
.6 Institute of Electrical and Electronic Engineers (IEEE).
.7 Audio Engineering Society (AES).
.8 Other Applicable CSA and UL approvals.

.2 Submit shop drawings in accordance with:

.1 Section 01 33 00 - Submittal Procedures
.2 Section 26 05 01 – Common Work Results

1.3 PRODUCT APPROVALS

.1 Manufacturers' and model numbers named in these specifications indicate an acceptable technical standard of performance and are not intended to be exclusive. Products submitted as alternates must result in a control system that meets or exceeds all technical performance criteria as described.

.2 Products proposed as alternatives to those specified, shall only be considered if submitted for approval no later than 15 working days before tender close. Submit alternates, for approval, as one complete listing. Provide complete product specification sheets with request for approval.

.3 The Bidder must provide a complete list of primary system products offered with their bid.

1.4 WASTE MANAGEMENT AND DISPOSAL

.1 Meet requirements of Section 01 74 19 - Waste Management and Disposal.

□

.2 Collect and separate waste for reuse, recycling, and other waste diversion strategies in accordance with Waste Management Plan.

Part 2 Products

2.1 SUPPORT CHANNELS

.1 U shape, size 41 x 41 mm, 2.5 mm thick, surface mounted suspended or set in poured concrete walls and ceilings.

Part 3 Execution

3.1 INSTALLATION

.1 Secure equipment to poured concrete with expandable inserts.

.2 Secure equipment to hollow masonry walls or suspended ceilings with toggle bolts.

.3 Secure surface mounted equipment with twist clip fasteners to inverted T bar ceilings. Ensure that T bars are adequately supported to carry weight of equipment specified before installation.

.4 Support equipment, conduit or cables using clips, spring loaded bolts, cable clamps designed as accessories to basic channel members.

.5 Fasten exposed conduit or cables to building construction or support system using straps.

- .1 One-hole steel straps to secure surface conduits and cables 50 mm and smaller.
- .2 Two-hole steel straps for conduits and cables larger than 50 mm.
- .3 Beam clamps to secure conduit to exposed steel work.

.6 Suspended support systems.

- .1 Support individual cable or conduit runs with 6 mm dia threaded rods and spring clips.
- .2 Support 2 or more cables or conduits on channels supported by 6 mm dia threaded rod hangers where direct fastening to building construction is impractical.

.7 For surface mounting of two or more conduits, use channels spaced as required by C22.1.

.8 Provide metal brackets, frames, hangers, clamps and related types of support structures where indicated or as required to support conduit and cable runs.

.9 Ensure adequate support for raceways and cables dropped vertically to equipment where there is no wall support.

.10 Do not use wire lashing or perforated strap to support or secure raceways or cables.

.11 Do not use supports or equipment installed for other trades for conduit or cable support except with permission of other trade and approval of Engineer.

□

.12 Install fastenings and supports as required for each type of equipment cables and conduits, and in accordance with manufacturer's installation recommendations.

3.2 WARRANTY

.1 The contractor must make available to the Owner a local service department of a duly authorized distributor of the equipment manufacturer, which shall stock the manufacturer's standard parts. The service department shall have at least one factory trained repair technician available to the Owner on 24 hours' notice.

.2 Provide warranty of installation of equipment installed by this contractor to be free of defects for a period of (1) one year from date of Substantial Completion.

.3 Provide during the warranty period, all service, maintenance, parts, etc., required for normal operation of the systems, such that Owner needs not purchase additional maintenance agreement or contracts. Upon request, the manufacturer and his agent shall provide direct to the Owner the following proposals:

.1 Continuation, after the warranty period, of full maintenance, including all service, labour, parts, etc. required to maintain the systems in a fully operational condition.

END OF SECTION

□

Part 1 General

1.1 GENERAL REQUIREMENTS

.1 The General Conditions of Contract, Division 01 General Requirements and all Addenda thereto form an integral part of and must be read in conjunction with the requirements of this Section.

.2 Cooperate and coordinate with the requirements of other units of work specified in other Sections.

1.2 REFERENCES

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.5 National Fire Protection Association (NFPA)
.6 Institute of Electrical and Electronic Engineers (IEEE).
.7 Audio Engineering Society (AES).
.8 Other Applicable CSA and UL approvals.

1.3 SHOP DRAWINGS AND PRODUCT DATA

.1 Submit shop drawings in accordance with:

.1 Section 01 33 00 - Submittal Procedures
.2 Section 26 05 01 – Common Work Results

1.4 PRODUCT APPROVALS

.1 Manufacturers' and model numbers named in these specifications indicate an acceptable technical standard of performance and are not intended to be exclusive. Products submitted as alternates must result in a control system that meets or exceeds all technical performance criteria as described.

.2 Products proposed as alternatives to those specified, shall only be considered if submitted for approval no later than 15 working days before tender close. Submit alternates, for approval, as one complete listing. Provide complete product specification sheets with request for approval.

1.5 WASTE MANAGEMENT AND DISPOSAL

.1 Meet requirements of Section 01 74 19 - Waste Management and Disposal.

□

.2 Collect and separate waste for reuse, recycling, and other waste diversion strategies in accordance with Waste Management Plan.

Part 2 Products

2.1 SPLITTERS

.1 Sheet metal enclosure, welded corners and formed hinged cover suitable for locking in closed position.

.2 Main and branch lugs to match required size and number of incoming and outgoing conductors as indicated.

.3 At least three spare terminals on each set of lugs in splitters.

2.2 JUNCTION AND PULL BOXES

.1 Welded steel construction with screw-on flat covers for surface mounting.

.2 Covers with 25 mm minimum extension all around, for flush-mounted pull and junction boxes.

2.3 CABINETS

.1 Sheet steel, hinged door and return flange overlapping sides, handle, lock and catch, for surface mounting.

Part 3 Execution

3.1 CLOSEOUT SUBMITTALS

.1 Provide operation and maintenance information for incorporation into manual specified in:

.1 Section 01 78 00 - Closeout Submittals

.2 Include:

.1 List specifying each piece of equipment in system or subsystem by its original manufacturer name and model number.

.2 Parts list specifying parts used in equipment by identification numbers that are standard to electronic industry.

3.2 SPLITTER INSTALLATION

.1 Install splitters and mount plumb, true and square to the building lines.

.2 Extend splitters full length of equipment arrangement except where indicated otherwise.

3.3 JUNCTION, PULL BOXES AND CABINETS INSTALLATION

.1 Install pull boxes in inconspicuous but accessible locations.

□

.2 Mount cabinets with top not higher than 2 m above finished floor.

.3 Install terminal / bix block where indicated in cabinets.

.4 Only main junction and pull boxes are indicated. Provide others as required by code. Install pull boxes so as not to exceed 30m of conduit run between pull boxes.

3.4 IDENTIFICATION

.1 Provide equipment identification in accordance with Section 26 05 01 - Common Work Results - Electrical.

.2 Install size 2 identification labels indicating system name, voltage and phase, Emergency, or Normal power.

3.5 WARRANTY

.1 The contractor must make available to the Owner a local service department of a duly authorized distributor of the equipment manufacturer, which shall stock the manufacturer's standard parts. The service department shall have at least one factory trained repair technician available to the Owner on 24 hours' notice.

.2 Provide warranty of installation of equipment installed by this contractor to be free of defects for a period of (1) one year from date of Substantial Completion.

.3 Provide during the warranty period, all service, maintenance, parts, etc., required for normal operation of the systems, such that Owner needs not purchase additional maintenance agreement or contracts. Upon request, the manufacturer and his agent shall provide direct to the Owner the following proposals:

.1 Continuation, after the warranty period, of full maintenance, including all service, labour, parts, etc. required to maintain the systems in a fully operational condition.

END OF SECTION

□

Part 1 General

1.1 GENERAL REQUIREMENTS

.1 The General Conditions of Contract, Division 01 General Requirements and all Addenda thereto form an integral part of and must be read in conjunction with the requirements of this Section.

.2 Cooperate and coordinate with the requirements of other units of work specified in other Sections.

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.4 National Building Code 2010 (NBC 2010)
.5 National Fire Protection Association (NFPA)
.6 Institute of Electrical and Electronic Engineers (IEEE).
.7 Audio Engineering Society (AES).
.8 Other Applicable CSA and UL approvals.

1.3 SHOP DRAWINGS AND PRODUCT DATA

.1 Submit shop drawings in accordance with:

.1 Section 01 33 00 - Submittal Procedures
.2 Section 26 05 01 – Common Work Results

.2 Shop drawings shall include but not be limited to speakers, riser diagram, cable types, and special mounting details.

1.4 PRODUCT APPROVALS

.1 Manufacturers' and model numbers named in these specifications indicate an acceptable technical standard of performance and are not intended to be exclusive. Products submitted as alternates must result in a control system that meets or exceeds all technical performance criteria as described.

.2 Products proposed as alternatives to those specified, shall only be considered if submitted for approval no later than 15 working days before tender close. Submit alternates, for approval, as one complete listing. Provide complete product specification sheets with request for approval.

□

.3 The Bidder must provide a complete list of primary system products offered with their bid.

1.5 WASTE MANAGEMENT AND DISPOSAL

.1 Meet requirements of Section 01 74 19 - Waste Management and Disposal.

.2 Collect and separate waste for reuse, recycling, and other waste diversion strategies in accordance with Waste Management Plan.

Part 2 Products

2.1 OUTLET AND CONDUIT BOXES GENERAL

.1 Size boxes in accordance with CSA C22.1.

.2 102 mm square or larger outlet boxes as required for special devices.

.3 Gang boxes where wiring devices are grouped.

.4 Provide blank cover plates for boxes without wiring devices.

.5 Provide combination boxes with barriers where outlets for more than one system are grouped.

.6 Each outlet box installed in steel stud and gyproc walls shall be mounted on Caddy #BHA, series SGB or TSGB screw gun brackets. Wood strapping with steel studs shall not be utilized for supporting outlet boxes

.7 Use condulets where 90° turn required on wall mounted conduit. They shall be of the type where cover screws do not enter the wire chamber and covers are left accessible.

.8 Each outlet box installed in acoustic tile ceilings shall be mounted on double Caddy "Tee Bar Hanger" #512 in such a manner that the outlet box will not twist in any direction.

.9 Where boxes are surface mounted in unfinished areas, such as furnace or boiler rooms, stamped galvanized steel 100 mm square box to accept #8300 series raised covers shall be used.

.10 Where surface wiring methods are allowed and approved in finished areas, use Hubbell or Wiremold boxes as per drawings c/w suitable adapter for wireway entrance.

.11 Outdoors or damp locations, boxes shall be cast Feraloy or aluminum type 'FS', with threaded hubs and vapourproof covers.

.12 Indoors, stamped zinc cadmium plated steel boxes shall be provided and set for each fixture, switch, wall receptacle or other types of outlets, adapted to suit its respective location and designed to accept its particular components.

.13 Standard octagon boxes shall be 100 mm diameter, 53 mm deep minimum. Increase depth where area fill requires. Equip each box used for fixture hanging with a fixture stud.

.14 Two gang or larger shall be solid type with raised cover for tile, block or gyproc finish.

□

.15 Wood strapping with steel studs shall not be utilized for supporting outlet boxes.

.16 Set boxes plumb and level within 6 mm of finished surface. Mats not permitted.

.17 Where required, provide voltage separation barriers.

2.2 SHEET STEEL OUTLET BOXES

.1 Electro-galvanized steel 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.

.2 Standard octagon boxes shall be 100 mm diameter, 53 mm deep minimum. Increase depth where area fill requires. Equip each box used for fixture hanging with a fixture stud.

.3 102 mm square outlet boxes with extension and plaster rings for flush mounting devices in finished walls.

.4 102 mm square or octagonal outlet boxes for lighting fixture outlets.

.5 102 mm square outlet boxes with extension and plaster rings for flush mounting devices in finished plaster walls.

2.3 MASONRY BOXES

.1 Electro-galvanized steel masonry single and multi-gang boxes for devices flush mounted in exposed block walls.

2.4 CONCRETE BOXES

.1 Electro-glavanized sheet steel concrete type boxes for flush mount in concrete with matching extension and plaster rings as required.

2.5 CONDUIT BOXES

.1 Outdoors or damp locations, boxes shall be cast Feraloy or aluminum type 'FS', with threaded hubs and vapourproof covers.

.2 Indoors, stamped zinc cadmium plated steel boxes shall be provided and set for each fixture, switch, wall receptacle or other types of outlets, adapted to suit its respective location and designed to accept its particular components.

.3 Standard octagon boxes shall be 100 mm diameter, 53 mm deep minimum. Increase depth where area fill requires. Equip each box used for fixture hanging with a fixture stud.

.4 Two gang or larger shall be solid type with raised cover for tile, block or gyproc finish.

.5 Wood strapping with steel studs shall not be utilized for supporting outlet boxes.

.6 Set boxes plumb and level within 6 mm of finished surface. Mats not permitted.

.7 Where required, provide voltage separation barriers.

□

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 32 mm and pull boxes for larger conduits.

.4 Double locknuts and insulated bushings on sheet metal boxes.

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. Reducing washers are not allowed.

.5 Outlet boxes shall be supported independently of conduit capable of supporting weight of fixture or other device. Conduit entering the back of a box shall not enter the centre knockout.

.6 For recessed fixtures in suspended ceilings, outlet box shall be accessible when fixture is removed.

.7 Flexible conduit to fixture shall be minimum 12 mm diameter, and shall not emanate from outlet box cover. Maximum length of flexible conduit from outlet box to fixture shall be 3000 mm. Outlet box for fixture shall not be located above ducts, pipes, etc. Outlet box shall be within 750 mm (vertically) of the fixture.

.8 Provide and set all special communications type back boxes associated with systems specified under Electrical Divisions.

.9 In placing outlets, allow for overhead pipes, ducts, etc., and for variation in wall and ceiling finishes, door and window trim, panelling, etc.

.10 Location of receptacle outlets in equipment rooms shall be finalized during construction to give optimum arrangement. Consultant to approve locations before installation.

.11 Multigang boxes shall have each gang fully barriered from the next, or multiple single gang boxes may be used, provided they are installed in a neat, orderly fashion. Barriers shall be steel and shall be firmly held in place.

Attention is directed to special outlet box locations for switches requiring wider mount spacing rejection feature.

□

3.2 CLOSEOUT SUBMITTALS

.1 Provide operation and maintenance information for incorporation into manual specified in:

.1 Section 01 78 00 - Closeout Submittals

.2 Include:

.1 Operation instructions

.2 Description of system operation

.3 Description of each subsystem operation

.4 List specifying each piece of equipment in system or subsystem by its original manufacturer name and model number.

.5 Parts list specifying parts used in equipment by identification numbers that are standard to electronic industry.

3.3 WARRANTY

.1 The contractor must make available to the Owner a local service department of a duly authorized distributor of the equipment manufacturer, which shall stock the manufacturer's standard parts. The service department shall have at least one factory trained repair technician available to the Owner on 24 hours' notice.

.2 Provide warranty of installation of equipment installed by this contractor to be free of defects for a period of (1) one year from date of Substantial Completion.

.3 Provide during the warranty period, all service, maintenance, parts, etc., required for normal operation of the systems, such that Owner needs not purchase additional maintenance agreement or contracts. Upon request, the manufacturer and his agent shall provide direct to the Owner the following proposals:

.1 Continuation, after the warranty period, of full maintenance, including all service, labour, parts, etc. required to maintain the systems in a fully operational condition.

END OF SECTION

□

Part 1 General

1.1 GENERAL REQUIREMENTS

.1 The General Conditions of Contract, Division 01 General Requirements and all Addenda thereto form an integral part of and must be read in conjunction with the requirements of this Section.

.2 Cooperate and coordinate with the requirements of other units of work specified in other Sections.

1.2 REFERENCES

.1 The Electrical Contractor shall be bound by industry standards, as interpreted by the Consultant, whether or not specifically referenced in this document. Comply with Electrical Protection Act and rules and regulations made pursuant thereto, including the 2012 Canadian Electrical Code. Also, comply with applicable standards of the following:

.1 CSA C22.1-2012, Canadian Electrical Code, Part 1.
.2 Electrical and Electronic Manufacturers Association of Canada (EEMAC).
.3 National Electrical Manufacturers Association (NEMA).
.4 National Building Code 2010 (NBC 2010)
.5 National Fire Protection Association (NFPA)
.6 Institute of Electrical and Electronic Engineers (IEEE).
.7 Audio Engineering Society (AES).
.8 Other Applicable CSA and UL approvals.

1.3 SHOP DRAWINGS AND PRODUCT DATA

.1 Submit shop drawings in accordance with:

.1 Section 01 33 00 - Submittal Procedures
.2 Section 26 05 01 – Common Work Results

1.4 PRODUCT APPROVALS

.1 Manufacturers' and model numbers named in these specifications indicate an acceptable technical standard of performance and are not intended to be exclusive. Products submitted as alternates must result in a control system that meets or exceeds all technical performance criteria as described.

.2 Products proposed as alternatives to those specified, shall only be considered if submitted for approval no later than 15 working days before tender close. Submit alternates, for approval, as one complete listing. Provide complete product specification sheets with request for approval.

.3 The Bidder must provide a complete list of primary system products offered with their bid.

□

1.5 WASTE MANAGEMENT AND DISPOSAL

.1 Meet requirements of Section 01 74 19 - Waste Management and Disposal.

.2 Collect and separate waste for reuse, recycling, and other waste diversion strategies in accordance with Waste Management Plan.

Part 2 Products

2.1 CONDUITS

.1 Electrical metallic tubing (EMT): to CSA C22.2 No. 83, with couplings.

.2 Rigid PVC conduit: to CSA C22.2 No. 211.2.

.3 Flexible metal conduit: to CSA C22.2 No. 56, liquid-tight flexible metal.

.4 Flexible PVC conduit: to CAN/CSA-C22.2 No. 227.3

.5 Conduit for use in corrosive atmospheres shall be rigid PVC or rigid steel with extruded PVC jacketed. Refer to drawings for areas requiring PVC.

.6 Condulets shall be of a type wherein cover screws do not enter the wire chamber.

.7 Flexible conduit connections to all mechanical equipment shall be of 'Sealtite' manufacture.

.8 Flexible conduit connectors shall be of the insulated throat type.

.9 Condulets with suitable covers shall be used where condulets are exposed. Each conduit fitting shall be of a type suitable to its particular use, and of a type which will allow installation of future conduits without blocking covers of existing condulets.

.10 Expansion joints shall be installed with ground jumper.

.11 All conduits shall be terminated with a suitable bushing.

.12 Flexible conduit and Rigid conduit entering boxes or enclosures shall be terminated with nylon insulated steel threaded bushings, grounded type.

2.2 CONDUIT FASTENINGS

.1 One hole steel straps to secure surface conduits 50 mm and smaller. 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 1.5 m oc.

.4 Threaded rods, 6 mm dia., to support suspended channels.

□

2.3 CONDUIT FITTINGS

.1 Fittings: manufactured for use with conduit / raceway specified. Coating: same as conduit / raceway.

.2 Factory "ells" where 90º bends are required for 25 mm and larger conduits / raceways.

2.4 EXPANSION FITTINGS FOR RIGID CONDUIT

.1 Weatherproof expansion fittings with internal bonding assembly suitable for 100 mm linear expansion.

.2 Watertight expansion fittings with integral bonding jumper suitable for linear expansion and 19 mm deflection in all directions.

.3 Weatherproof expansion fittings for linear expansion at entry to panel.

2.5 FISH CORD

.1 Polypropylene.

Part 3 Execution

3.1 INSTALLATION

.1 Install conduits to conserve headroom in exposed locations and cause minimum interference in spaces through which they pass.

.2 Conduits and cables shall be supported, at regular intervals, with corrosion resisting clamps. Lead anchors or expansion bolts shall be used to attach clamps to masonry walls.

.3 Conduit and cables shall be installed to avoid proximity to water and heating pipes. They shall not run within 150 mm of such pipes, except where crossings are unavoidable, in which case they shall be kept at least 25 mm from covering of pipe crossed.

.4 Cap ends of all conduits to prevent entrance of foreign matter during construction. Manufactured caps shall be employed.

.5 Conduit shall be installed as close to building structure as possible so that where concealed, necessary furring can be kept to a minimum.

.6 Empty conduits, installed under this Division but in which wiring will be installed by others, shall be swabbed out with "Jet Line" foam packs, and be c/w Polypropylene pull wire or polytwine.

.7 Conduits shall be installed at right angles or parallel to building lines, accurate in line and level.

.8 Conduit shall not be bent over sharp objects. Improperly formed bends and running threads will not be accepted. Bends and fittings shall not be used together. Proper supports of manufactured channels shall be provided where exposed conduits and cable runs are grouped.

□

.9 Under no condition will EMT be allowed exposed within 1200 mm of floor, outdoors, or in areas where explosive, corrosive or moist atmosphere exists.

.10 Not more than four (4) 90 degree bends or equivalent offsets will be permitted between pull boxes. When maximum number of bends are used, the total run between pull boxes shall not exceed 18000 mm.

.11 PVC conduit shall not pass through a fire partition or floor separation. Where it is necessary for PVC conduits to pass through a fire barrier, a transition to rigid steel conduit shall be provided for 2000 mm on either side of the fire barrier.

.12 Surface mount conduits except where noted otherwise.

.13 Use rigid PVC conduit in corrosive areas or as indicated on plans.

.14 Use flexible metal conduit or Teck90 for connection to motors.

.15 Use liquid tight flexible metal conduit or Teck90 for connection to motors or vibrating equipment in damp, wet or corrosive locations.

.16 Use explosion proof flexible connection for connection to explosion proof motors.

.17 Minimum conduit size for lighting and power circuits: 19 mm.

.18 Bend conduit cold. Replace conduit if kinked or flattened more than 1/10th of its original diameter. Mechanically bend steel conduit over 19 mm dia.

.19 Field threads on rigid conduit must be of sufficient length to draw conduits up tight.

.20 Install pulltwine in all empty conduits / raceways and conduits / raceways that are less than 40% filled.

.21 Remove and replace blocked conduit sections. Do not use liquids to clean out conduits.

.22 Dry conduits out before installing wire.

.23 Conduits/Cabling/raceways are not to be run within concrete floors/ceilings. Any conduits/cabling/raceways required to be run along the concrete slabs shall be surface run and not recessed into the concrete. Any instances where cabling is required to be run vertically within concrete poured walls, coreline may be used as the raceway but it shall be transitioned to EMT or Rigid Steel (where required) with interfacing connectors or junction boxes being provided as required. This specification contains references to cast in place conduits. This is only applicable where specifically called for in certain locations within the documents.

3.2 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 surface 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.

3.3 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.

3.4 CONDUITS UNDERGROUND

.1 Slope conduits to provide drainage.

.2 Waterproof joints (pvc excepted) with heavy coat of bituminous paint.

3.5 CLOSEOUT SUBMITTALS

.1 Provide operation and maintenance information for incorporation into manual specified in:

.1 Section 01 78 00 - Closeout Submittals

.2 Include:

.1 List specifying each piece of equipment in system or subsystem by its original manufacturer name and model number.

.2 Parts list specifying parts used in equipment by identification numbers that are standard to electronic industry.

3.6 WARRANTY

.1 The contractor must make available to the Owner a local service department of a duly authorized distributor of the equipment manufacturer, which shall stock the manufacturer's standard parts. The service department shall have at least one factory trained repair technician available to the Owner on 24 hours' notice.

.2 Provide warranty of installation of equipment installed by this contractor to be free of defects for a period of (1) one year from date of Substantial Completion.

Provide during the warranty period, all service, maintenance, parts, etc., required for normal operation of the systems, such that Owner needs not purchase additional maintenance agreement or contracts.

END OF SECTION

□

Part 1 General

1.1 GENERAL REQUIREMENTS

.1 The General Conditions of Contract, Division 01 General Requirements and all Addenda thereto form an integral part of and must be read in conjunction with the requirements of this Section.

.2 Cooperate and coordinate with the requirements of other units of work specified in other Sections.

.3 Section 01 33 00 - Submittal Procedures.

.4 Section 01 74 19 - Construction/Demolition Waste Management And Disposal.

1.2 REFERENCES

.1 Canadian Standards Association (CSA International)

.1 CAN/CSA C22.2No.126-M91(R1997), Cable Tray Systems.

.2 National Electrical Manufacturers Association (NEMA) standards

.1 NEMA FG 1-1993, Fibreglass and Cable Tray Systems.

.2 NEMA VE 1-1998, Metal Cable Tray Systems.

1.3 SHOP DRAWINGS AND PRODUCT DATA

.1 Submit shop drawings and product data in accordance with section 01 33 00 - Submittal Procedures.

.2 Identify types of cabletroughs used.

.3 Show actual cabletrough installation details and suspension system.

1.4 WASTE MANAGEMENT AND DISPOSAL

.1 Meet requirements of Section 01 74 19 - Waste Management and Disposal.

.2 Collect and separate waste for reuse, recycling, and other waste diversion strategies in accordance with Waste Management Plan.

Part 2 Products

2.1 CABLETROUGH / CABLE TRAY

.1 Provide solid cable tray and basket style cable tray in widths and locations noted on drawings.

.2 Cable trays shall be complete with necessary factory elbows, fittings, joiner plates, radius turns, supports, etc., as necessary for the total installation.

.3 Cable tray shall be provided for communications conductors where shown on the drawings. The cable tray shall be used for the running of data/voice communications cables, coax cable.

.4 The cable tray shall not be used for the running of low-voltage Class 2 control wiring.

.5 Solid cable tray shall be 12 gauge steel construction, minimum of 105mm deep, 305mm or 450mm widths as noted on the drawings, in standard 3048mm lengths, with hinged cover. Solid tray shall be painted custom colour as specified by architect.

.6 Basket style cable tray shall be electroplated welded wire-mesh, minimum of 50 x 100mm mesh size, 105mm deep, in standard 3048mm lengths. Tray width shall be 305mm or 450mm as noted on the drawings.

.7 Where required, provide framed cable or conduit drops.

.8 Provide cable clamps or ties at 1000 mm intervals to maintain alignment of cable in tray.

.9 All hanger rods and supports shall be galvanized.

.10 Solid cable tray shall be Wiremold “SpecMate” or approved equal.

.11 Basket style cable tray shall be manufactured by Cooper B-Line Systems, Cablofil, Canstrut, Code Manufacturing Ltd., or Thomas and Betts ‘Express’ Tray.

2.2 WATERFALL KITS FOR DATA CABLES

.1 Provide data cable waterfall kits mounted to cable tray within Room 213 to support data cables and maintain cable radius as they transition from cable tray to data racks.

.2 Two (2) waterfall kits shall be provided for each data rack. Coordinate locations on site.

.3 Waterfall kits shall be steel or glass reinforced nylon construction, and be of the same manufacturer as cable tray

2.3 SUPPORTS

.1 Provide supports as required.

Part 3 Execution

3.1 INSTALLATION

.1 Install complete cabletrough system.

.2 The cable tray within LAN room shall be suspended 2700mm above the floor ceiling in the layout noted

.3 The cable trays run within existing ceiling spaces shall be installed above ceilings where existing, to maximize headroom.

.4 Do not run tray within 300 mm of steam or hot water lines. Cable tray shall not be in contact of any sprinkler piping or laboratory gas lines.

.5 Cuts shall be filed smooth and treated with a galvanizing compound where cutting of certain sections is required.

.6 Cable tray shall be supported on 1500 mm centres, and shall be adequately braced to withstand loads due to pulling in of cables.

.7 Check routing and field dimensions to ensure there is absolutely no interference with work and equipment of other divisions. Cable tray routing may be altered to address existing ductwork and building elements upon approval by owner.

.8 Cable tray shall be bonded with manufactured grounding lugs every 15 meters with AWG #6 insulated copper unless otherwise noted.

.9 Remove sharp burrs or projections to prevent damage to cables or injury to personnel.

.10 Install waterfall kits onto cable tray over data rack locations.

END OF SECTION

Part 1 General

1.1 GENERAL REQUIREMENTS

.1 The General Conditions of Contract, Division 01 General Requirements and all Addenda thereto form an integral part of and must be read in conjunction with the requirements of this Section.

.2 Cooperate and coordinate with the requirements of other units of work specified in other Sections.

1.2 REFERENCES

.1 The Electrical Contractor shall be bound by industry standards, as interpreted by the Consultant, whether or not specifically referenced in this document. Comply with Electrical Protection Act and rules and regulations made pursuant thereto, including the 2012 Canadian Electrical Code. Also, comply with applicable standards of the following:

.1 CSA C22.1-2012, Canadian Electrical Code, Part 1.

.2 CSAC22.2No.26, Construction and Test of Wireways, Auxiliary Gutters and Associated Fittings.

.3 Electrical and Electronic Manufacturers Association of Canada (EEMAC).

.4 National Electrical Manufacturers Association (NEMA).

.5 National Building Code 2010 (NBC 2010)

.6 National Fire Protection Association (NFPA)

.7 Institute of Electrical and Electronic Engineers (IEEE).

.8 Audio Engineering Society (AES).

.9 Other Applicable CSA and UL approvals.

1.3 SHOP DRAWINGS AND PRODUCT DATA

.1 Submit shop drawings in accordance with:

.1 Section 01 33 00 - Submittal Procedures

.2 Section 26 05 01 – Common Work Results

1.4 PRODUCT APPROVALS

.1 Manufacturers' and model numbers named in these specifications indicate an acceptable technical standard of performance and are not intended to be exclusive. Products submitted as alternates must result in a control system that meets or exceeds all technical performance criteria as described.

.2 Products proposed as alternatives to those specified, shall only be considered if submitted for approval no later than 15 working days before tender close. Submit alternates, for approval, as one complete listing. Provide complete product specification sheets with request for approval.

.3 The Bidder must provide a complete list of primary system products offered with their bid.

1.5 WASTE MANAGEMENT AND DISPOSAL

.1 Meet requirements of Section 01 74 19 - Waste Management and Disposal.

.2 Collect and separate waste for reuse, recycling, and other waste diversion strategies in accordance with Waste Management Plan.

Part 2 Products

2.1 WIREWAYS

.1 Wireways and fittings: to CSA C22No.26.

.2 Sheet steel with hinged cover to give uninterrupted access.

.3 Finish: baked grey enamel.

.4 Elbows, tees, couplings and hanger fittings manufactured as accessories to wireway supplied.

Part 3 Execution

3.1 INSTALLATION

.1 Install wireways and auxiliary gutters.

.2 Keep number of elbows, offsets, connections to minimum.

.3 Install supports, elbows, tees, connectors, fittings.

.4 Install barriers where required.

.5 Install gutter to full length of equipment.

3.2 CLOSEOUT SUBMITTALS

.1 Provide operation and maintenance information for incorporation into manual specified in:

.1 Section 01 78 00 - Closeout Submittals

.2 Include:

.1 List specifying each piece of equipment in system or subsystem by its original manufacturer name and model number.

.2 Parts list specifying parts used in equipment by identification numbers that are standard to electronic industry.

3.3 WARRANTY

.1 The contractor must make available to the Owner a local service department of a duly authorized distributor of the equipment manufacturer, which shall stock the manufacturer's standard parts. The service department shall have at least one factory trained repair technician available to the Owner on 24 hours' notice.

.2 Provide warranty of installation of equipment installed by this contractor to be free of defects for a period of (1) one year from date of Substantial Completion.

.3 Provide during the warranty period, all service, maintenance, parts, etc., required for normal operation of the systems, such that Owner needs not purchase additional maintenance agreement or contracts.

END OF SECTION

PART 1 General

1.1 GENERAL REQUIREMENTS

.1 The General Conditions of Contract, Division 01 General Requirements and all Addenda thereto form an integral part of and must be read in conjunction with the requirements of this Section.

.2 Cooperate and coordinate with the requirements of other units of work specified in other Sections.

1.2 REFERENCES

.1 The Electrical Contractor shall be bound by industry standards, as interpreted by the Consultant, whether or not specifically referenced in this document. Comply with Electrical Protection Act and rules and regulations made pursuant thereto, including the 2012 Canadian Electrical Code. Also, comply with applicable standards of the following:

.1 CSA C22.1-2012, Canadian Electrical Code, Part 1.
.2 Electrical and Electronic Manufacturers Association of Canada (EEMAC).
.3 National Electrical Manufacturers Association (NEMA).
.4 National Building Code 2010 (NBC 2010)
.5 National Fire Protection Association (NFPA)
.6 Institute of Electrical and Electronic Engineers (IEEE).
.7 Audio Engineering Society (AES).
.8 Other Applicable CSA and UL approvals.

1.3 RELATED SECTIONS

.1 Section 26 05 01 - Common Work Results - Electrical.

.2 Section 26 05 32 – Outlet Boxes, Conduit Boxes and Fitting

.3 Section 26 05 34 – Conduits, Conduit Fastenings & Conduit Fittings

.4 Section 50 00 – Lighting

.5 Section 26 27 26 – Wiring Devices

1.4 WASTE MANAGEMENT AND DISPOSAL

.1 Meet requirements of Section 01 74 19 - Waste Management and Disposal.

.2 Collect and separate waste for reuse, recycling, and other waste diversion strategies in accordance with Waste Management Plan.

1.5 SYSTEM DESCRIPTION

.1 Supply and install a fully programmable, networkable, and centralized low voltage lighting control system to provide automatic and manual control of the building’s interior and exterior

lighting as shown on the drawings and as described herein. Components shall be networked where indicated on drawings.

.2 Groups of relays or channels, in multiple panels, shall be connected and automated using time of day, switching or dimming photocell control, and manual switch over-ride control. Lighting control panels shall be networked or interconnected by a data-line to operate as a stand-alone lighting control system.

.3 Each connected load shall be capable of being switched or dimmed as noted on the panel schematics. Loads shall be capable of being controlled independently or grouped into zones to provide multi-circuit control.

1.6 PERFORMANCE PARAMETERS

.1 The low voltage lighting control system shall be built with commercial off-the-shelf components such that any future requested changes or additions can be accommodated for without changing the existing system's components.

.2 All required control panels shall be capable of adding new panels daisy-chained to existing control panels without requiring the alteration of any other system hardware. System shall be capable of extending low voltage lighting control capabilities to future building renovations through the addition of these control panels.

.3 The low voltage light control system shall provide automatic control of connected interior and exterior lighting loads by timeclock, interior and exterior daylight sensors, and/or occupancy sensors as indicated on the drawings.

.4 Occupancy sensors shall automatically turn lights on upon the detection of movement. Where fixtures are controlled via a daylight sensor, light fixtures shall turn on to the pre-set levels determined by the daylight sensors. Lights shall automatically turn off when the room becomes vacant.

.5 Interior daylight sensors shall continuously adjust the light fixture output based on amount of natural light within the room or area. In specific rooms indicated on the drawings, fixtures shall be grouped and controlled in up to three daylight zones (Z1, Z2, Z3), with each zone dimmed independently to provide separate levels of dimming that are proportional to the amount of natural light available in that zone.

.6 Where fixtures are grouped and controlled in daylight zones, manual dimming over-ride switches shall adjust light levels of all fixtures within the group with each zone adjusted proportionally to the pre-set levels determined by the daylight sensor. Manual switches shall be capable of over-riding the daylight sensor to provide full brightness of fixtures.

.7 Manual low voltage switches shall provide over-ride capabilities to raise/lower, and/or switch (on/off) automatically controlled loads via remote relay panels or IRC's. When the lights within a room or area have been manually switched off, occupancy sensors shall automatically turn lights on upon the detection of movement after the sensor pre-set time delays.

.8 Exterior lighting zones shall be automatically switched based on time of day and exterior light levels as described on drawings. Timeclock scheduling shall be provided via the BMS. Exterior daylight sensor shall measure the actual exterior light level and automatically switch loads on or off.

1.7 SHOP DRAWINGS

.2 Submit shop drawings in accordance with:

.1 Section 01 33 00 - Submittal Procedures

.2 Section 26 05 01 – Common Work Results

.1 Shop drawings shall include a fully detailed description of the system, control schematics, a single line of the entire system wiring diagrams for all system components, cable types, and operating instructions. Component equipment shall include relay or contactor control panel, transformers and power supplies, rectifiers, override switches, occupancy and photo-sensors, etc. Each component shall be identified as to the manufacturer, type, description and catalogue number.

.2 System riser shall be submitted with the shop drawings. Riser shall include all control boxes, cable, conduit, backbox, and rough in requirements for the system to ensure early coordination of supplier and contractor.

PART 2 Products

2.1 MATERIALS

.1 Provide all necessary components and devices for a complete and fully operational low voltage light control system. System components shall include, but not limited to, the following components:

.1 Low voltage digital switches

.2 Low voltage switching and dimming relays

.3 Power supplies

.4 Low voltage panels and/or individual room controllers

.5 Automated and manual switch controls

.6 Switching photocell controllers

.7 Continuous dimming photocell controllers

.2 All catalogue numbers shown are approximate and are intended to assist in providing the current features. Coordinate all catalogue numbers with the manufacturer to ensure a fully operable system. The catalogue numbers shown shall not reduce or amend the requirements of the specifications.

.3 All equipment and components shall be of the same manufacturer throughout.

.4 All materials provided shall be CUL listed and carry the CSA approval seal.

.5 All equipment shall be manufactured by Lutron ‘Energi Savr Node’, Leviton “Green Max”, or Acuity Brands ‘nLight’.

2.2 RELAY PANELS

.1 Each new low voltage lighting control panel shall be a complete system with 4, 8, 12, 24, or 48-relay capacity, sized to suit capacity shown on the panel schematics. Each lighting control panel shall be sized with 20% spare relay capacity for future use. The lighting control panel shall include an intelligent card with built-in control logic, and photo-control package. The lighting control panels shall include the required networking modules and components to link multiple low voltage lighting control panels together for a flexible facility-wide lighting control system.

.2 The networked lighting control system shall provide a central location to maintain its programming data including schedules, programmable point overrides and parameter configuration. In the event of a component or panel failure, the system will continue to operate as programmed. The system shall have non-volatile memory to protect programming during power failures.

.3 Networking cable shall be FT6 plenum rated, Class 2, Cat6/5e cable, or as recommended by the manufacturer. Install cable within communications cable basket tray/conduit system unless noted otherwise. Cable colour shall be such that it is distinguishable from to the data/voice cable installed in the same tray system.

.4 The relay panels/IRC shall have integral photocell input capabilities. The photo-control input shall be connected directly to the panel to allow daylight harvesting switching and dimming capabilities. Dimming outputs (0-10V) shall provide up to three daylighting zones, each independently controlled proportionally to the photosensor input.

.5 Panels/IRC’s shall be capable of limiting the maximum output of each dimming zone to 60%.

.6 Relay panel tubs shall be surface mounted, type Nema 1 enclosures with conduit knock outs and removable hinged cover. Enclosures and components shall be suitable for installation in plenum spaces.

.7 Provide voltage barriers to separate line voltages fed from different sources into the same panel and to separate line voltages from class 2 low voltage wiring and the low voltage components of the system.

2.3 REMOTE CONTROL SWITCHES

.1 Local and remote switches shall be 2-button or 4-button low voltage digital switches, white with pilot light. Any button shall be configurable and upgradable to provide switching or dimming control of connected loads.

.2 Switches shall be connected and communicate with the light control system network. Switches shall draw power from the system network. No external power supplies shall be required.

.3 Provide stainless steel wall plates with the low voltage switches. Ganged wall plates shall be provided where the switches are grouped together at one location.

.4 All switch buttons shall be custom engraved. Engraving requirements shall be confirmed with shop drawings.

2.4 PHOTOCELLS

.1 Indoor day-light sensors shall provide continuous dimming control (0-10V) of the designated lighting fixtures. The sensor shall control the light fixtures depending on the natural light available. The sensors shall be ceiling mounted and shall measure light reflected upward from the surface below. The sensor shall be easy to adjust with a range setting and a set-point at the device. The day-light sensor shall have an adjustable dead-band and 5-minute time delay setting so that cycling effects can be eliminated, adjustable setpoints 0 – 7500 lux, and adjustable time delay 3 seconds to 5 minutes, LED status indicator.

.2 Pendant mounted direct/indirect lighting sources may affect the operation of ceiling mounted photocells. The contractor shall adjust the sensors to allow for proper operation where such fixtures are provided.

.3 Low voltage photocells and sensors as located on the floor plans shall operate exterior lighting zones via the photo-controllers included with the low voltage lighting control system. The photo controller shall be capable of controlling any connected load in the panel network.

.4 Outdoor photosensors: Surface exterior wall mounted with weatherproof plate, range between 10 – 160 lux. All exterior fixtures shall be connected to photocell control.

2.5 OCCUPANCY SENSORS

.1 Provide where indicated and as described on lighting plans. The sensor shall be easy to adjust with a 5 minute time delay setting (adjustable from 30 seconds to 30 minutes), LED status indicator and push button programmable. Occupancy sensors shall be white in finish. Provide two (2) devices not shown on drawings of each type for Owner stockpile. See drawings for type of occupancy sensors required.

.1 OC1 – Extended range, dual technology, 360 degree sensor, ceiling mounted, low voltage.

.2 OC2 - Passive dual technology, 360 degree sensor, standard range, ceiling mounted, low voltage

2.6 LOW VOLTAGE RELAYS

.1 Provide switching and dimming (0-10V) relays to control zones indicated on plans.

.2 Relays shall be momentary-pulsed mechanically latching contactors with plug in connector. Relays shall have mechanically latching contacts with single moving part design.

.3 Contacts of low voltage relays shall be rated at 20 amp, 120 volt rated for electronic fluorescent ballasts, electronic LED drivers, resistive loads and up to ½ hp rated motor loads. Coils shall be mechanically held, momentary coil activation, operate on 24 volt, 60 Hz. Relays shall be equipped with pilot light switch operation. Provide for each relay, a varistor between line and neutral.

.4 Next to each relay mounted in the low voltage panel shall be an individual override button and a bi-colour LED to indicate status.

.5 Dimming relay module shall be self-contained, 0-10V (sinking) in a single pole configuration. All dimming ballast/driver wiring connections shall connect directly to the relay module.

.6 All relays shall have a minimum short circuit current rating of 18,000 amps.

.7 Relay load terminals shall accept #14 to #6 AWG copper wire. Control wire terminals shall accept #14 to #12 AWG, copper.

2.7 POWER SUPPLY UNITS

.1 Power supplies shall be integral to the relay cabinets and sized to provide power output to operate all connected devices and components including of occupancy sensors, photosensors, digital switches, etc. External auxiliary power supplies shall be provided where the number of connected devices exceeds the onboard supply.

.2 Input voltage for the power supply shall be 120 volt AC. The power supplies shall include internal over-current protection, and voltage spike protection. Two pole power supply units may be provided where practical.

.3 Mount auxiliary power supply units adjacent to relay panels, where applicable. Locations of all power supply units shall be located on the as-built drawings.

2.8 BMS INTERFACE MODULE

.1 The low voltage lighting control system shall be capable of integration to the Building Management System (BMS) using the protocol compatible with the BMS system being supplied by Division 25. Interfacing the lighting control system to the BMS shall allow all programming including scheduling and control to be maintained by the BMS. The low voltage lighting control panels would be allowed to receive instructions from the facility management system via a communication bus to turn on and off the lighting zones, relays or relay groups as required. Confirm with Division 25 the BMS protocol prior to finalizing ordering of the low voltage lighting control system for this capability.

.2 The networked lighting control panels shall be capable of being linked to the BMS over a single data-line that uses the same BMS protocol for communications. The data-line would be required to provide a highly reliable communications bus for transferring control and status between the relay panels. The data-line shall not require any ancillary equipment to function properly.

.3 Provide an empty 21mm conduit raceway from the lighting control panel and the BMS master panel. Confirm with the manufacturer of the lighting control system and Division 25 the recommended data cable that would be required between the future BMS interface module and the BSM master control panel in determining the final conduit size. Division 25 would be responsible for the maintenance and programming of the BMS, and would also complete the interface of the lighting control system to the BMS using the appropriate protocol.

.4 The BMS interface module is used in lieu of the Network Clock to provide the same lighting control functions (with the exception of the Astronomic function), but shall allow an external automation device to provide the signal that changes channel status from Occupied to Unoccupied (after-hours).

2.9 OPERATOR’S SOFTWARE

.1 The operator’s software program shall be compatible with Microsoft ® Windows 7, 8, and 10.

.2 The data-line shall be 18 AWG 4 unshielded copper conductors (two independent twisted pairs) meeting Class 2P NEC code requirements. The data-line may be run in a loop, serial or star configuration in accordance with the manufacturer's recommendations. Confirm all wiring and cable requirements with the manufacturer of the lighting control system. Maximum length for all data-line wire in the system is 457 meters (1,500 feet) without repeaters.

PART 3 Execution

3.1 INSTALLATION

.1 The low voltage lighting control panels shall be grouped and mounted adjacent to the electrical panels, as located on the floor plans.

.2 All low voltage wiring shall be installed in conduit. Confirm with the manufacturer of this system all wiring and cable requirements.

.3 The system components shall be bonded to ground.

.4 Low voltage switches shall be as located on the floor plans, mounted up at 1200mm unless otherwise noted. Low voltage switches shall be ganged where more than one occurs in the same location. Labeling shall be applied to ganged switches to identify the areas in which the switches control.

.5 Data-line switches and/or photocells shall be mounted in the spaces as indicated on the lighting plans. Each low voltage wire shall be labeled clearly indicating which relay panel the cable is connected to.

.6 All relays and switches shall be tested after installation to confirm proper operation, and all connected loads shall be recorded on the relay schedule for each panel.

.7 Do not mount occupancy sensors within 1800mm of mechanical diffusers.

.8 Refer to manufacturer's literature for typical methods of installation and connection of components. The contractor shall be responsible for coordinating the actual components and equipment utilized so as to provide a fully operational and reliable system.

.9 Locate and install equipment in accordance with manufacturer's recommendations and as indicated.

.10 Provide separate junction box to allow for transition from 120 volt to low voltage wiring of power supplies.

3.2 CLOSEOUT SUBMITTALS

.1 Submit maintenance data in accordance with Section 01 78 00 - Closeout Submittals.

3.3 IDENTIFICATION AND DOCUMENTATION

.1 Provide lamecoid identification to the relay cabinets as named on the panel schematics. Individual relay load descriptions and the channels to which they are smart-wired shall be recorded on the relay schedule form provided with each relay panel.

.2 Where data-line switches are provided, each intelligent switch on a relay panel's local data-line shall be numbered consecutively. The relays or channels controlled by each switch shall be recorded on the switch documentation form provided with the relay panel.

.3 Network Clock (or BMS Interface): The automation scenarios and operating data for each of the eight channels shall be recorded on the appropriate forms provided by the manufacturer.

.4 Include in the Electrical Operating Manuals, the system installation and operating manuals for the lighting control system, including the installation and operation of the Network Clock or BMS Interface Module. Include a copy of all forms and schedules provided for each relay panel.

3.4 SYSTEM START-UP AND TRAINING

.1 Provide trained factory authorized technician to confirm proper installation, programming and operation of the system.

.2 Perform tests in accordance with Section 26 05 01 – Common Work Results – Electrical and Electrical Commissioning Specifications.

.3 Actuate control units in the presence of Engineer to demonstrate lighting circuits are controlled as designated.

.4 The Owner's operating and maintenance personnel shall be instructed in the operation and maintenance of the lighting control system by a trained factory authorized technician. The minimum training period shall be (4) four hours of instruction over two trips, with the second trip occurring two months after Owner occupancy. Written documentation bearing name and signature of Owner's personnel who received the above instruction shall be included in the operating Electrical Operating and Maintenance manuals.

END OF SECTION

Part 1 General

1.1 GENERAL REQUIREMENTS

.1 The General Conditions of Contract, Division 01 General Requirements and all Addenda thereto form an integral part of and must be read in conjunction with the requirements of this Section.

.2 Cooperate and coordinate with the requirements of other units of work specified in other Sections.

1.2 REFERENCES

.1 The Electrical Contractor shall be bound by industry standards, as interpreted by the Consultant, whether or not specifically referenced in this document. Comply with Electrical Protection Act and rules and regulations made pursuant thereto, including the 2012 Canadian Electrical Code. Also, comply with applicable standards of the following:

.1 CSA C22.1-2012, Canadian Electrical Code, Part 1.
.2 Electrical and Electronic Manufacturers Association of Canada (EEMAC).
.3 National Electrical Manufacturers Association (NEMA).
.4 National Building Code 2010 (NBC 2010)
.5 National Fire Protection Association (NFPA)
.6 Institute of Electrical and Electronic Engineers (IEEE).
.7 CSA-C22.2 No.42, General Use Receptacles, Attachment Plugs and Similar Devices.
.8 CSA-C22.2 No.42.1, Cover Plates for Flush-Mounted Wiring Devices (Bi-national standard, with UL 514D).
.9 CSA-C22.2 No.55, Special Use Switches.
.10 CSA-C22.2 No.111, General-Use Snap Switches (Bi-national standard, with UL 20, twelfth edition).

1.3 SHOP DRAWINGS AND PRODUCT DATA

.1 Submit shop drawings in accordance with:

.1 Section 01 33 00 - Submittal Procedures
.2 Section 26 05 01 – Common Work Results

1.4 PRODUCT APPROVALS

.1 Manufacturers' and model numbers named in these specifications indicate an acceptable technical standard of performance and are not intended to be exclusive. Products submitted as alternates must result in a control system that meets or exceeds all technical performance criteria as described.

.2 Products proposed as alternatives to those specified, shall only be considered if submitted for approval no later than 15 working days before tender close. Submit alternates, for approval,

as one complete listing. Provide complete product specification sheets with request for approval.

.3 The Bidder must provide a complete list of primary system products offered with their bid.

1.5 WASTE MANAGEMENT AND DISPOSAL

.1 Meet requirements of Section 01 74 19 - Waste Management and Disposal.

.2 Collect and separate waste for reuse, recycling, and other waste diversion strategies in accordance with Waste Management Plan.

Part 2 Products

2.1 SWITCHES

.1 15 A, 120 Volt and 347 Volt, single pole, three-way switches where required on drawings.

.2 Manually-operated general purpose ac switches with following features:

.1 Terminal holes approved for No. 10 AWG wire.
.2 Silver alloy contacts.
.3 Urea or melamine molding for parts subject to carbon tracking.
.4 Suitable for back and side wiring.
.5 Ivory toggle.

.3 Toggle operated fully rated for tungsten filament, LED and fluorescent lamps.

.4 All wiring devices specified shall be of the same manufacture throughout the project.

.5 Switches controlling motors shall be K.W. (H.P.) rated and approved for motor control service.

.6 Set switches flush in all finished areas, or in surface box where conduit or wireway is exposed.

.7 Refer to drawing symbol schedule for further requirements.

.8 Switches and receptacles shall comply with requirements of CSA and NEMA Standards.

.9 Switches shall be specification grade from one of the following manufacturers: Cooper, Leviton, Hubbell or Pass & Seymour.

2.2 RECEPTACLES

.1 Duplex receptacles, CSA type 5-15 R, 125 V, 15 A, U ground, with following features:

.1 Ivory high impact chemical resistant molded nylon or polycarbonate face.
.2 Suitable for No. 10 AWG for back and side wiring.
.3 Break-off links for use as split receptacles.

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.4 Eight back wired entrances, four side wiring screws.

.5 Triple wipe contacts and rivetted grounding contacts.

.6 Specification grade from one of the following manufacturers: Cooper, Leviton, Hubbell or Pass & Seymour.

.2 Single locking receptacles CSA type L5-15 R, L6-30R, 125 V, 15 A, U ground with following features:

.1 High impact chemical resistant molded nylon or polycarbonate face.

.2 Suitable for No. 10 AWG for back and side wiring.

.3 Four back wired entrances, 2 side wiring screws.

.4 Specification grade from one of the following manufacturers: Cooper, Leviton, Hubbell or Pass & Seymour.

.3 All UPS powered receptacles specified above shall be blue

.4 All emergency powered receptacles specified above shall be red.

.5 Other receptacles with ampacity and voltage as indicated.

.6 Receptacles shall be of one manufacturer throughout project.

.7 Set receptacles flush in all finished areas, or in surface box where conduit or wireway is exposed.

.8 Receptacles located in LAN room for data rack equipment shall be mounted within a surface box secured to cable tray above rack location using uni-strut supports. Provide lamecoid label riveted to outlet box cover indicating circuit number – blue labels for UPS circuit, and red labels for Emergency power circuit.

2.3 COVER PLATES

.1 Cover plates for wiring devices.

.2 Cover plates shall be from one manufacturer throughout project.

.3 Wall plates shall be designed and manufactured in accordance with performance and dimensional requirements of the following industry standards:

CSA Standard C22-2 No. 42

U.S. Federal Specification WP455

NEMA Standard WD-1

.4 Wall plates shall be manufactured by one of the following:

Cooper, Arrow Hart, Eagle, Hubbell, Leviton or Pass & Seymour.

.5 Blank cover plates in finished ceiling areas shall be Columbia Electric #9002 baked white enamel for white ceilings, or painted to match colored finishes.

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.6 Stainless steel wall plates shall be provided for all switches, receptacles, blanks, and special purpose outlets. The wall plates shall be of suitable configuration for the device for which it is to cover with color matched mounting screws. Use ganged plate where more than one device occur at one location. Refer to Section 27 05 28 for data and communications cover plate requirements.

.7 Where surface wiring methods need to be employed in a high finish area because of renovations to existing structure, wall plates shall be used in conjunction with Wiremold surface box to suit the device.

.8 Where outlets occur in an unfinished area such as boiler or furnace room and surface conduit and boxes are specified, stamped galvanized steel wall plates shall be used to suit configuration.

.9 All receptacles shall be provided with a lamecoid label riveted to outlet box cover indicating circuit number.

.10 Exterior outlets shall be fitted with weatherproof “while in use” die cast aluminum cover plates to suit wiring device. Weatherproof covers shall provide protection in wet and damp locations.

Part 3 Execution

3.1 INSTALLATION

.1 Switches:

.1 Install single throw switches with handle in "UP" position when switch closed.

.2 Install switches in gang type outlet box when more than one switch is required in one location.

.3 Switches shall be as located on the drawings, mounted up 1200 mm, and ganged where more than one occurs in the same location.

.2 Receptacles:

.1 Install receptacles in gang type outlet box when more than one receptacle is required in one location.

.2 Convenience outlets shall be as located on the drawings, and mounted up 450 mm, unless otherwise noted.

.3 Where split receptacle has one portion switched, mount vertically and switch upper portion.

.4 Outlets over counter tops shall be mounted 150 mm above counter, or immediately above backsplash. Co-ordinate with architectural drawings for location of all counter tops, millwork and feature walls, to ensure proper location and mounting height.

.5 Coordinate with the location of all mechanical convectors and mount convenience outlets up 100 mm above heating convectors.

.6 All convenience outlets shall meet tension tests as per CSA requirements, and will be subjected to 'on site' tests during final inspection.

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.3 All plug-in type receptacles shall be identified by means of a Lamecoid label fixed with self tapping screws on the cover plate. Each cover plate shall contain the panel and circuit number. Those receptacles fed from ground fault interrupters shall have 'GFI' labeled adjacent to the panel and circuit number. Those receptacles designated for housekeeping purposes shall have ‘HOUSEKEEPING’ labeled adjacent to the panel and circuit number.

.4 The circuits controlled by all switches on all levels, shall be neatly printed with waterproof ink on the side of the switch outlet box so that the panel and circuit number are clearly legible when the cover plate is removed. It shall not be necessary to remove the switch from the outlet box in order to read the panel or circuit number.

.5 Cover plates:

.1 Protect cover plate finish with paper or plastic film until painting and other work is finished.

.2 Install suitable common cover plates where wiring devices are grouped.

.3 Do not use cover plates meant for flush outlet boxes on surface-mounted boxes.

3.2 WARRANTY

.1 The contractor must make available to the Owner a local service department of a duly authorized distributor of the equipment manufacturer, which shall stock the manufacturer’s standard parts. The service department shall have at least one factory trained repair technician available to the Owner on 24 hours’ notice.

.2 Provide warranty of installation of equipment installed by this contractor to be free of defects for a period of (1) one year from date of Substantial Completion.

.3 Provide during the warranty period, all service, maintenance, parts, etc., required for normal operation of the systems, such that Owner needs not purchase additional maintenance agreement or contracts. Upon request, the manufacturer and his agent shall provide direct to the Owner the following proposals:

.1 Continuation, after the warranty period, of full maintenance, including all service, labour, parts, etc. required to maintain the systems in a fully operational condition.

END OF SECTION

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Part 1 General

1.1 GENERAL REQUIREMENTS

.1 The General Conditions of Contract, Division 01 General Requirements and all Addenda thereto form an integral part of and must be read in conjunction with the requirements of this Section.

.2 Cooperate and coordinate with the requirements of other units of work specified in other Sections.

1.2 REFERENCES

.1 The Electrical Contractor shall be bound by industry standards, as interpreted by the Consultant, whether or not specifically referenced in this document. Comply with Electrical Protection Act and rules and regulations made pursuant thereto, including the 2012 Canadian Electrical Code. Also, comply with applicable standards of the following:

.1 CSA C22.1-2012, Canadian Electrical Code, Part 1.
.2 Electrical and Electronic Manufacturers Association of Canada (EEMAC).
.3 National Electrical Manufacturers Association (NEMA).
.4 National Building Code 2010 (NBC 2010)
.5 National Fire Protection Association (NFPA)
.6 Institute of Electrical and Electronic Engineers (IEEE).
.7 Other Applicable CSA and UL approvals.

1.3 SHOP DRAWINGS AND PRODUCT DATA

.1 Submit shop drawings in accordance with:

.1 Section 01 33 00 - Submittal Procedures
.2 Section 26 05 01 – Common Work Results

.2 Submit fuse performance data characteristics for each fuse type and size above 50 A. Performance data to include: average melting time-current characteristics.

1.4 PRODUCT APPROVALS

.1 Manufacturers' and model numbers named in these specifications indicate an acceptable technical standard of performance and are not intended to be exclusive. Products submitted as alternates must result in a control system that meets or exceeds all technical performance criteria as described.

.2 Products proposed as alternatives to those specified, shall only be considered if submitted for approval no later than 15 working days before tender close. Submit alternates, for approval, as one complete listing. Provide complete product specification sheets with request for approval.

.3 The Bidder must provide a complete list of primary system products offered with their bid.

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1.5 WASTE MANAGEMENT AND DISPOSAL

.1 Meet requirements of Section 01 74 19 - Waste Management and Disposal.

.2 Collect and separate waste for reuse, recycling, and other waste diversion strategies in accordance with Waste Management Plan.

1.7 DELIVERY AND STORAGE

.1 Ship fuses in original containers.

.2 Do not ship fuses installed in switchboard.

.3 Provide a typed list of all spare fuses

.4 Provide three (3) spare fuses of each type and size installed.

Part 2 Products

2.1 FUSES GENERAL

.1 Fuses: product of one manufacturer for entire project.

.2 Fuse interrupting rating shall be 200,000 amperes RMS symmetrical, unless otherwise noted.

.3 Time delay fuses shall carry 500% of rated current for a minimum of 10 seconds and shall be labeled "Time Delay" by the manufacturer.

2.2 FUSE TYPES

.1 HRC fuses rated 600 amperes and smaller shall be CSA certified HRC1-J time delay and shall be in accordance with CSA Specification C22-2 No. 106-M92. HRC-1 fuse dimensions and current limiting performance shall be in accordance with the UL Standard 198C

Part 3 Execution

3.1 INSTALLATION

.1 Install fuses in mounting devices immediately before energizing circuit.

.2 Ensure correct fuses fitted to physically matched mounting devices.

.3 Ensure correct fuses fitted to assigned electrical circuit.

.4 Application of all fuses shall comply with the Canadian Electrical Code - Part 1 and local inspection authority regulations.

.5 Unless otherwise noted on the drawings, Time Delay fuses for overcurrent protection of motor circuits shall be rated at 150% of full-load current and

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.6 Time Delay fuses for overcurrent protection of transformer circuits shall be rated at 125% of full-load current.

.7 All fuses shall be manufactured by Littlefuse, Buss, Ferraz Shawmut**,** or Edison.

3.2 WARRANTY

.1 The contractor must make available to the Owner a local service department of a duly authorized distributor of the equipment manufacturer, which shall stock the manufacturer's standard parts. The service department shall have at least one factory trained repair technician available to the Owner on 24 hours' notice.

.2 Provide warranty of installation of equipment installed by this contractor to be free of defects for a period of (1) one year from date of Substantial Completion.

.3 Provide during the warranty period, all service, maintenance, parts, etc., required for normal operation of the systems, such that Owner needs not purchase additional maintenance agreement or contracts. Upon request, the manufacturer and his agent shall provide direct to the Owner the following proposals:

.1 Continuation, after the warranty period, of full maintenance, including all service, labour, parts, etc. required to maintain the systems in a fully operational condition.

END OF SECTION

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Part 1 General

1.1 GENERAL REQUIREMENTS

.1 The General Conditions of Contract, Division 01 General Requirements and all Addenda thereto form an integral part of and must be read in conjunction with the requirements of this Section.

.2 Cooperate and coordinate with the requirements of other units of work specified in other Sections.

1.2 REFERENCES

.1 The Electrical Contractor shall be bound by industry standards, as interpreted by the Consultant, whether or not specifically referenced in this document. Comply with Electrical Protection Act and rules and regulations made pursuant thereto, including the 2012 Canadian Electrical Code. Also, comply with applicable standards of the following:

.1 CSA C22.1-2012, Canadian Electrical Code, Part 1.

.2 Electrical and Electronic Manufacturers Association of Canada (EEMAC).

.3 National Electrical Manufacturers Association (NEMA).

.4 National Building Code 2010 (NBC 2010)

.5 National Fire Protection Association (NFPA)

.6 Institute of Electrical and Electronic Engineers (IEEE).

.7 CSA-C22.2 No. 5-02, Moulded-Case Circuit Breakers, Moulded-Case Switches and Circuit-Breaker Enclosures (Tri-national standard with UL 489, tenth edition, and the second edition of NMX-J-266-ANCE).

.8 Other Applicable CSA and UL approvals.

1.3 SHOP DRAWINGS AND PRODUCT DATA

.1 Submit shop drawings in accordance with:

.1 Section 01 33 00 - Submittal Procedures

.2 Section 26 05 01 – Common Work Results

.2 Include time-current characteristic curves for breakers with ampacity of 50 A and over or with interrupting capacity of 18,000 A symmetrical (rms) and over at system voltage.

1.4 PRODUCT APPROVALS

.1 Manufacturers' and model numbers named in these specifications indicate an acceptable technical standard of performance and are not intended to be exclusive. Products submitted as alternates must result in a control system that meets or exceeds all technical performance criteria as described.

.2 Products proposed as alternatives to those specified, shall only be considered if submitted for approval no later than 15 working days before tender close. Submit alternates, for approval,

as one complete listing. Provide complete product specification sheets with request for approval.

.3 The Bidder must provide a complete list of primary system products offered with their bid.

1.5 WASTE MANAGEMENT AND DISPOSAL

.1 Meet requirements of Section 01 74 19 - Waste Management and Disposal.

.2 Collect and separate waste for reuse, recycling, and other waste diversion strategies in accordance with Waste Management Plan.

Part 2 Products

2.1 BREAKERS GENERAL

.1 Bolt-on moulded case circuit breaker: quick- make, quick-break type, for manual and automatic operation with temperature compensation for 40 deg C ambient.

.2 Common-trip breakers: with single handle for multi-pole applications.

.3 Magnetic instantaneous trip elements in circuit breakers to operate only when value of current reaches setting. Trip settings on breakers with adjustable trips.

.4 Circuit breakers with interchangeable trips as indicated.

.5 Circuit breakers to have minimum of 10,000 A symmetrical rms interrupting capacity rating in breaker panelboards.

.6 Magnetic instantaneous trip elements in circuit breakers to operate only when value of current reaches setting.

.1 Trip settings on breakers to have adjustable trips.

2.2 THERMAL MAGNETIC BREAKERS

.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 SOLID STATE TRIP BREAKERS

.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 long time, short time, instantaneous, tripping for ground fault short circuit protection.

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Part 3 Execution

3.1 INSTALLATION

.1 Install circuit breakers as indicated.

3.2 WARRANTY

.1 The contractor must make available to the Owner a local service department of a duly authorized distributor of the equipment manufacturer, which shall stock the manufacturer's standard parts. The service department shall have at least one factory trained repair technician available to the Owner on 24 hours' notice.

.2 Provide warranty of installation of equipment installed by this contractor to be free of defects for a period of (1) one year from date of Substantial Completion.

.3 Provide during the warranty period, all service, maintenance, parts, etc., required for normal operation of the systems, such that Owner needs not purchase additional maintenance agreement or contracts. Upon request, the manufacturer and his agent shall provide direct to the Owner the following proposals:

.1 Continuation, after the warranty period, of full maintenance, including all service, labour, parts, etc. required to maintain the systems in a fully operational condition.

END OF SECTION

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Part 1 General

1.1 GENERAL REQUIREMENTS

.1 The General Conditions of Contract, Division 01 General Requirements and all Addenda thereto form an integral part of and must be read in conjunction with the requirements of this Section.

.2 Cooperate and coordinate with the requirements of other units of work specified in other Sections.

1.2 REFERENCES

.1 The Electrical Contractor shall be bound by industry standards, as interpreted by the Consultant, whether or not specifically referenced in this document. Comply with Electrical Protection Act and rules and regulations made pursuant thereto, including the 2012 Canadian Electrical Code. Also, comply with applicable standards of the following:

.1 CSA C22.1-2012, Canadian Electrical Code, Part 1.

.2 Electrical and Electronic Manufacturers Association of Canada (EEMAC).

.3 National Electrical Manufacturers Association (NEMA).

.4 National Building Code 2010 (NBC 2010)

.5 National Fire Protection Association (NFPA)

.6 Institute of Electrical and Electronic Engineers (IEEE).

.2 American National Standards Institute (ANSI)

.1 ANSI C82.1, Electric Lamp Ballasts-Line Frequency Fluorescent Lamp Ballast.

.2 ANSI C82.4, Ballasts for High-Intensity-Discharge and Low-Pressure Sodium Lamps.

.3 American National Standards Institute/Institute of Electrical and Electronics Engineers (ANSI/IEEE)

.4 ANSI/IEEE C62.41, Surge Voltages in Low-Voltage AC Power Circuits.

.5 American Society for Testing and Materials (ASTM)

.6 ASTM F1137, Specification for Phosphate/Oil and Phosphate/Organic Corrosion Protective Coatings for Fasteners.

.7 United States of America, Federal Communications Commission (FCC)

.8 FCC (CFR47) EM and RF Interference Suppression.

1.3 SHOP DRAWINGS AND PRODUCT DATA

.1 Submit shop drawings in accordance with:

.1 Section 01 33 00 - Submittal Procedures

.2 Section 26 05 01 – Common Work Results

.2 Shop drawings for each fixture shall include but not be limited to, lamps, ballasts, fixture cuts, custom colors, and special mounting details. All pertinent information for each fixture shall be stapled separately from other fixtures.

1.4 PRODUCT APPROVALS

.1 Manufacturers' and model numbers named in these specifications indicate an acceptable technical standard of performance and are not intended to be exclusive. Products submitted as alternates must result in a control system that meets or exceeds all technical performance criteria as described.

.2 Products proposed as alternatives to those specified, shall only be considered if submitted for approval no later than 10 working days before tender close. Submit alternates, for approval, as one complete listing. Provide complete product specification sheets with request for approval.

.3 The Bidder must provide detailed lighting calculation drawings for fixtures that are submitted for approval for offices, open office areas, or as requested by the consultant. These shall be submitted no later than 10 working days before tender close.

.4 The Bidder must provide a complete list of primary system products offered with their bid.

Part 2 Products

2.1 LAMPS

.1 Provide in wattages and types to properly suit the specified fixtures.

.2 T5 Linear Fluorescent Lamps:

.1 Miniature Bi-pin, slim 5/8" diameter for operating with high frequency electronic programmed start ballasts

.2 Colour Rendering Index (CRI) of 85

.3 Colour Temperature: 3500°K

.4 Nominal Life Rating: 20,000 hours

.3 Lamps shall be manufactured by Osram-Sylvania or Philips.

2.2 BALLASTS

.1 Ballasts for fluorescent fixtures shall be supplied with the fixtures, pre-wired for operation with the compatible lamps and quantity of lamps specified for the fixture. Provide ballasts in the voltage noted with the fixture specification.

.2 Fluorescent ballast systems shall include:

.1 Operate lamps for maximum efficacy, high lumen output operation and operate for full lamp life

.2 Eliminate lamp flicker

.3 UL Listed Class P, Type 1 Outdoor

.4 CSA Certified
.5 70°C Maximum Case Temperature
.6 FCC 47CFR Part 18 Non-Consumer for EMI and RFI filtering
.7 Class A Sound Rating
.8 ANSI C62.41 Category A Transient Protection
.9 CFCI Compatible

.3 Ballasts for Linear T5 Lamps

.1 Starting Method: Programmed Rapid Start
.2 Stepped Switching Ballast System where indicated bi-level 100% and 50% stepped output
.3 Ballast Factor (BF): 1.00
.4 Circuit Type: Series
.5 Lamp Frequency: >40kHz to reduce potential interference with infrared control systems
.6 Lamp Current Crest Factor (CCF): less than 1.6
.7 Total Harmonic Distortion: <10% THD
.8 Power Factor: >98%
.9 End of Lamp Life Sensing
.10 Manufacturer:

Sylvania 'Quicktronic PROStart T5 Professional Series
Advance 'Optanium Step Dim EL' series, available in 120-volt only

.4 Dimming Fluorescent Ballasts for T5, T5HO and Compact Fluorescent Lamps

.1 Starting Method: Programmed Rapid Start System
.2 Ballast Factor (BF): 1.00 – Normal Ballast Factor
.3 Circuit Type: Series
.4 Lamp Frequency: >40kHz to reduce potential interference with infrared control systems
.5 Lamp Current Crest Factor (CCF): less than 1.7
.6 Total Harmonic Distortion: <10% THD
.7 Power Factor: >98%
.8 Dimming Range: 100 to 10%
.9 1 – 10 Volt Control
.10 Anti-Flash Circuitry turns on in dimmed mode
.11 End of Lamp Life Sensing for T4 and T5 lamps
.12 Compatible with 4-pin compact fluorescent lamp types
.13 Manufacturers (unless noted otherwise):

Lutron 'Hi-Lume' series
Sylvania 'Quicktronic – Powersense' series
Advance Mark 10

.5 Fluorescent ballasts shall have inrush current limiting capability to assure compatibility with all lighting systems controls.

.6 Ballast Warranty: All fluorescent ballasts shall include a written manufacturer's warranty against defects in materials and workmanship for 60 months from date of substantial completion and include a nominal replacement labour allowance.

2.3 LED LIGHTING – LAMP MODULES AND DRIVERS

.1 Solid-State Lighting (LED luminaires) shall comply with ENERGY STAR® SSL test standards for the following qualification requirements:

.1 Testing: SSL testing standards including IES LM-79-2008 and LM-80-2008 as performed by an independent test lab.

.2 Efficacy: The luminaire test data and submitted report shall demonstrate a minimum of 35 lumens per watt and 575 lumens for the least efficient LED for apertures ≥ 4.5" (345 lumens for apertures ≤ 4.5"), lowest efficient optic, and hottest luminaire configuration for the product group submitted for qualification.

.3 Colour: LED luminaire shall demonstrate colour uniformity across the aperture.

.4 Power: The driver/power supply must have a power factor of > 0.90 for all non-residential products, meet FCC requirements, sound rating of A and provide transient protection.

.5 Reliability: The LED luminaire shall demonstrate 70% lumen maintenance at 35,000 hours for non-residential products, as calculated using the DOE's linear extrapolation model.

.2 Tight chromaticity specification and LED colour binning process shall ensure LED colour uniformity, sustainable Colour Rendering Index (CRI) and Correlated Colour Temperature (CCT) consistency over the useful life of the LED. Consistent colour uniformity and tight colour control shall be maintained even during dimming.

.3 LED modules shall be InGaN (Indium Gallium Nitride) semiconductor material, absent of UV and minimal IR wavelengths. The conglomeration of diodes covered with remote phosphor technology shall provide consistent colour uniformity and tight colour control.

.4 LED Light Engine (Driver)

.1 Over-voltage, over-current and short-circuit protected

.2 Thermal management of the LED system shall be designed to yield 70% lumen maintenance after 50,000 hours of operation

.3 Total Harmonic Distortion: < 20% THD

.5 LED fixtures where specified as dimmable, shall have a dimming range of 100% to 10% unless otherwise noted.

.6 Warranty: The light engine and power components of LED luminaires installed for indoor applications shall be free from defects in material and workmanship for a minimum period of three (3) years from date of original purchase. Warranty shall cover only product failure due to defective material or workmanship, and does not include labour to remove or install

fixtures. Defective LED's shall be considered if a minimum of 5% of LEDs per luminaire are non-operative in the fixture or module.

2.4 LUMINAIRES

.1 Contractor is responsible for all required mounting details for all lighting fixtures. If mounting of fixture is uncertain, contractor shall confirm prior to finalising pricing.

.2 Lighting fixtures shall be of the makes indicated. Similar types of fixtures shall be by one manufacturer.

.3 Only clean luminaires and lamps will be accepted at time of final inspection.

.4 Recessed fixtures shall generally be supplied complete with trim, plaster frame or ring and mounting brackets where installed in plaster, or without plaster frame in acoustic ceilings.

.5 Fixtures shall bear appropriate CSA labels.

.6 Cooperate with all other trades for the proper installation of all lighting fixtures.

.7 Verify the quantity of fixtures before placing orders.

.8 Verify all ceiling types with architectural drawings and the General Contractor before ordering fixtures.

.9 Fluorescent lighting fixtures shall be so designed that the temperature on the ballast case shall not exceed a maximum of 70°C in an ambient temperature of 25°C.

.10 Co-ordinate with drawings to ensure that all fluorescent fixtures are equipped with ballasts of a suitable voltage to match branch circuitry.

.11 All fluorescent fixtures such as troffers, specified as being equipped with flat acrylic lens, shall be provided with lens not less than 3.175 mm thick, regardless of catalogue numbers specified.

.12 All fluorescent and LED troffers specified as being installed in inverted T-bar ceilings shall be painted on bottom face of fixture to match the T-bar splines unless otherwise noted.

.13 A self adhesive small circular label coloured blue shall be placed on a T-bar spline adjacent to each fixture housing the ballast to facilitate its location.

.14 All fluorescent luminaires installed on branch circuits with voltages exceeding 150 volts-to-ground shall be provided with a disconnecting means integral with the luminaire that simultaneously opens all circuit conductors between the branch circuit conductors and the conductors supplying the ballast(s), and shall be marked in a conspicuous and permanent manner adjacent to the disconnecting means so as to identify the disconnect.

.15 The new light fixture lamps shall not be used during construction. The contractor may use their own temporary lamps during construction at their own expense with the Owner's approval. The contractor shall replace temporary lamps with new lamps upon completion of work. All fixtures shall be cleaned inside and outside prior to substantial completion.

.16 Provide lighting fixtures of type and quality as specified in the following schedule. Fixtures shall be complete with necessary accessories, lamps and ballasts. The contractor shall advise of any restrictions on providing luminaire, lamp and ballast as specified during tender period.

.17 The lighting fixtures shall be as specified in the following schedule, and the manufacturer's numbers shown shall not reduce or amend the requirements as outlined under the description of each fixture type.

2.5 LUMINAIRE SCHEDULE

.1 Fixture type 'AA'

.1 Luminaire: Pendant linear LED direct fixture, 1219mm length, maximum 310mm width 347 volt drivers, die-cast extruded aluminum housing with end caps. Fixture shall be provided with a satin/smooth lens, 100% downlight reflector. Centre of fixture shall be mounted approximately 2,400mm A.F.F. by aircraft cable from structural joists. Confirm final mounting heights with architect and consultant prior to installation. Fixture finish shall be aluminum paint.

.2 Lamp: 48 watt, 800 lumens/ft LED module with remote phosphor technology, 3500K, minimum 80 CRI, 50,000 hours at 70% lumen maintenance,

.3 Driver: over-voltage, over-current and short-circuit protected, 347 volt, < 20% THD, dimmable to 1%.

.4 Manufacturer:
Axis Lighting #Slim series
Alera Lighting #PLK series
Ledalite #Thrive series
Or approved equal.

.2 Fixture type 'AA8'

.1 Luminaire: Pendant linear LED direct fixture, 2440mm length, fixture shall be one continuous section with 2440mm length shielding, maximum 310mm width 347 volt drivers, die-cast extruded aluminum housing with end caps. Fixture shall be provided with a satin/smooth lens, 100% downlight reflector. Fixtures shall be suspended by aircraft cable from structural joists. Over workstations, centre of fixture shall be suspended approximately 460mm below suspended wood panels; in walkways centre of fixture shall be mounted approximately 2400mm A.F.F. Confirm final mounting heights with architect and consultant prior to installation. Fixture finish shall be aluminum paint.

.2 Lamp: 48 watt, 800 lumens/ft LED module with remote phosphor technology, 3500K, minimum 80 CRI, 50,000 hours at 70% lumen maintenance,

.3 Driver: over-voltage, over-current and short-circuit protected, 347 volt, < 20% THD, dimmable to 1%.

.4 Manufacturer:
Axis Lighting #Slim series
Alera Lighting #PLK series
Ledalite #Thrive series
Or approved equal.

.3 Fixture type ‘BB’

.1 Luminaire: Pendant linear LED direct fixture,1219mm length, 347 volt drivers, die-cast extruded aluminum housing with end caps and in-line joint components suitable for continuous row mounting as shown on plans. Fixture shall be provided with a interior reflector allowing 100% downlight, frosted acrylic lens. Fixture shall be mounted flush with bottom of architectural wooden slat bulkheads, roughly 2,700mm A.F.F. by aircraft cable from structural joists. Confirm final mounting heights with consultant. Fixture finish shall be aluminum paint.

.2 Lamp: 3.6 watts/ft, 400 lumens/ft LED module with remote phosphor technology, 3500K, minimum 80 CRI, 50,000 hours at 70% lumen maintenance,

.3 Driver: over-voltage, over-current and short-circuit protected, 347 volt, < 20% THD, dimmable.

.4 Manufacturer:
Axis Lighting Beam 2 series
Or approved equal.

.4 Fixture type ‘BB5’

Same as fixture ‘BB’, except 1524mm length.

.5 Fixture type ‘CC’

.1 Luminaire: Recessed LED volumetric fixture suitable for installation in metal panel ceiling, 305 x 1219 mm, painted white steel frame and side reflectors, frosted acrylic center diffuser with satin lens. Fixture finish shall be aluminum paint.

.2 Lamp: 35 watt, 3000 lumen LED module with remote phosphor technology, 3500K, minimum 80 CRI, 50,000 hours at 70% lumen maintenance,

.3 Driver: over-voltage, over-current and short-circuit protected, 347 volt, < 20% THD, dimmable to 1%.

.4 Manufacturer:
Focal Point Equation LED series
Axis Lighting Day LED series
Or approved equal.

.6 Fixture type ‘DD’

.1 Luminaire: Recessed LED volumetric fixture suitable for inverted t-bar ceiling or metal panel ceiling, 610 x 610 mm, painted white steel frame and side reflectors, frosted acrylic center diffuser with satin lens.

.2 Lamp: 34 watt, 3000 lumen LED module with remote phosphor technology, 3500K, minimum 80 CRI, 50,000 hours at 70% lumen maintenance,

.3 Driver: over-voltage, over-current and short-circuit protected, 347 volt, < 20% THD, dimmable to 1%.

.4 Manufacturer:
Focal Point Equation series
Axis Lighting Day LED series

Or approved equal.

.7 Fixture type ‘EE’

.1 Luminaire: Suspended LED strip light, 1219mm length c/w frosted lens. Provide chain hanger to mount fixture to 2700mm A.F.F. unless otherwise noted. Coordinate final mounting height and locations with mechanical equipment and ductwork on site. Provide fixture complete with wire guard where specified on drawings with ‘WG’.

.2 Lamp: 40 watt, minimum 4000 lumen LED module with remote phosphor technology, 3500K, minimum 80 CRI, 50,000 hours at 70% lumen maintenance,

.3 Driver: over-voltage, over-current and short-circuit protected, 347 volt, < 20% THD.

.4 Manufacturer:
Cooper Metalux #SNLED series
Or approved equal.

.8 Fixture type ‘EE2’

.1 Luminaire: Suspended lensed LED strip light, 610mm length c/w frosted lens. Provide chain hanger to mount fixture to 2700mm A.F.F. unless otherwise noted. Coordinate final mounting height and locations with mechanical equipment and ductwork on site. Provide fixture complete with wire guard where specified on drawings with ‘WG’.

.2 Lamp: 20 watt, minimum 2000 lumen LED module with remote phosphor technology, 3500K, minimum 80 CRI, 50,000 hours at 70% lumen maintenance,

.3 Driver: over-voltage, over-current and short-circuit protected, 347 volt, < 20% THD.

.4 Manufacturer:
Cooper Metalux #SNLED series
Or approved equal.

.9 Fixture type ‘FF’

.1 Luminaire: Suspended lensed LED strip light, 1219mm length c/w semi-frosted lens. Provide chain hanger to mount fixture to 2700mm A.F.F. unless otherwise noted. Coordinate final mounting height and locations with mechanical equipment and ductwork on site. Provide fixture complete with wire guard where specified on drawings with ‘WG’.

.2 Lamp: 22 watt, minimum 2600 lumen LED module with remote phosphor technology, 3500K, minimum 80 CRI, 50,000 hours at 70% lumen maintenance,

.3 Driver: over-voltage, over-current and short-circuit protected, 347 volt, < 20% THD.

.4 Manufacturer:
Cooper Metalux #SNLED series
Or approved equal.

.10 Fixture type ‘GG’

.1 Luminaire: Recessed linear LED direct fixture, 915mm length, suitable for installation in metal panel ceiling. 347 volt drivers, die-cast extruded aluminum housing. Fixture finish shall be aluminum paint.

.2 Lamp: 7 watts/ft, 750 lumens/ft LED module with remote phosphor technology, 3500K, minimum 80 CRI, 50,000 hours at 70% lumen maintenance,

.3 Driver: over-voltage, over-current and short-circuit protected, 347 volt, < 20% THD.

.4 Manufacturer:
Axis Lighting Beam 4 series
Or approved equal.

.11 Fixture type 'JJ'

.1 Luminaire: Surface wall mounted LED fixture with white finish. 1219mm in length, smooth opalescent acrylic diffuser. Mount up 2100mm or as noted on drawings.

.2 Lamp: LED, 51 Watts, 4000 lumens LED module with remote phosphor technology, 4000K, minimum 80 CRI, 50,000 hours at 70% lumen maintenance,

.3 Driver: Over-voltage, over-current and short-circuit protected, 347 volt, < 20% THD.

.4 Manufacturer:
Cooper Metalux #BCLED Series
Lithonia #WL4 Series
Philips Day-Brite #CSW Series
Or approved equal

.12 Fixture type 'C'

.1 Luminaire: Suspended LED pendant, 311mm diameter diffused acrylic refractor with linear pattern, extruded cylindrical aluminum top housing in black finish, clear flat bottom lens, 347 Volt input with 0-10 Volt dimming driver, 13 Watts. Suspend from ceiling with silver braided power cord with bottom of fixture mounted flush with bottom of decorative ceiling panels. Five year warranty.

.2 Lamps: minimum 1316 lumen LED module, 4,000K, 80 CRI, 50,000 hours at 70% lumen maintenance.

.3 **Driver: 347-volt input, 0-10 Volt dimming driver.**

.4 Manufacturers:
Luminis Prisma series
Or approved equal

.13 Fixture type 'D'

.1 Luminaire: Suspended LED pendant, 416mm diameter conical diffuser, flat PMMA lens, die cast cylindrical aluminum top housing in black finish, black heat sink, clear flat bottom lens, 347 Volt input with 0-10 Volt dimming driver, 26 input watts. Suspend from ceiling with three adjustable stainless steel suspension cables, bottom of fixture mounted flush with bottom of decorative ceiling panels. Five year warranty.

.2 Lamps: 2,400 lumen LED module, 4,000K, 80 CRI, 50000 hours at 70% lumen maintenance.

.3 **Driver: 347-volt input, 0-10 Volt dimming driver.**

.4 Manufacturers:
Eureka Turbo series
Or approved equal

.14 Fixture type 'F'

.1 Luminaire: Suspended LED pendant, 584 mm diameter housing in 14 gauge aluminum in black finish, white triplex glass diffuser, 347 Volt input with 0-10 Volt dimming driver, 10 input watts. Suspend from ceiling with three adjustable stainless steel suspension cables, bottom of fixture mounted flush with bottom of decorative ceiling panels. Five year warranty.

.2 Lamps: 4727 to 5400 lumen LED module, 4,000K, 80 CRI, 50000 hours at 70% lumen maintenance.

.3 **Driver: 347-volt input, 0-10 Volt dimming driver.**

.4 Manufacturers:
Eureka 'Ollo' Series,
Or approved equal.

.15 Fixture type 'G'

.1 "Room In Use" sign shall be wall mounted LED (Lighting Emitting Diodes), solid state design with high output LED's for a maximum 2 watts per sign, 120 volt. Aluminum housing in white finish, acrylic barrier, Red "ROOM IN USE" custom special wording - confirm wording with owner prior to shop drawings. Universal mounting, minimum five year warranty. Wall mount above door. Sign shall be one of the following manufacturers:
Ready-Lite 'RA' Series,
Beghelli 'Quadra' #RM series,
Emergi-Lite #EA series,

.16 Fixture type 'H'

.1 Luminaire: Suspended LED pendant, 152 mm diameter faceted specular aluminum refractor, extruded cylindrical aluminum housing in powder coated black finish, clear flat tempered glass bottom lens, step down transformer to 347 Volt input with 0-10 Volt dimming driver, tilting mechanism allowing for 30 degree directional adjustability. Suspend from ceiling with suspension braided power cord with adjustable cable, bottom of fixture mounted flush with bottom of decorative ceiling panels. Five year warranty.

.2 Lamps: 18 watt, 1686 lumen LED module, 3500K, 80 CRI, 50000 hours at 70% lumen maintenance.

.3 **Driver: 347-volt input, 0-10 Volt dimming driver.**

.4 Manufacturers:
Luminis 'Syrios SY605 Series
Or approved equal.

2.6 SPARE FIXTURES

.1 In addition to the quantities of fixtures noted on drawings, the contractor shall provide the following fixtures as spare, to be turned over to the owner upon completion of the project:
- .1 Fixture type 'AA' – (1) additional fixture.
- .2 Fixture type 'AA8' – (1) additional fixture.
- .3 Fixture type 'BB' – (1) additional fixture.
- .4 Fixture type 'BB5' – (1) additional fixture.
- .5 Fixture type 'DD' – (1) additional fixture.
- .6 Fixture type 'EE' – (1) additional fixture.
- .7 Fixture type 'FF' – (1) additional fixture.
- .8 Fixture type 'GG' – (1) additional fixture.
- .9 Fixture type 'C' – (1) additional fixture.
- .10 Fixture type 'H' – (1) additional fixture.

Part 3

3.1 INSTALLATION

.1 The contractor under this Division shall be responsible for expediting the delivery and installation of the fixtures to suite the construction schedule and the work of other trades.

.2 Remove packing material and debris from the job site immediately after installation of fixtures and lamps. Debris shall not be allowed to accumulate more than a reasonable amount.

.3 Industrial fixtures where suspended shall have 12 mm conduit hangers and ball aligners, the length and location shall clear equipment ducts and pipes.

.4 Lighting fixture diffusers are not to be installed until the area is completely finished in order to minimize the amount of dirt collection on these units.

.5 Exit signs shall be wired in a separate conduit system.

.6 Conduit installation shall conform to the specifications.

.7 Emergency battery lighting units shall be connected to the existing 120-Volt or 347-Volt lighting circuit, non-switched leg.

3.2 CLOSEOUT SUBMITTALS

.1 Provide operation and maintenance information

- .1 Section 01 78 00 - Closeout Submittals

.2 Include:

- .1 Operation instructions
- .2 Description of system operation

.3 Description of each subsystem operation

.4 List specifying each piece of equipment in system or subsystem by its original manufacturer name and model number.

.5 Parts list specifying parts used in equipment by identification numbers that are standard to electronic industry.

3.3 WIRING

.1 Each fixture shall be fed with a separate flex or AC-90 drop. Looping between fixtures or wiring rows through ballast channel will not be accepted.

3.4 LUMINAIRE SUPPORTS

.1 Lighting fixtures shall be supported independent of plasterboard or acoustic tile. Support from structural joist members of the building or ceiling.

.2 Where existing ductwork and other obstructions in the ceiling space are present, light fixtures shall be provided with a support system consisting of horizontal unistrut members spanning below the obstructions and supported by vertical threaded rods connected to the existing steel structure.

.3 Fixtures installed in exposed ceilings may require plywood backing behind the acoustical panels. Confirm support requirements with manufacturer.

3.5 LUMINAIRE ALIGNMENT

.1 Luminaires shown in continuous lines or rows shall be carefully aligned so that all rows appear as straight lines.

.2 Fixtures shall be installed accurately in line and level. Any fixtures which are not installed properly shall be taken down and re-installed at no change to the contract sum. Plaster frames and rings required for recessed fixtures shall be supplied under this section, and installed under the lathing and plaster or acoustic ceiling divisions. The work of the electrical division shall include the necessary co-ordination with the above divisions in regard to the correct location and installation of the plaster frame and rings.

3.6 WARRANTY

.1 The contractor must make available to the Owner a local service department of a duly authorized distributor of the equipment manufacturer, which shall stock the manufacturer's standard parts. The service department shall have at least one factory trained repair technician available to the Owner on 24 hours' notice.

.2 Provide warranty of installation of equipment installed by this contractor to be free of defects for a period of (1) one year from date of Substantial Completion.

.3 Provide during the warranty period, all service, maintenance, parts, etc., required for normal operation of the systems, such that Owner needs not purchase additional maintenance agreement or contracts. Upon request, the manufacturer and his agent shall provide direct to the Owner the following proposals:

.1 Continuation, after the warranty period, of full maintenance, including all service, labour, parts, etc. required to maintain the systems in a fully operational condition.

3.7 VERIFICATION

.1 Perform tests in accordance with:

.1 Section 26 05 01 - Common Works Results - Electrical

.2 The entire installation shall be performed under the supervision of the manufacturer. Upon completion of the installation, the manufacturer shall check and test the entire system. Certification of all tests shall be submitted in writing to the Consultant and shall certify the following:

.1 That the system is complete in accordance with this specification

.2 That the system is installed in accordance with the manufacturer's best recommendations

.3 During the certification tests, the contractor shall provide one (1) electrician and (1) helper to assist the manufacturer's representative. The contractor shall also provide any required equipment such as ladders, scaffolding, etc.

3.8 TRAINING

.1 Perform training in accordance with:

.1 Section 26 05 01 - Common Works Results – Electrical

.2 Written documentation bearing name and signature of Owner's personnel who received the above instructions shall be included in the operating instructions and service manuals.

END OF SECTION

Part 1 General

1.1 GENERAL REQUIREMENTS

.1 The General Conditions of Contract, Division 01 General Requirements and all Addenda thereto form an integral part of and must be read in conjunction with the requirements of this Section.

.2 Cooperate and coordinate with the requirements of other units of work specified in other Sections.

1.2 REFERENCES

.1 The Electrical Contractor shall be bound by industry standards, as interpreted by the Consultant, whether or not specifically referenced in this document. Comply with Electrical Protection Act and rules and regulations made pursuant thereto, including the 2012 Canadian Electrical Code. Also, comply with applicable standards of the following:

.1 CSA C22.1-2012, Canadian Electrical Code, Part 1.

.2 CSA C22.2 No. 141, Unit Equipment for Emergency Lighting

.3 National Building Code 2010 (NBC 2010)

.4 National Fire Code 2010

1.3 SHOP DRAWINGS AND PRODUCT DATA

.1 Submit shop drawings in accordance with:

.1 Section 01 33 00 - Submittal Procedures

.2 Section 26 05 01 – Common Work Results

.2 Shop drawings for each fixture shall include but not be limited to, lamps, ballasts, fixture cuts, custom colors, and special mounting details. All pertinent information for each fixture shall be stapled separately from other fixtures.

1.4 PRODUCT APPROVALS

.1 Manufacturers' and model numbers named in these specifications indicate an acceptable technical standard of performance and are not intended to be exclusive. Products submitted as alternates must result in a control system that meets or exceeds all technical performance criteria as described.

.2 Products proposed as alternatives to those specified, shall only be considered if submitted for approval no later than 15 working days before tender close. Submit alternates, for approval, as one complete listing. Provide complete product specification sheets with request for approval.

.3 The Bidder must provide a complete list of primary system products offered with their bid.

1.5 CLOSEOUT SUBMITTALS

.1 Provide operation and maintenance information

.1 Section 01 78 00 - Closeout Submittals

.2 Include:

.1 Operation instructions

.2 Description of system operation

.3 Description of each subsystem operation

.4 List specifying each piece of equipment in system or subsystem by its original manufacturer name and model number.

.5 Parts list specifying parts used in equipment by identification numbers that are standard to electronic industry.

1.6 WASTE MANAGEMENT AND DISPOSAL

.1 Meet requirements of Section 01 74 19 – Waste Management and Disposal.

.2 Collect and separate waste for reuse, recycling, and other waste diversion strategies in accordance with Waste Management Plan. \

1.7 WARRANTY

.1 The warranty period for the supply and installation of emergency battery units and remote emergency lighting fixtures shall commence on the date of substantial completion regardless of the manufacturer's specific warranty disclaimers with respect to date of shipment or date of installation of the equipment. The warranty period from date of substantial completion is one full year.

.2 Provide a full replacement warranty of the emergency lighting equipment free of defects in material and workmanship for a period of (1) one year from date of substantial completion. In addition to this requirement:

.1 Batteries shall include a pro-rated warranty for a minimum (5) five years shall commence the date the full warranty period ends.

.2 Integral and remote MR16 LED lamps shall have a (5) year warranty from date of substantial completion.

.3 A battery determined to be defective during the pro-rated warranty period shall be repaired or replaced at a cost equal to the net price in effect at the time, reduced by the percentage obtained in multiplying 10% by the number of full years remaining in the total warranty period. Such repair or replacement at this adjusted price shall be the purchaser's exclusive remedy.

Part 2 Products

2.1 EQUIPMENT

.1 Emergency lighting equipment: to CSA C22.2 No. 141.

.2 Products shall be compatible with the Nexus RF emergency lighting monitoring system.

.3 Emergency lighting units shall be battery contained units 120 volt and 347 volt, with a combination of remote heads interconnected as indicated on drawings, including wiring to a DC terminal block in the exit sign fixtures.

.4 Output voltage: 12 V, DC.

.5 Battery: sealed long-life, maintenance free lead acid battery with 10-year life expectancy.

.6 Charger: solid state, pulse type charger, current limited, temperature-compensated, short-circuit proof, reverse-polarity protected. Unit standard with electronic lockout and brownout circuits. Complete battery recharge in 24 hours.

.7 Solid state transfer circuit.

.8 Low voltage battery circuit protection to disconnect the battery form the fused output circuit at the end of discharge.

.9 Non-audible LED diagnostic display to identify source of failure: battery, charger circuitry or lamps.

.10 Signal lights: solid state, for 'AC Power ON' and 'High Charge'.

.11 Lamp heads: Integral to battery unit unless otherwise noted, 345° horizontal and 180° vertical adjustment without need for tools to adjust aim. Lamp type: 6 watt 12-volt MR16 LED.

.12 All emergency lighting fixtures shall be surface mounted up 2100mm unless otherwise noted. Lighting heads shall be adjusted on site to provide optimum lighting within the area with an emphasis directed at illuminating means of egress towards the exits. Coordinate mounting heights with architectural elevation drawings prior to rough-in.

.13 Battery units shall be labeled with identification numbers to match the owner's existing numbering system. Contractor shall coordinate with the owner.

.14 Emergency lighting units and remote fixtures shall be as specified in the following schedule, and the manufacturer's numbers shown shall not reduce or amend the requirements as outlined under the description of each fixture type.

Fixture type 'E-MA': Emergency lighting unit shall be a battery contained unit with two integral lighting heads equipped with 2 x 6 watt, **12-volt** MR16 LED lamps. The emergency battery unit shall have a minimum **108 watt** capacity for 30 minutes, sealed long life battery with 10 year life expectancy. Solid state charger and battery protection circuit. Include auto-test self-diagnostic option, 120 and 347 Volt input. Unit shall be Nexus RF compatible.
Emergi-Lite - #NXM Series
Ready-Lite - #TUF-NM Series

Fixture type 'E-R2' – Emergency remote light fixture powered from fixture type 'E-MA', 'as indicated, 2 x 20 watt **12 volt** MR16 lamps, fully gasketed cast aluminium back plate in white finish, clear polycarbonate cover. PRO
Emergi-Lite – Survive-All NXM series
Ready-Lite - #TUF-NM Series

Emergency Lighting Monitoring System 'NEXUS RF Series' – Wireless radio frequency (RF) communication system capable of activating and testing individual or multiple emergency lights and generating reports. System is 900 MHz mesh networking technology with optimum channel selection, graphical user interface (GUI) accessible on wireless area controller (AC) also stores the master database, operates as a user interface c/w keypad and LCD touch screen, coordinates nodes both through the routers and its own cluster. The area controller router (ACR) can coordinate a cluster of up to 90 nodes and maintains the database independent to the (AC). Unit c/w touch screen, USB ports, Ethernet connection, battery back-up, SD slot for removable memory, CF slot for memory or peripheral devices. Unit is capable of logging test results and generating reports using NEXUS reporting functions. Provide all components and wiring and cables and interface modules for a fully operational system.

RF Area Controller (AC) – head end database system, coordinates up to 90 nodes, 128MB RAM, SD flash memory 2GB, 100-240VAC 50/60Hz, 12VDC @2.1A output, 918 to 925.8 MHz, battery backed, integrated web server, 2 meter Blue Cat5e UTP patch cord, wall bracket c/w security latch, USB ports for connection to keyboard, mouse, printer and PC, 1GB USB flash memory stick, Ethernet port, 50 ohm SMA antenna jack and 75mm stub antenna.

Nexus RF Repeater (REP-EL) – Provide five (5) RF repeaters to boost the RF signal where required. Provide 120 Volt connection from the nearest existing 120 Volt non-switched circuit. Locations are not shown on drawings - Coordinate locations on site with manufacturer during system setup where stronger RF signal is required.

2.2 ADDITIONAL MATERIALS

.1 In addition to the materials specified and the quantity of materials as determined on the plans, provide for the supply and installation of the following additional materials, which shall be turned over to the owner if not installed during construction:

Fixture type 'E-R2': 3 fixtures

.2 For each spare emergency light fixture listed, include in the base pricing the supply and installation of 2 # 10 RW90 and insulated ground in 10 meter length of 16mm conduit (including fittings).

Part 3 Execution

3.1 INSTALLATION

.1 The contractor under this Division shall be responsible for expediting the delivery and installation of the fixtures to suite the construction schedule and the work of other trades.

.2 Batteries for lighting units if placed in storage prior to installation shall be placed in an environment protected from cold and extreme heat. Store batteries in accordance with the manufacturer's recommendations. Batteries shall have a maximum storage life (shelf life) of 6 months. Batteries must be recharged or placed in service within the 6 months of storage life.

.3 Remove packing material and debris from the job site immediately after installation of fixtures and lamps. Debris shall not be allowed to accumulate more than a reasonable amount.

.4 Lighting fixtures installed in any area that is not completely finished shall be cleaned at the end of the construction.

.5 Emergency battery lighting units shall be direct connected to the room's light circuit (non-switched leg).

.6 Battery units shall be labeled with identification numbers to match the owner's existing numbering system. Contractor shall coordinate with the owner.

.7 Mounting heights: The minimum mounting height of emergency lighting battery units and remote emergency light fixtures shall be as noted herein, unless otherwise noted on drawings:

.1 Emergency battery units: 2100mm above finished floor.

.2 Emergency remote fixtures: Ceiling mounted or wall mounted as indicated on the floor plans. Wall mounted fixtures shall be a minimum 2100mm above finished.

.8 Lighting heads shall be adjusted on site to provide optimum lighting within the area with an emphasis directed at illuminating means of egress towards the exits.

3.2 WIRING

.1 Conduit: in accordance with Section 26 05 34 – Conduits, Conduit Fastenings and Conduit Fittings.

.2 Conductors: In accordance with Section 26 05 21 – Wires and Cables 0 – 1000 V

.1 In accordance with Section 26 05 21 – Wires and Cables 0 – 1000 V

.2 Minimum #12 AWG Copper up to maximum 5% voltage drop.

.3 Each fixture shall be fed with a separate flex or AC-90 drop.

.4 Providing wiring from the battery unit emergency dc circuit to the exit sign DC terminal block.

3.3 LUMINAIRE SUPPORTS

.1 Lighting fixtures shall be supported independent of plasterboard or acoustic tile. Support from structural members of the building or ceiling.

.2 Fixtures installed in exposed ceilings may require plywood backing behind the acoustical panels. Confirm support requirements with manufacturer.

3.4 LUMINAIRE ALIGNMENT

.1 Fixtures shall be installed accurately in line and level. Any fixtures which are not installed properly shall be taken down and re-installed at no change to the contract sum.

3.5 VERIFICATION

.1 Perform tests in accordance with:

.1 Section 26 05 01 - Common Works Results - Electrical

.2 The entire installation shall be performed under the supervision of the manufacturer. Upon completion of the installation, the manufacturer shall check and test the entire system. Certification of all tests shall be submitted in writing to the Consultant and shall certify the following:

.1 That the system is complete in accordance with this specification

.2 That the system is installed in accordance with the manufacturer's best recommendations

.3 During the certification tests, the contractor shall provide one (1) electrician and (1) helper to assist the manufacturer's representative. The contractor shall also provide any required equipment such as ladders, scaffolding, etc.

3.6 TRAINING

.1 Perform training in accordance with section 26 05 01 - Common Works Results – Electrical.

.2 Written documentation bearing name and signature of Owner's personnel who received the above instructions shall be included in the operating instructions and service manuals.

END OF SECTION

PART 1 General

1.1 REFERENCES

.1 Canadian Standards Association (CSA)

.2 National Fire Protection Association (NFPA) requirements

1.2 SUBMITTALS

.1 Submit product data in accordance with Section 01 33 00 - Submittals .

.2 Submit product data sheets for exit lights. Include product characteristics, performance criteria, physical size, limitations and finish.

.3 Manufacturer's Instructions: Provide to indicate special handling criteria, installation sequence and cleaning procedures.

1.3 WASTE MANAGEMENT AND DISPOSAL

.1 Meet requirements of Section 01 74 19 - Waste Management and Disposal.

.2 Collect and separate waste for reuse, recycling, and other waste diversion strategies in accordance with Waste Management Plan.

PART 2 Products

2.1 STANDARD UNITS

.1 Exit signs: to CSA C22.2 No.141 and CSA C860, packaged in accordance with the Canadian Code for Preferred Packaging guidelines.

.2 Exit sign fixtures shall be LED (Lighting Emitting Diodes), solid state design with high output LED's for a maximum 2 watts per sign single or double face.

.3 Exit sign fixture shall be compatible with the Nexus RF emergency lighting monitoring system and shall be c/w Nexus wireless system interface.

.4 Universal input voltage of 120, 277 or 347 Volt AC.

.5 DC terminal block for 12 Volt DC input

.6 Aluminum housing in white finish

.7 Acrylic barrier

.8 Three green "Running Man" pictograms for direction selection (straight, left and right)

.9 Universal mounting

.10 Minimum five year warranty.

.11 Exit signs shall be one of the following manufacturers:

Ready-Lite 'RA' Series, Emergi-Lite #EA series,

2.2 Fixture Type 'X1'

Exit sign, ceiling mounted, single face, direction indicators as shown on drawings.

2.3 Fixture Type 'X2'

Exit sign, ceiling mounted, double face, direction indicators as shown on drawings.

2.4 Fixture Type 'X3'

Exit sign, surface wall mounted, single face, bottom of fixture mounted 100mm above door, direction indicators as shown on drawings.

2.5 ADDITIONAL MATERIALS

.1 In addition to the materials specified and the quantity of materials as determined on the plans, supply and install the following additional exit sign fixtures:

Fixture type 'X1': 2 x additional exit fixtures
Fixture type 'X2': 2 x additional exit fixtures
Fixture type 'X3': 2 x additional exit fixtures

.2 For each additional exit sign fixture noted, include supply and installation conduit/wire for connection of the additional exit fixtures:

.1 120V / 347V : 10 meters of 2 # 12 RW90 plus insulated ground wire in 10 meters of 16mm conduit per fixture

.2 DC Input: 10 meters of 2 # 10 RW90 in 10 meters of 16mm conduit per fixture

.3 Location of the additional exit sign fixtures to be confirmed on site with the Consultant.

PART 3 Execution

3.1 INSTALLATION

.1 The contractor under this Division shall be responsible for expediting the delivery and installation of the exit fixtures to suit the construction schedule and work of other trades.

.2 Install exit signs so as to be visible from the exit approach.

.3 Exit signs shall be wired in a separate conduit system.

.4 Interconnect exit fixtures to the emergency lighting battery unit emergency circuit.

.5 Ensure the exit sign circuit breaker is locked in the 'ON' position.

.6 Exit sign shall be connected into the Nexus RF emergency lighting monitoring system specified in Section 265200.

3.2 WARRANTY

.1 The contractor must make available to the Owner a local service department of a duly authorized distributor of the equipment manufacturer, which shall stock the manufacturer's standard parts. The service department shall have at least one factory trained repair technician available to the Owner on 24 hours' notice.

.2 Provide warranty of installation of equipment installed by this contractor to be free of defects for a period of (1) one year from date of Substantial Completion.

.3 Provide during the warranty period, all service, maintenance, parts, etc., required for normal operation of the systems, such that Owner needs not purchase additional maintenance agreement or contracts. Upon request, the manufacturer and his agent shall provide direct to the Owner the following proposals:

.1 Continuation, after the warranty period, of full maintenance, including all service, labour, parts, etc. required to maintain the systems in a fully operational condition.

3.3 VERIFICATION

.1 The entire installation shall be performed under the supervision of the manufacturer. Upon completion of the installation, the manufacturer shall check and test the entire system. Certification of all tests shall be submitted in writing to the Consultant and shall certify the following:

.1 That the system is complete in accordance with this specification

.2 That the system is installed in accordance with the manufacturer's best recommendations

.2 During the certification tests, the contractor shall provide one (1) electrician and (1) helper to assist the manufacturer's representative. The contractor shall also provide any required equipment such as ladders, scaffolding, etc.

3.4 TRAINING

.1 Perform training in accordance with:

.1 Section 26 05 01 - Common Works Results - Electrical

.2 Written documentation bearing name and signature of Owner's personnel who received the above instructions shall be included in the operating instructions and service manuals.

END OF SECTION

Part 1 General

1.1 GENERAL REQUIREMENTS

.1 The General Conditions of Contract, Division 01 General Requirements and all Addenda thereto form an integral part of and must be read in conjunction with the requirements of this Section.

.2 Cooperate and coordinate with the requirements of other units of work specified in other Sections.

1.2 REFERENCES

.1 The Electrical Contractor shall be bound by industry standards, as interpreted by the Consultant, whether or not specifically referenced in this document. Comply with Electrical Protection Act and rules and regulations made pursuant thereto, including the 2012 Canadian Electrical Code. Also, comply with applicable standards of the following:

.1 CSA C22.1-2012, Canadian Electrical Code, Part 1.

.2 Electrical and Electronic Manufacturers Association of Canada (EEMAC).

.3 National Electrical Manufacturers Association (NEMA).

.4 National Building Code 2010 (NBC 2010)

.5 National Fire Protection Association (NFPA)

.6 Institute of Electrical and Electronic Engineers (IEEE).

.2 Canadian Standards Association, (CSA International)

.1 CSA-T529, Telecommunications Cabling Systems in Commercial Buildings (Adopted ANSI/EIA TIA 568A with modifications).

.2 CSA-C22.2 No. 214, Communications Cables (Bi-national Standard, with UL 444).

.3 CAN/CSA-C22.2 No. 182.4, Plugs, Receptacles, and Connectors for Communication Systems.

.3 Telecommunications Industry Association (TIA)

.1 TIA/EIA/ANSI – 568B.1/2/3 latest revision Commercial Building Standards for Telecommunications Pathways and Spaces;

.2 TIA-568-C.0 Generic Telecommunications Cabling for Customer Premises;

.3 TIA-568-C Series Commercial Building Telecommunications Cabling Standard;

.4 TIA/EIA-569 Commercial Building Standard for Telecommunications Pathway and Spaces;

.5 TIA/EIA-606 The Administration Standard for the Telecommunications Infrastructure of Commercial Building;

.6 TIA/EIA-607 Commercial Building Ground (Earthing) and Bonding Requirements for Telecommunications;

.7 Category 6A system and testing as released by TIA/EIA/ANSI – latest revision

.8 TIA/EIA T568-A UTP wiring/pinout

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1.3 SHOP DRAWINGS AND PRODUCT DATA

.1 Submit shop drawings in accordance with:

.1 Section 01 33 00 - Submittal Procedures

.2 Section 26 05 01 – Common Work Results

1.4 PRODUCT APPROVALS

.1 Manufacturers' and model numbers named in these specifications indicate an acceptable technical standard of performance and are not intended to be exclusive. Products submitted as alternates must result in a control system that meets or exceeds all technical performance criteria as described.

.2 Products proposed as alternatives to those specified, shall only be considered if submitted for approval no later than 15 working days before tender close. Submit alternates, for approval, as one complete listing. Provide complete product specification sheets with request for approval.

.3 The Bidder must provide a complete list of primary system products offered with their bid.

1.5 SYSTEM DESCRIPTION

.1 The data and voice cable installation shall include all cable, patch panels, data racks, patch cords, connectors, terminations, and coverplates. New cables shall be terminated on new patch panels within new racks within new LAN closet, and on new patch panels within existing racks within the existing LAN closet, as noted on drawings.

.2 The cabling system shall meet or exceed the minimum characteristics as outlined TIA Standards Category 6A. In addition, the testing method and parameters shall be as per the TIA recommendations.

.3 The cabling installer shall be a Belden Certified System Vender installing Belden components. Once completed, the installation must be a Belden Certified System. The data system and components shall be guaranteed for a period of twenty (20) years from the date of installation against defects in materials and workmanship.

1.6 SUBMITTALS

.1 Submit product data in accordance with Section 01 33 00 - Submittal Procedures and 26 05 01 – Common Work Results, Electrical.

.2 Submit shop drawings for review prior to ordering equipment. Shop drawings shall include but not be limited to, photocopies of accredited installers, cabling, hardware and components, patch cords, tester information, and labeling.

.3 Submit manufacturer's certification documentation that guarantees installation techniques, cable and cabling components and carry a minimum 20 year certification from the manufacturer for the capability to support gigabit applications such as 1000 Base-T, 622MB/s and 2.4 Gb/s ATM and work case channel performance based on the values indicated. The term channel performance incorporates manufacturer certified patch cords.

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.4 Upon request and at no cost, the contractor shall provide a manufacturer's technical representative to conduct an onsite visit to ensure complete technical compliance.

.5 The manufacturer's certification must guarantee that design or installation negligence on the part of the certified contractor will not negate or void any portion of the certified system. The manufacturer must guarantee that all material, components and labour are covered for the full certification period. It must also guarantee that in the event a contractor is no longer in business, the full certification remains valid.

1.7 CONTRACTOR QUALIFICATIONS

.1 The Installer (Firm and Employees) conducting the installation shall have full working knowledge of cabling low voltage applications such as, but not limited to data/voice communications cabling systems. The Installer shall have at least five years of continuous recent experience on similar projects. The Installer shall hold recent, up-to-date licenses, certifications and training certificates in the area the project is located and for the equipment to be installed. The Installer shall:

.1 Provide references of the type of installation provided for this specification;

.2 Be a Belden Certified System Vendor.

.3 Have a knowledge of all applicable Telecommunication standards such as but not limited to CSA, TIA/EIA, IEEEE and ANSI;

.4 Have a experience in the installation of pathways and support for horizontal and backbone cabling;

.5 Be experienced in the installation and testing of telecommunication network cabling system, including the use of light meter and OTDR.

.6 Provide proof of being a manufacturer certified installer for all cable network components being installed such as but not limited to cables, connectors and end termination equipment. The use of non-manufacture certified installer is not permitted.

1.8 PROJECT CLOSEOUT

.1 Submit product data in accordance with Section 01 33 00 - Submittal Procedures and 26 05 01 – Common Work Results, Electrical.

.2 Operating and Maintenance Manuals at project closeout shall include

.1 List of cables, hardware and components;

.2 Copies of approved shop drawings;

.3 Record drawings.

.4 Warranty certification from the Manufacturer

.5 Receipts that include the listing of spare parts, materials and supplies, including patch cables and equipment cords.

.6 Test and verification reports (may be submitted on CD Disk inserted in an appropriate envelope page in the manual).

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Part 2 Products

2.1 COMMUNICATION CABLES, PATHWAYS AND TERMINATION BLOCKS

.1 Refer to Section 27 05 14 - Communication Cables Inside Buildings

.2 Refer to Section 27 05 28 – Pathways for Communications Systems

.3 Refer to Section 27 11 19 – Communications Termination Blocks

Part 3 Execution

3.1 FIELD QUALITY CONTROL

.1 Perform tests in accordance with Section 26 05 01 - Common Work Results - Electrical.

.2 The communications cabling system and testing shall comply with the following standards. All standards shall be as per the latest revision at the time of tendering this project.

.1 TIA/EIA/ANSI – 568B.1/2/3 latest revision
.2 Category 6A system and testing as released by TIA/EIA/ANSI – latest revision
.3 TIA/EIA T568-A UTP wiring/pinout
.4 BICSI, TDMM Telecommunications Distribution Methods Manual (latest edition)
.5 CAN/CSA-T529-M91
.6 CAN/CSA-T530-M90
.7 CAN/CSA-T527-94, EIA/TIA-607
.8 CAN/CSA-T528-93, EIA/TIA-606
.9 EIA/TIA-TSB 40-A
.10 EIA/TIA-TSB 67
.11 EIA/TIA-569
.12 EIA/TIA-606

.3 The total installation shall be completed by the cable Installer who is certified by the manufacturer for Category 6A cable installations. The Installer shall submit photocopies of accreditation certificates with the shop drawings. Submit testing method and tester with shop drawings.

.4 The contractor shall submit the verified test result on each cable, connector, and connection for the total installation, including back-bone and horizontal cabling. The model number and manufacturer of the Category 6A cable shall be documented. The type of tester used for testing the Category 6A cabling must also be documented.

.5 Test results shall be evaluated by the test equipment using the most up-to-date criteria from the TIA/EIA Standard. This information shall be supplied in electronic format.

.1 Room number of installation
.2 Wall plate ID
.3 Test Results with an identification of type of test used and whether the result was PASS or FAIL

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.6 Category 6A cable tests shall provide results for the following tests:

.1 Near End Crosstalk (NEXT)

.2 Attenuation

.3 Ambient Noise

.4 Attenuation to Crosstalk Ration (ACR)

.5 Far End Crosstalk (FEXT)

.7 Provide with maintenance manuals, a marked set of prints illustrating the network drop name for each drop location. No other as-built information shall be provided on these prints unless it relates to the data or voice network.

.8 The consultant will spot test this testing following test completion. Contractor shall provide the testing technician for (2) hours, and the completed test charts, for spot check verifications.

3.2 WARRANTY

.1 Testing and certification of the building network distribution cable installation shall be by the Installer and shall include the provision of a full Manufacturer's and Vendor's Warranty covering performance, products and installation. The Warranties shall cover the full repair and/or replacement of any component failing or failure to meet the design requirements within one (1) year. Warranties shall be delivered to the Project Manager with the Testing and Certification documentation.

.2 Within ten (10) days after testing, the Installer shall submit the cable test results, and a marked up record drawing(s) of the as-built cable network. The record drawing(s) shall include the cable/jack identification at the outlet locations.

.3 The contractor must make available to the Owner a local service department of a duly authorized distributor of the equipment manufacturer, which shall stock the manufacturer's standard parts. The service department shall have at least one factory trained repair technician available to the Owner on 24 hours' notice.

.4 Provide during the warranty period, all service, maintenance, parts, etc., required for normal operation of the systems, such that Owner needs not purchase additional maintenance agreement or contracts

3.3 VERIFICATION

.1 Perform tests in accordance with:

.1 Section 26 05 01 - Common Works Results - Electrical

.2 The entire installation shall be performed under the supervision of the manufacturer. Upon completion of the installation, the manufacturer shall check and test the entire system. Certification of all tests shall be submitted in writing to the Consultant and shall certify the following:

.1 That the system is complete in accordance with this specification

.2 That the system is installed in accordance with the manufacturer's best recommendations

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.3 During the certification tests, the contractor shall provide one (1) electrician and (1) helper to assist the manufacturer's representative. The contractor shall also provide any required equipment such as ladders, scaffolding, etc.

3.4 TRAINING

.1 Perform training in accordance with:

.1 Section 26 05 01 - Common Works Results - Electrical

.2 Written documentation bearing name and signature of Owner's personnel who received the above instructions shall be included in the operating instructions and service manuals.

END OF SECTION

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Part 1 General

1.1 GENERAL REQUIREMENTS

.1 The General Conditions of Contract, Division 01 General Requirements and all Addenda thereto form an integral part of and must be read in conjunction with the requirements of this Section.

.2 Cooperate and coordinate with the requirements of other units of work specified in other Sections.

1.2 REFERENCES

.1 The Electrical Contractor shall be bound by industry standards, as interpreted by the Consultant, whether or not specifically referenced in this document. Comply with Electrical Protection Act and rules and regulations made pursuant thereto, including the 2012 Canadian Electrical Code. Also, comply with applicable standards of the following:

.1 CSA C22.1-2012, Canadian Electrical Code, Part 1.

.2 Electrical and Electronic Manufacturers Association of Canada (EEMAC).

.3 National Electrical Manufacturers Association (NEMA).

.4 National Building Code 2010 (NBC 2010)

.5 National Fire Protection Association (NFPA)

.6 Institute of Electrical and Electronic Engineers (IEEE).

.7 Audio Engineering Society (AES).

.8 Other Applicable CSA and UL approvals.

1.3 SHOP DRAWINGS AND PRODUCT DATA

.1 Submit shop drawings in accordance with:

.1 Section 01 33 00 - Submittal Procedures

.2 Section 26 05 01 – Common Work Results

1.4 PRODUCT APPROVALS

.1 Manufacturers' and model numbers named in these specifications indicate an acceptable technical standard of performance and are not intended to be exclusive. Products submitted as alternates must result in a control system that meets or exceeds all technical performance criteria as described.

.2 Products proposed as alternatives to those specified, shall only be considered if submitted for approval no later than 15 working days before tender close. Submit alternates, for approval, as one complete listing. Provide complete product specification sheets with request for approval.

1.5 WASTE MANAGEMENT AND DISPOSAL

.1 Meet requirements of Section 01 74 19 - Waste Management and Disposal.

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.2 Collect and separate waste for reuse, recycling, and other waste diversion strategies in accordance with Waste Management Plan.

1.6 SYSTEM DESCRIPTION

.1 The data and voice cable installation shall include all cable, connectors as specified and shown on drawings.

.2 The cabling system shall meet or exceed the minimum characteristics as outlined TIA Standards Category 6A. In addition, the testing method and parameters shall be as per the TIA recommendations and meet requirements for testing Category 6A installations.

.3 The cabling system shall use matched components from a single manufacturer certified to deliver system performance over the lifetime of the applications which the cabling system was originally designed to support. The data system and components to be certified by the manufacturer and shall be guaranteed for a period of twenty (20) years from the date of installation against defects in materials and workmanship. The manufacturer shall be Belden.

.4 Each cable shall be equipped with connectors on each end and connected to wall jacks or cable connectors. All field communications cabling to be terminated on patch panels located on the drawings.

.5 The data cabling channel shall not exceed four (4) connections and shall not exceed 90m.

Part 2 Products

2.1 HORIZONTAL COMMUNICATIONS BUILDING CABLE (CBC)

.1 All communication cable (data and voice) shall be unshielded twisted pair, Category 6A. four (4) pair #23 AWG, CMP (FT6) rated and meet TIA/EIA/ANSI – 568-C.2, latest revision unless noted otherwise. Data cable colour shall be blue unless noted otherwise on drawings as white in areas of Rooms 205 & 214.

.2 Each cable shall be equipped with connectors on each end at the wall jacks and patch panels at the data equipment racks.

.3 The data cabling channel shall not exceed four (4) connections and overall length shall not exceed 90m. The maximum distance shall include an allowance of 3 meters from the outlet to the workstation and 6 meters for patch cords.

.4 Data and voice may be installed in a common box.

2.2 NETWORK PATCH CORDS

.1 Pre-terminated, factory tested patch cords shall be of the same manufacturer as the installed system and shall be part of the certified system. Patch cords shall be labeled at both ends.

.2 Patch cords for data and voice cables shall have stranded conductors and meets the requirements of TIA/EIA 568A (latest revision). Patch cords shall meet Category 6A criteria when tested with the components of the system. Patch cords at workstations shall be Category 6A cable terminated with 8 pin modular male jacks, TIA T568A pinout.

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.3 Provide two (2) patch cords for each cable drop located on the plans.

.4 Provide cords in the following lengths: 50% (data total) shall be 1.2m length; 30% (data total) shall be 1.8m length; 20% (data total) shall be 2.1m length.

.5 Patch cords shall be provided in the following colours for each length noted above, but shall be confirmed with the owner prior to turn over:
- .1 40% - Yellow (Tech & ICE)
- .2 20% - Green (Internet)
- .3 20% - Blue (ROSS)
- .4 20% - White (Phone)

.6 At each voice jack location at the workstation, provide a manufactured Ethernet RJ45 Male to RJ11 Female adapter converter. The RJ45 male adapter shall be separated from the RJ11 female adapter with a minimum 150mm cable to allow adjacent patch cables to be installed in the wall plate.

Part 3 Execution

3.1 INSTALLATION OF COMMUNICATION CABLES

.1 All cable shall be pulled using proper wire grips. Pulling force and bend radius shall not exceed manufacturer's specifications.

.2 Velcro straps shall be used in all locations, cable ties are unacceptable.

3.2 WARRANTY

.1 The contractor must make available to the Owner a local service department of a duly authorized distributor of the equipment manufacturer, which shall stock the manufacturer's standard parts. The service department shall have at least one factory trained repair technician available to the Owner on 24 hours' notice.

.2 Provide warranty of installation of equipment installed by this contractor to be free of defects for a period of (1) one year from date of Substantial Completion.

.3 Provide during the warranty period, all service, maintenance, parts, etc., required for normal operation of the systems, such that Owner needs not purchase additional maintenance agreement or contracts. Upon request, the manufacturer and his agent shall provide direct to the Owner the following proposals:

- .1 Continuation, after the warranty period, of full maintenance, including all service, labour, parts, etc. required to maintain the systems in a fully operational condition.

.4 During the warranty period, provide three (3) separate site visits of four (4) hours each on site for owner revisions and additional training.

3.3 VERIFICATION

.1 Perform tests in accordance with:

.1 Section 26 05 01 - Common Works Results - Electrical

.2 The entire installation shall be performed under the supervision of the manufacturer. Upon completion of the installation, the manufacturer shall check and test the entire system. Certification of all tests shall be submitted in writing to the Consultant and shall certify the following:

.1 That the system is complete in accordance with this specification

.2 That the system is installed in accordance with the manufacturer's best recommendations

.3 During the certification tests, the contractor shall provide one (1) electrician and (1) helper to assist the manufacturer's representative. The contractor shall also provide any required equipment such as ladders, scaffolding, etc.

3.4 TRAINING

.1 Perform training in accordance with:

.1 Section 26 05 01 - Common Works Results - Electrical

.2 Written documentation bearing name and signature of Owner's personnel who received the above instructions shall be included in the operating instructions and service manuals.

END OF SECTION

□

PART 1 General

1.1 GENERAL REQUIREMENTS

.1 The General Conditions of Contract, Division 01 General Requirements and all Addenda thereto form an integral part of and must be read in conjunction with the requirements of this Section.

.2 Cooperate and coordinate with the requirements of other units of work specified in other Sections.

1.2 REFERENCES

.1 The Electrical Contractor shall be bound by industry standards, as interpreted by the Consultant, whether or not specifically referenced in this document. Comply with Electrical Protection Act and rules and regulations made pursuant thereto, including the 2012 Canadian Electrical Code. Also, comply with applicable standards of the following:

.1 CSA C22.1-2012, Canadian Electrical Code, Part 1.

.2 Electrical and Electronic Manufacturers Association of Canada (EEMAC).

.3 National Electrical Manufacturers Association (NEMA).

.4 National Building Code 2010 (NBC 2010)

.5 National Fire Protection Association (NFPA)

.6 Institute of Electrical and Electronic Engineers (IEEE).

.7 Audio Engineering Society (AES).

.8 Other Applicable CSA and UL approvals.

.2 Telecommunications Industry Association (TIA)

.1 TIA/EIA/ANSI – 568B.1/2/3 latest revision Commercial Building Telecommunications Cabling Standards for Telecommunications Pathways and Spaces;

.2 TIA/EIA/ANSI – 515000 Generic Specification for Optical Fibre and Cable Splices

.3 TIA-568-C.0 Generic Telecommunications Cabling for Customer Premises;

.4 TIA-568-C Series Commercial Building Telecommunications Cabling Standard;

.5 TIA/EIA-569 Commercial Building Standard for Telecommunications Pathway and Spaces;

.6 TIA/EIA-606 The Administration Standard for the Telecommunications Infrastructure of Commercial Building;

.7 TIA/EIA-607-A Commercial Building Ground (Earthing) and Bonding Requirements for Telecommunications;

.8 Category 6A system and testing as released by TIA/EIA/ANSI – latest revision

.9 TIA/EIA T568-A UTP wiring/pinout

1.3 SHOP DRAWINGS AND PRODUCT DATA

.1 Submit shop drawings in accordance with:

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.1 Section 01 33 00 - Submittal Procedures

.2 Section 26 05 01 – Common Work Results

.2 Submit shop drawings for review prior to ordering equipment. Shop drawings shall include but not be limited to, photocopies of accredited installers, outlets, and coverplates.

1.4 PRODUCT APPROVALS

.1 Manufacturers' and model numbers named in these specifications indicate an acceptable technical standard of performance and are not intended to be exclusive. Products submitted as alternates must result in a control system that meets or exceeds all technical performance criteria as described.

.2 Products proposed as alternatives to those specified, shall only be considered if submitted for approval no later than 15 working days before tender close. Submit alternates, for approval, as one complete listing. Provide complete product specification sheets with request for approval.

.3 The Bidder must provide a complete list of primary system products offered with their bid.

1.5 WASTE MANAGEMENT AND DISPOSAL

.1 Meet requirements of Section 01 74 19 - Waste Management and Disposal.

.2 Collect and separate waste for reuse, recycling, and other waste diversion strategies in accordance with Waste Management Plan.

1.6 SYSTEM DESCRIPTION

.1 Telecommunications raceways system consists of outlet boxes, cover plates, cabinets, racks, conduits, cable troughs, pull boxes, sleeves and caps, fish wires, service poles, service fittings, concrete encased ducts.

PART 2 Products

2.1 MATERIAL

.1 Conduits: in accordance with Section 26 05 34 - Conduits, Conduit Fastenings and Conduit Fittings

.2 Cable troughs: type, in accordance with Section 26 05 36 - Cable Trays for Electrical Systems

.3 Junction boxes, in accordance with Section 26 05 31 - Splitters, Junction, Pull Boxes and Cabinets

2.2 OUTLET BOXES

.1 Outlet boxes shall be 100mm square boxes. Multiple boxes shall not be ganged unless noted otherwise.

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.2 Wall plates for communication cable systems shall be white and have integral self labeling. The wall plates must support up to four (4) network drops and be run in a minimum of **27mm** conduit to the nearest equipment rack or stub at the basket tray in the accessible ceiling. Provide blank filler plates for unused drops.

.3 Wall plates shall be modular and in 'Keystone' format opening to allow the possibility of changing connector types in the future without replacing the wall plate. Faceplates shall be equipped with small form factor terminating connectors to fit the individual outlet's requirements (RJ45 and or Dual LC and or CATV bulkheads).

.4 Wall plates shall be equipped with a minimum of four (4) angled keystone openings. The installer shall equip the wall plate with the required amount of blank inserts as required. The minimum standard of acceptance for wallplates are Corning WLL-PL-AP or Panduit NK4VSFWH.

2.3 CABLE MANAGEMENT

.1 Velcro ties shall be used. Each cable type shall be bundled separately; that is data bundle, voice bundle, and fibre bundle. Cable ties wraps are unacceptable. Ensure maximum distance between cable Velcro wraps is 610mm.

PART 3 Execution

3.1 SECURITY

.1 All cabling shall be installed in conduit in areas deemed unsecured. Unsecured areas, unless otherwise noted include the following:

.1 Any area accessible by more than one tenant or the public.

.2 Any area where cabling crosses from one tenant space to another tenant space.

.2 No communication (data, voice or fibre) cabling shall share same raceway or junction boxes with any other pathway system.

3.2 INSTALLATION

.1 All horizontal cables shall be run in conduit. All raceways shall be grounded. All conduits shall have suitable bushings.

.2 Backbone/riser cables (fibre, copper) and horizontal cables shall be run in EMT conduit, minimum 27mm diameter unless otherwise noted on drawings. Maximum allowable percentage conduit fill shall not exceed 40%.

.3 EMT conduit shall be reamed and bushed at both ends and bonded to the distribution system. Rigid PVC or flexible metallic or PVC conduits are not acceptable.

.4 Inside radius bend in EMT conduit shall not be less than 6 times the internal diameter for conduit sizes up to 41mm inside diameter; 10 times the internal diameter for conduit sizes 53mm diameter and larger.

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.5 Pull boxes shall be installed in conduit runs where the total number bends exceed 180 degrees; where the overall length of the conduit run is more than 30m, or if there is a reverse bend in the run.

.6 Pull boxes shall be installed in the straight sections of the conduit run and shall not be used lieu of a bend. Corresponding ends of conduit shall be aligned with each other. Conduit fittings shall not be used in place of pull boxes or bends.

.7 Use of LL, LR and LL conduit fittings is not permitted.

.8 The use of J-Hooks, brackets, cable ties and other attachments to support cabling **is not** permitted. Meshed-basket Data Cable tray is required. J-Hooks shall be permitted to support cable only where cables leaves cable tray and feeds outlets, and shall be provided every 1500mm.

.9 In all wall outlet boxes, the contractor shall leave 400mm length of cable in each box.

.10 In all wall workstation drops, leave 300mm of cable slack before entering wall or workstation in suspended ceiling.

3.3 WARRANTY

.1 The contractor must make available to the Owner a local service department of a duly authorized distributor of the equipment manufacturer, which shall stock the manufacturer's standard parts. The service department shall have at least one factory trained repair technician available to the Owner on 24 hours' notice.

.2 Provide warranty of installation of equipment installed by this contractor to be free of defects for a period of (1) one year from date of Substantial Completion.

.3 Provide during the warranty period, all service, maintenance, parts, etc., required for normal operation of the systems, such that Owner needs not purchase additional maintenance agreement or contracts. Upon request, the manufacturer and his agent shall provide direct to the Owner the following proposals:

.1 Continuation, after the warranty period, of full maintenance, including all service, labour, parts, etc. required to maintain the systems in a fully operational condition.

.4 During the warranty period, provide three (3) separate site visits of four (4) hours each on site for owner revisions and additional training.

3.4 VERIFICATION

.1 Perform tests in accordance with:

.1 Section 26 05 01 - Common Works Results - Electrical

.2 The entire installation shall be performed under the supervision of the manufacturer. Upon completion of the installation, the manufacturer shall check and test the entire system. Certification of all tests shall be submitted in writing to the Consultant and shall certify the following:

.1 That the system is complete in accordance with this specification

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.2 That the system is installed in accordance with the manufacturer's best recommendations

.3 During the certification tests, the contractor shall provide one (1) electrician and (1) helper to assist the manufacturer's representative. The contractor shall also provide any required equipment such as ladders, scaffolding, etc.

3.5 TRAINING

.1 Perform training in accordance with:

.1 Section 26 05 01 - Common Works Results - Electrical

.2 Written documentation bearing name and signature of Owner's personnel who received the above instructions shall be included in the operating instructions and service manuals.

END OF SECTION

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PART 1 General

1.1 GENERAL REQUIREMENTS

.1 The General Conditions of Contract, Division 01 General Requirements and all Addenda thereto form an integral part of and must be read in conjunction with the requirements of this Section.

.2 Cooperate and coordinate with the requirements of other units of work specified in other Sections.

1.2 REFERENCES

.1 The Electrical Contractor shall be bound by industry standards, as interpreted by the Consultant, whether or not specifically referenced in this document. Comply with Electrical Protection Act and rules and regulations made pursuant thereto, including the 2012 Canadian Electrical Code. Also, comply with applicable standards of the following:

.1 CSA C22.1-2012, Canadian Electrical Code, Part 1.

.2 Electrical and Electronic Manufacturers Association of Canada (EEMAC).

.3 National Electrical Manufacturers Association (NEMA).

.4 National Building Code 2010 (NBC 2010)

.5 Institute of Electrical and Electronic Engineers (IEEE).

.2 Canadian Standards Association (CSA) International

.1 CAN/CSA-C22.2 No.182.4, Plugs, Receptacles and Connectors for Communication Systems.

.2 CSA T529, Telecommunications Cabling Systems in Commercial Buildings (Adopted ANSI/EIA TIA 568a with modifications).

.3 Electronic Industries Alliance (EIA) / Telecommunications Industries Association (TIA)

.1 TIA/EIA/ANSI – 568-B.1/2/3 latest revision Commercial Building Telecommunications Cabling Standards for Telecommunications Pathways and Spaces;

.2 TIA/EIA/ANSI – 515000 Generic Specification for Optical Fibre and Cable Splices

.3 TIA-568-C.0 Generic Telecommunications Cabling for Customer Premises;

.4 TIA-568-C Series Commercial Building Telecommunications Cabling Standard;

.5 TIA/EIA-569 Commercial Building Standard for Telecommunications Pathway and Spaces;

.6 TIA/EIA-606 The Administration Standard for the Telecommunications Infrastructure of Commercial Building;

.7 TIA/EIA-607-A Commercial Building Ground (Earthing) and Bonding Requirements for Telecommunications;

.8 Category 6A system and testing as released by TIA/EIA/ANSI – latest revision

.9 TIA/EIA T568-A UTP wiring/pinout

.4 Other Applicable CSA and UL approvals.

1.3 SHOP DRAWINGS AND PRODUCT DATA

.1 Submit shop drawings in accordance with:

.1 Section 01 33 00 - Submittal Procedures

.2 Section 26 05 01 – Common Work Results

.2 Submit shop drawings for review prior to ordering equipment. Shop drawings shall include but not be limited to, photocopies of accredited installers, copper termination jacks, and sample labeling.

1.4 PRODUCT APPROVALS

.1 Manufacturers' and model numbers named in these specifications indicate an acceptable technical standard of performance and are not intended to be exclusive. Products submitted as alternates must result in a control system that meets or exceeds all technical performance criteria as described.

.2 Products proposed as alternatives to those specified, shall only be considered if submitted for approval no later than 15 working days before tender close. Submit alternates, for approval, as one complete listing. Provide complete product specification sheets with request for approval.

.3 The Bidder must provide a complete list of primary system products offered with their bid.

1.5 WASTE MANAGEMENT AND DISPOSAL

.1 Meet requirements of Section 01 74 19 - Waste Management and Disposal.

.2 Collect and separate waste for reuse, recycling, and other waste diversion strategies in accordance with Waste Management Plan.

1.7 SYSTEM DESCRIPTION

.1 Termination, patch cords, and cross-connection equipment installed inside building for voice and data for telecommunications systems employing unshielded-twisted-pair (UTP) cables. Refer to drawings for details.

PART 2 Products

2.1 PATCH PANELS, CONNECTORS AND ADAPTORS

.1 Data and voice patch panels shall be 24-port or 48-port panels mounted in the communication equipment racks, as indicated in rack diagrams. A minimum of 12 ports shall be spare for future. Patch panels shall be compatible with Category 6A installations, and shall accept snap-in non keyed modular 8-pin jacks with T568-A pinout.

.2 Connectors shall be modular 8 PIN jacks, rated Category 6A –TIA/EIA T568-A UTP wiring/pinout. All data jacks shall be colour coded to match data cable colour identified in specifications.

2.2 NETWORK COMMUNICATION OPEN STYLE RACK

.1 Provide an open style data rack within Room 213 designated as Data Rack D.

.2 Data rack shall be two post, open style free standing with floor mounting kit, 2134mm (84 inch) high x 483 (19-inch) mounting width providing 44U rack units, and be bolted to floor with an electrically insulating sleeve and plastic bushings. The equipment rack shall be in black finish.

.3 Rack shall be equipped with 19” mounting rails and full length vertical management.

.4 Provide a two-ring horizontal wiring management between each patch panel. The horizontal wire management shall occupy a maximum 2U rack space.

.5 Provide shelves or organizer trays per rack to mount owner supplied equipment.

.6 Provide one 6-outlet power bar per rack with 12-foot shielded cord set, integral on/off switch, 15-amp breaker reset, EMI/RFI filtering. Mounting within the equipment rack at the base, facing the rear.

.7 All racks shall be grounded with a minimum #6 AWG insulated ground wire connected to the ground bus bar within Room 213.

2.3 OWNER SUPPLIED NETWORK COMMUNICATION CABINET STYLE RACKS

.1 Cabinet style data racks A, B and C within Room 213 are owner supplied. Relocated and install data racks A, B, and C.

PART 3 Execution

3.1 LABELLING

.1 Cable labels shall be self laminating labels as manufactured by Burndy or Panduit.

.2 Wall plates shall have integral labeling; self-adhesive labels will not be acceptable. Wall plates shall have self-adhesive icons adjacent to each jack of either a telephone or workstation to illustrate type of jack.

.3 Labeling shall be neatly typewritten and be in accordance with TIA 660. Cabling shall be labeled with the drop ID number at both termination points. Cable labeling shall be a logical numbering system of <room number> - <drop number>. Confirm if owner has special labeling system prior to installation. If owner has no set labeling system, confirm contractor suggested labeling with owner or consultant prior to any installation. The owner or consultant must sign off on labeling prior to installation; this sign-off shall be included in the maintenance manuals.

3.2 WARRANTY

.1 The contractor must make available to the Owner a local service department of a duly authorized distributor of the equipment manufacturer, which shall stock the manufacturer's standard parts. The service department shall have at least one factory trained repair technician available to the Owner on 24 hours' notice.

.2 Provide warranty of installation of equipment installed by this contractor to be free of defects for a period of (1) one year from date of Substantial Completion.

.3 Provide during the warranty period, all service, maintenance, parts, etc., required for normal operation of the systems, such that Owner needs not purchase additional maintenance agreement or contracts. Upon request, the manufacturer and his agent shall provide direct to the Owner the following proposals:

.1 Continuation, after the warranty period, of full maintenance, including all service, labour, parts, etc. required to maintain the systems in a fully operational condition.

.4 During the warranty period, provide three (3) separate site visits of four (4) hours each on site for owner revisions and additional training.

3.3 VERIFICATION

.1 Perform tests in accordance with:

.1 Section 26 05 01 - Common Works Results - Electrical

.2 The entire installation shall be performed under the supervision of the manufacturer. Upon completion of the installation, the manufacturer shall check and test the entire system. Certification of all tests shall be submitted in writing to the Consultant and shall certify the following:

.1 That the system is complete in accordance with this specification

.2 That the system is installed in accordance with the manufacturer's best recommendations

.3 During the certification tests, the contractor shall provide one (1) electrician and (1) helper to assist the manufacturer's representative. The contractor shall also provide any required equipment such as ladders, scaffolding, etc.

3.4 TRAINING

.1 Perform training in accordance with:

.1 Section 26 05 01 - Common Works Results - Electrical

.2 Written documentation bearing name and signature of Owner's personnel who received the above instructions shall be included in the operating instructions and service manuals.

END OF SECTION

Part 1 General

1.1 SYSTEM DESCRIPTION

.1 The intent of this specification is to provide a complete and satisfactory modular stand-alone sound masking system for the floors and areas identified on the drawings.

.2 The electrical contractor shall coordinate all installation requirements with the manufacturer prior to start of work on site.

.3 This electronics sound masking system shall be used for two basic purposes:

.1 To achieve a stated degree of speech privacy in the open office areas between adjacent and defined work stations.

.2 To unobtrusively mask or block out normal unwanted office noises.

.4 Electronic sound masking shall be used to achieve the appropriate background sound level in the open office areas. Masking shall provide uniform work privacy throughout the area without being readily apparent or objectionable to the open office occupants.

.5 It shall be the responsibility of the contractor to ensure that all necessary components are provided to result in a fully operational sound masking system.

.6 All equipment furnished shall be the standard products of the manufacturer.

.7 The sound masking system shall be a distributed direct field system.

1.2 PUBLIC ADDRESS SYSTEM INTEGRATION

.1 The sound masking system shall utilize speakers installed as part of the public address system as the transducers/emitters for the sound masking system. These speakers are denoted with a ‘SM’ on drawings. In normal operation, these speakers will be used as part of the sound masking system. Once a page is made from the commissionaire’s desktop microphone, the speakers will output the page before returning to sound masking mode. This mode switching is controlled by a digital signal processor. For further information on the digital signal processor and speakers, refer to drawings and public address specifications.

.2 The contractor shall coordinate the programming of the sound masking/public address system for the time period after a page has been completed and the system is returning to normal operation with sound masking present. The system shall be programmed such that the switch from paging to sound masking does not cause the sound masking sound to become noticeable under normal operation.

.3 The sound masking control modules / amplifiers as described below shall be used to power the speakers that output both sound masking audio and public address announcements. While testing audio levels, the contractor shall ensure that the speaker’s tap settings are well suited for both the sound masking application and public address intelligibility.

Part 2 Products

2.1 EQUIPMENT

.1 The system shall be comprised of three (3) zones with three (3) control modules. Refer to drawings for zone and module layout.

.2 Operation of zones shall be via a wireless infrared remote control with four (4) volume control preset buttons. Each module shall have two (2) output levels configured via an internal switch.

.3 Ranges shall be (30db – 88db) user selectable

.4 Ability for sound masking volume ramp-up over long periods of time. Minimum 3 week ramp up time.

.5 Control modules shall be power by the supplied wall adapter power supply.

.6 No more than 150 speakers shall be connected to each module.

.7 Control modules shall be the SmartSMS-NET RL200-8ch or approved equal.

Part 3 Execution

3.1 INSTALLATION

.1 Install equipment in accordance with the manufacturer's instructions and as indicated herein.

.2 Ceiling tiles shall be cut using the manufacturer recommended hole-saw bit.

.3 Electronic distribution to all transducers/emitters, shall be daisy chained via a FT6 plenum-rated enhanced Category 3 cable or other cable type as recommended by the manufacture. Refer to transducer/emitter criteria.

.4 Where equipment is located in storage room, mount in a separate enclosure or shelf. Confirm location for the enclosure or shelf on site.

.5 The level of sound masking shall be adjusted so that it is audible to a point but not distracting to room occupants. The effect shall be similar to the soft sound of moving air. Tuning reference shall be as per NIC curves.

.6 Conduct intelligibility test.

.7 The sound masking system shall be tuned for maximum speech privacy within designated areas. Tune the system with an appropriately calibrated acoustical instrumentation. Tuning shall comply with CSA 'guideline on office ergonomics' (doc #Z412-00).

.8 The contractor shall exercise caution, as necessary, to guard against electrostatic hum, and to install the equipment so as to provide maximum safety to non-technical operators.

.9 Provide for final demonstration of system to owner and consultant demonstrating compliance with requirements.

.10 On completion of the installation, all equipment and operations manuals shall be provide to the customer.

.11 In addition to the emitters/speakers shown on drawings, provide five (5) additional emitters/speakers c/w cable to be located on site after system is commissioned.

3.2 TRAINING

.1 At least two hours of training shall be provided to customer selected staff. Training shall include theory of operation, configuration and maintenance of the system.

END OF SECTION

Part 1 General

1.1 RELATED SECTIONS

.1 Section 26 05 01 – Common Work Results – Electrical

.2 Section 27 05 28 – Pathways for Communication Systems

.3 Section 27 05 14 - Communication Cables Inside Buildings.

.4 Section 27 11 16 – Sound Masking

1.2 REFERENCES

.1 Contractor shall be bound by industry standards, as interpreted by the Consultant, whether or not specifically referenced in this document. Comply with Electrical Protection Act and rules and regulations made pursuant thereto, including the Canadian Electrical Code. Also, comply with applicable standards of the following:

.1 Electrical and Electronic Manufacturers Association of Canada (EEMAC).

.2 National Electrical Manufacturers Association (NEMA).

.3 Institute of Electrical and Electronic Engineers (IEEE).

.4 Audio Engineering Society (AES).

.5 Applicable Electrical Safety Codes, 2009 Canadian Electrical Code.

.6 Applicable CSA and UL approvals.

1.3 SHOP DRAWINGS AND PRODUCT DATA

.1 Submit shop drawings in accordance with Section 01 33 00 - Submittal Procedures and 26 05 01 – Common Work Results

.2 Shop drawings shall include but not be limited to, speakers, riser diagram, cable types, and special mounting details.

.3 System riser shall be submitted with the shop drawings. Riser shall include all cable, conduit, backbox, and rough in requirements for the system to ensure early coordination of supplier and contractor.

1.4 WASTE MANAGEMENT AND DISPOSAL

.1 Meet requirements of Section 01 74 19 - Waste Management and Disposal.

.2 Collect and separate waste for reuse, recycling, and other waste diversion strategies in accordance with Waste Management Plan.

1.5 SYSTEM DESCRIPTION

.1 Provide the speakers and infrastructure for a fully operational public address system as herein specified.

.2 It shall be the responsibility of the contractor to ensure that all necessary interconnecting wiring, etc., are provided to result in a fully operational system. The contractor shall be responsible for coordinating testing, schedule, rough-in, etc.

.3 The contractor shall exercise caution, as necessary, to guard against electrostatic hum, and to install the cabling so as to provide maximum safety to non-technical operators.

.4 The only input location shall be a desktop microphone located at the commissionaire's desk.

1.6 SOUND MASKING INTEGRATION

.1 All speakers denoted on drawings with suffix 'PA' shall be dedicated to the public address system only. These shall be powered through a public address amplifier as described below and in the drawings.

.2 All speakers denoted on drawings with suffix 'SM' shall be shared between the sound masking system and public address system. In normal operation these speakers shall output sound masking audio. Once a page is made from the commissionaire's desktop microphone the speakers will output the page before returning to sound masking mode. These speakers shall be powered by the sound masking control modules / amplifiers. Refer to sound masking specifications for further information.

1.7 CLOSEOUT SUBMITTALS

.1 Provide operation and maintenance data for public address system for incorporation into manual specified in Section 01 78 00 - Closeout Submittals.

.1 Include:

.1 Operation instructions.

.2 Description of system operation.

.3 Description of each subsystem operation.

.4 List specifying each piece of equipment in system or subsystem by its original manufacturer name and model number.

.5 Part list specifying parts used in equipment by identification numbers that are standard to electronic industry.

1.8 SYSTEM STARTUP

.1 Manufacturer's representative to instruct:

.1 Maintenance personnel in maintenance of system.

.2 Operating personnel in use of system.

1.9 EXTRA MATERIALS

.1 Provide maintenance materials in accordance with Section 01 78 00 - Closeout Submittals.

Part 2 Products

2.1 MATERIALS

.1 Conduits: to Section 26 05 34 - Conduits, Conduit Fastenings and Conduit Fittings.

.2 Communication conductors: as indicated, to Section 27 05 14 - Communication Cables Inside Buildings.

2.2 COMPONENTS

.1 Distributed paging speakers shall be provided throughout the corridors and other areas. Speakers shall be provided and distributed throughout the facility as required to provide proper coverage. See drawing for speaker types and locations.

.2 Paging zones will be restricted to all-call only.

.3 The Contractor shall coordinate all requirements of the respective systems with the manufacturer and provide as required. The wiring of the speakers and phone sets shall be coordinated with the manufacturer and wired to suit the needs of the Owner.

.4 Upon completion of the installation, the contractor shall perform technical performance tests, in the presence of the consultant and to the consultant's satisfaction, that the system meets the performance criteria, as stated in this specification document and associated illustrations. The results of these tests shall be documented, in written form, noting all conditions at the time of tests and evaluation.

.5 All system components shall be grounded.

2.3 TYPE '1' - SUSPENDED CEILING SOUNDMASKING/PUBLIC ADDRESS SPEAKER

.1 Provide speakers suspended between/above ceiling locations as shown on the drawings. Exact locations of speakers shall be coordinated on site.

.2 Specifications:

Suspended speakers shall be 5" c/w back box/can and grill	
Frequency response:	100 Hz to 10 kHz
Sensitivity @ 1 W/M:	91 dB
Power rating:	10 W (xfmr)

Nominal impedance:	Integrated 70V: 8W, 4W
Color:	White
The technical standard of acceptance is Soft dB SMS-STR or approved equal	

.3 Provide two (2) additional speakers c/w 20m cabling, installation, and commissioning.

2.4 TYPE '2' – RECESSED SOUNDMASKING/PUBLIC ADDRESS SPEAKER

.1 Provide speakers in t-bar and metal panel ceiling locations as shown on the drawings. Exact locations of speakers shall be coordinated on site. It shall be the responsibility of the contractor to coordinate all requirements of mounting speakers in metal panel ceilings.

.2 Specifications:

Ceiling mounted speakers shall be 5" co-axial bass reflex c/w back box/can and grill	
Beam width:	155^{o} conical, minimum
Frequency response:	80 Hz to 20 kHz
Sensitivity @ 1 W/M:	89 dB SPL
Power rating:	6W (70 V)
Nominal impedance:	Integrated 70V: 6W, 3W, 1.5W, 0.5W, 0.25W
Color:	White grill, paint to match décor.
The technical standard of acceptance is TOA electronics model F2352SC or approved equal	

.3 Cable length to be determined and adjustment on site. Paint cabinet and ceiling mount to match décor.

2.5 TYPE '3' – SURFACE WALL MOUNTED PUBLIC ADDRESS SPEAKER

.1 Specifications:

Ceiling mounted speakers shall be 4" dual cone bass reflex c/w white grill, mounted in new contractor supplied enclosure.	
Beam width:	175^{o} conical
Frequency response:	130 Hz to 18 kHz
Sensitivity @ 1 W/M:	90 dB SPL (rated maximum)
Power rating:	15 W continuous program

Nominal impedance:	Integrated 70V: 5W, 2.5W, 1.3W, 0.7W
Color:	White
The technical standard of acceptance is JBL CSS8004 or approved equal	

.2 Include white, steel, surface mounted speaker box.

2.6 TYPE '4' – SURFACE WALL MOUNTED HORN PUBLIC ADDRESS SPEAKER

.1 Specifications:

Surface wall mounted horn style speaker	
Beam width:	70^{o} horizontal
Frequency response:	400 Hz to 7.5 kHz
Sensitivity @ 1 W/M:	105 dB SPL
Power rating:	15 W continuous
Nominal impedance:	Integrated 70V: 15W, 7.5W, 3.8W, 1.9W, 0.9W
Color:	White
The technical standard of acceptance is JBL CSS-H15 or approved equal	

2.7 PUBLIC ADDRESS AMPLIFIER

.1 Provide amplifiers with power ratings and technical performance such that each loudspeaker shall achieve the overall audio system performance specification stated. This amplifier will drive the speakers denoted on drawings as 'PA' only.

.2 Technical specifications shall include:

.1 Shall be modular power, two-channel or single channel amplifiers as required.

.2 All amplifiers shall be rack mountable.

.3 Have non-linear switching power supply

.4 Cooled by forced air.

.5 Have electronically balanced XLR inputs with an input impedance of 10Kohms or greater.

.6 Provide full short circuit protection and power monitoring capabilities.

.7 Capable of driving 70V loads

.8 Provide adequate power capacity for all loudspeakers with added headroom of 3db SPL or greater for the specified loudspeakers.

.3 Acceptable products shall be those manufactured by TOA, QSC, or Crown.

2.8 DSP / MATRIX ROUTING

.1 Provide one (1) DSP that shall provide the following.

.2 Performance features and functions shall include but not limited to:

.1 Fully programmable, fully configurable DSP based audio signal processing and control via a programmable drag and drop interface.

.2 4 balanced analogue inputs and 4 balanced analogue outputs.

.3 All audio processing shall be accomplished via DSP methods. These processes shall include but not limited to the following: audio level control, equalization (parametric and graphical), speaker zone delays, zone control, gating, ducking, output limiting, matrix routing, low pass filtering, high pass filtering, and band pass filtering.

.4 Metering for audio signals within DSP.

.5 The host processor unit shall have non-volatile flash memory to be used as primary storage media and operating system root.

.6 Reconfigurable via site computer loaded software.

.3 Technical specifications shall include:

.1 Frequency response @ 20 Hz to 20 kHz;

.2 Rack mountable

.3 Total harmonic distortion no more than .02% from 20 Hz to 20 kHz.

.4 Dynamic range of not less than 107 dB unweighted;

.5 Input common mode rejection ratio (CMRR) greater than 75 dB @ 1KHz.

.6 Maximum input level without clipping shall be +20 dBu while maintaining CMRR;

.7 Maximum output level shall be +19 dBu;

The standard of acceptance shall be SoundWeb London BLU-50 or approved equal.

2.9 DESKTOP PAGING MICROPHONE

.1 Technical features shall include:

.1 Dynamic (moving coil) microphone

.2 Polar pattern shall be unidirectional (cardioid)

.3 Shall feature high shock resistance and on/off switch

.4 Balanced, 600ohm impedance

.5 Sensitivity of -58dbV/Pa @ 1kHz

.6 3 pin XLR male connector complete with 25' XLR extension cable

.7 Frequency response of 100 to 10Khz

.8 Push-to-talk button

.2 These shall be the Toa PM660U or approved equal.

2.10 WALL MOUNTED AUDIO RACK

.1 Technical features shall include:

.1 Minimum 12U usable rack space

.2 Black powder coat finish

.3 Ventilation slots for air movement

.4 Removable back pan

.5 Double hinged, window door

.6 Horizontal mounting on threaded steel rails

.7 Bottom, top, and rear knockouts

.2 Manufactured by Mid-Atlantic, Pentair Hoffman, or approved equal.

2.11 CABLE AND CONNECTOR PANELS

.1 Provide all cable, wire and connectors for a complete and operational sound system.

.2 All cable for sound system to be PVC insulated, stranded pairs (or multi-conductor), as required. Provide shielded program (line level) cable, as required.

.3 Cable type and gauge shall be at the discretion of the Speaker supplier. However, all systems, when completed, must meet technical performance requirements, as specified.

.4 Provide all wiring terminal panels, terminal strips and cable wiring blocks. All connections, in sound panels and racks, shall be made with screw clamp terminal blocks.

.5 Loudspeaker cable to overhead speakers shall be #16 AWG stranded paired.

Part 3 Execution

3.1 INSTALLATION

.1 All wiring shall be in conduit. Division 26 is responsible for coordinating the rough in requirements with the suppliers of the systems.

.2 Review detailed shop drawings and wiring layouts provided by Speaker supplier.

.3 Cable and conduit necessary to make the system operable shall be provided as instructed by the supplier of the Speaker system. The overall system coordination shall be the responsibility of the contractor, and they shall ensure that all of the necessary system components are installed to result in a complete, workable system. Where conduit sizes have been shown on the drawings larger than those recommended by the supplier, they shall not be reduced.

.4 All wiring shall be in separate EMT conduit utilized solely for public address/soundmasking, or within communication tray. Cabling shall be run in EMT conduit to within 305 mm of communication lay-in tray.

.5 Minimum wiring shall be FT6 Category 6 cabling for telephone sets. Minimum wiring shall be #18 gauge, PVC jacketed FT6 for other. Coordinate cable requirements with manufacturer and provide other cable if required. Any substituted cable type utilized shall not be lesser in quality or capability with the specified cable types. See section 27 05 14 - Communication Cables Inside Buildings.

.6 All interconnecting wiring terminations shall be made on numbered screw type terminal strips. Soldered, crimped or twisted connections will not be accepted.

.7 Rack terminations shall be made on internal termination panels.

.8 Provide all speaker and outlet terminations.

.9 All wiring installed in conduit shall be with a maximum conduit fill of 40%. Increase indicated conduit sizes, if necessary, to accommodate manufacturer's cable requirements

.10 Coordinate installation of equipment in and on millwork with millwork supplier and installer.

.11 No audio cable shall be installed adjacent to power cable or power conduit.

.12 All audio equipment shall be fixed mounted. This shall include loudspeakers, input and output jacks, switches and interconnecting cable.

.13 All loudspeaker fastenings and supports shall be of appropriate type to support loads with a safety factor of eight times their weight.

.14 Sufficient slack cable shall be left on termination at outlets to allow easy removal of panels for maintenance and re-wiring as necessary. Slack cabling shall be neatly coiled. All high signal level wiring shall be terminated on outlet connectors and terminal blocks.

.15 All wiring shall be neatly harnessed, with signal category segregation maintained throughout.

.16 Absolute phasing of all loudspeaker lines shall be maintained. The contractor must take such precautions as are necessary in a public building, and in this particular environment, to guard against electromagnetic and electrostatic hum and radio frequency interference. Proper mounting shall assure adequate amplifier equipment ventilation. Equipment shall be installed to provide maximum safety to non-technical operators.

.17 Exact locations of paging distributed speakers, and associated controls, shall be coordinated on site with the consultant.

.18 Care shall be taken in wiring to avoid damage to cables, which might at a future date prove troublesome. All wiring shall be executed in strict adherence to professional industry standards, with due consideration to appropriate grounding and shielding practices

.19 All switches, connectors, input and outlet jacks, controls, etc., shall be clearly, logically, and permanently marked during installation. All markings on operating panels of equipment shall be 'Lamecoid' plates. Refer to Section 260 05 01 – Common Works Electrical.

.20 The system shall be checked for:

.1 Verification of color codes with respect to interconnections as recommended by the manufacturer

.2 Verification of color codes with respect to drawings and maintenance manuals

.3 Inspection of wiring and methods of termination in open junction boxes, backboxes for the devices and termination at control equipment

.4 Inspection of wiring and methods of termination in open junction boxes, backboxes for the devices and termination at control equipment;

.5 Designation of junction box covers and references with respect to these boxes on electrical drawings

.21 The system shall be tested for:

.1 Grounding

.1 System to building electrical ground;

.2 Cable shielding;

.3 Balance transmission lines above ground;

.2 Operation of system shall be checked step by step as described in user's manual

.3 Isolation of extraneous noises induced or otherwise, if present.

.22 Provide cable management and “waterfall” kits for cabling entering racks. Provide Velcro ties for bundled cabling, cable ties are unacceptable.

.23 All wiring shall be point to point and terminated directly onto the equipment or terminal strips that form part of the equipment.

.24 Provide a minimum of 200 mm of cable slack prior to termination to allow for future upgrades.

3.2 COMMISSIONING AND TESTING

.1 Commissioning shall be completed with the electrical consultant, electrical contractor, the Public Address System Supplier, owner representatives, and a manufacturer representative.

.2 The entire system shall be tested for ground loops.

.3 Refer to 26 05 01 for training requirements.

END OF SECTION

Part 1 General

1.1 GENERAL REQUIREMENTS

.1 Wherever practical and reasonable, all cabinets and electrical boxes shall be installed in the locations shown on the attached floor plans.

.2 Drawings show conduit connection requirements. Actual conduit runs shall run parallel to building lines.

.3 Unless specified otherwise, all conduits shall be sized according to the number of cables in the run. Maximum conduit fill is 50%.

.4 Unless specified otherwise, all junction boxes (J1, J2, J3, etc.) shall be steel and sized according to the number of conduits they must accommodate.

.5 Unless noted otherwise, all cables pulled to a 'T' Type cabinet (T1, T2, T3, etc.) shall have no less than **2400mm** of cable slack in the ‘T’ cabinet.

.6 Unless noted otherwise, all cables terminating in a device or outlet box shall have no less than **600mm** of cable slack at the device/outlet box.

.7 All cables terminating in a cabinet, a splitter trough, a device box, a utility box or an outlet box shall be labelled.

.8 The contractor shall test all cables installed as part of this contract for opens, grounds and shorts. The contractor shall replace any cables found to be defective by the owner.

Part 2 Materials & Products

.1 Conduit

.1 Unless specified otherwise, all conduits shall be EMT.

.2 Junction, Outlet and Pull Boxes

.1 Unless specified otherwise, all outlet, device and pull boxes shall be steel.

.3 Cable

.1 All telephone type (Cat3) cables shall be NORDX D-INSIDE CABLE, **24 AWG**, CMR, Category 3 solid copper with a grey jacket (or equivalent).

.2 All Category 5e (Cat5e) cables shall be Provo 24104L5E (or equivalent).

.3 All LVT cables shall be four (4) conductor #18 solid AWG Standard Control LVT cable.

.4 All 8 conductor overall shielded cable shall be Provo 6708 cable (or equivalent).

.5 All 12 conductor overall shielded cable shall be Provo 6712 cable (or equivalent).

.6 All two pair shielded cable shall be Provo 5402 (or equivalent).

.4 Pull Cord/Tape

.1 Polypropylene type, 200 lb tensile strength minimum.

Part 3 Execution

.1 **J1** Junction Box

.1 Supply and install one junction box above the suspended ceiling. If the ceiling is finished the junction box should be recessed on a wall 100mm below finished ceiling but no higher than 2400mm A.F.F.. Junction box shall be sized according to the number of conduits that must be accommodated.

.2 Supply and install conduit, sized to fit cables, from this junction box to another junction box in the area **OR** to a T9 cabinet in the area (as per floor plans).

.2 **J3** Junction Box (200H X 200W X 100D)

.1 Supply and install one 200H X 200W X 100Dmm junction box 150mm above the suspended ceiling. If the ceiling is finished the junction box should be recessed on a wall 100mm below finished ceiling but no higher than 2400mm A.F.F..

.2 Junction box must be accessible and serviceable.

.3 Supply and install conduit, sized to fit cables, from this junction box to another junction box in the area **OR** to a T9 cabinet in the area (as per floor plans).

.3 **T1** Existing "T" Cabinet (600H X 600W X 150D)

.1 Existing recessed 600H X 600W X 150Dmm Type 1 Telephone cabinet centred 1500mm A.F.F..

.2 Existing cables and equipment in this cabinet are not to be disturbed and are to be protected from damage during demolition and construction.

.3 All existing conduit and cabling terminating in this cabinet are not to be disturbed and are to be protected from damage during demolition and construction.

.4 **T2** "T" Cabinet (300H X 300W X 100D)

.1 Supply and install one 300H X 300W X 100Dmm Type 1 Telephone cabinet with wood back (BEL Products TCFKO12124WB or equivalent) **mounted 150mm above the suspended ceiling on the protected side of the wall**. If the ceiling is finished, the cabinet should be recess mounted 225mm above the strike side of the frame on the protected side of the wall. See attached detail drawings for Access Controlled doors.

.2 **Cabinet must be accessible and serviceable**.

.3 Supply and install conduit, sized to fit cables, from this cabinet to another T2 in the area **OR** to an X1 cabinet in the area (as per floor plans).

.4 An additional 13mm conduit **may** be required from the T2 cabinet to an alarm junction/outlet box in the area (as per floor plans).

.5 Supply, install and label **one** Provo 6708 cable (or equivalent) and **one** 4 conductor **18 AWG** solid copper LVT cable in the conduit from the T2 cabinet to an X1 cabinet (as per floor plans).

.5 **T9** "T" Cabinet (900H X 600W X 150D)

.1 Supply and install one 900H X 600W X 150Dmm Type 1 Telephone cabinet with 3/4" wood back (BEL Products TCFKO36246WB) directly above the T1 cabinet and above the drop ceiling (or surface mounted if a drop ceiling does not exist).

.2 Supply and install **one** structured wiring/data outlet in the bottom right corner inside this cabinet. Provide Cat5e cabling from the wiring/data outlet and terminate on a patch panel in a LAN Room.

.3 Supply one empty 32mm conduit from the new T9 cabinet to the existing T1 cabinet.

.6 **X1** Existing Access Control Cabinet (300H X 300W X 100D)

.1 Existing 300H X 300W X 100Dmm cabinet for existing access control system.

.2 Existing cables and equipment in this cabinet are not to be disturbed and are to be protected from damage during demolition and construction.

.3 All existing conduit and cabling terminating in this cabinet are not to be disturbed and are to be protected from damage during demolition and construction.

.7 **X2** Existing Junction Box

.1 Existing junction box for existing alarm system.

.2 Existing cables and equipment in this cabinet are not to be disturbed and are to be protected from damage during demolition and construction.

.3 All existing conduit and cabling terminating in this cabinet are not to be disturbed and are to be protected from damage during demolition and construction.

.8 **01** Device Box

.1 Supply and install one recessed 76H X 100W X 63Dmm **double** gang device box c/w blank cover plate 150mm below finished ceiling but no higher than 2400mm A.F.F..

.2 Supply and install conduit from this device box to another device/junction box in the area **OR** to a T9 cabinet in the area (as per floor plans).

.3 Supply, install and label **two** 4 pair telephone (Cat3) cables in the conduit from this outlet box to a T9 cabinet in the area.

.9 **11** Square Outlet Box

.1 Supply and have door-frame fabricator spot weld one 100H X 100W X **40**Dmm square outlet box on top of the frame as per attached detail drawing "PROTECTED DOOR - ELEVATION OF SINGLE DOOR WITH DOOR CONTACT".

.2 Drill a 19mm hole 75mm (centre point) from the edge of the door casing to allow for door switch installation and access to frame mounted outlet box.

.3 Supply and install conduit from the outlet box in the door frame to a 76H X 50W X 63Dmm single gang pull box mounted above the door on the protected side of

the wall. This pull box shall have a blank cover plate installed and shall be mounted above the suspended ceiling **OR** 100mm below the ceiling if the ceiling is finished.

.4 Supply and install conduit from the pull box to a device/junction box in the area **OR** to a T9 cabinet in the area (as per floor plans).

.5 Supply, install and label **one** 4 pair telephone (Cat3) cable in the conduit from the outlet box in the door frame to a T9 cabinet in the area.

.6 The cable slack at the outlet box in the door frame shall be tucked into the outlet box to protect the cable from damage.

.10 **12** Square Outlet Box

.1 Supply and have door-frame fabricator spot weld one 100H X 100W X **40**Dmm square outlet box on top of the door frame as per attached detail drawing(s) for access controlled doors.

.2 Drill a 19mm hole 75mm (centre point) from the edge of the door casing to allow for door switch installation and access to frame mounted outlet box.

.3 Supply and install conduit from the outlet box in the door frame to a T2 cabinet in the area (as per floor plan).

.4 Supply, install and label **one** 4 pair telephone (Cat3) cable in the conduit from the outlet box in the door frame **to the T2 cabinet**.

.5 The cable slack at the outlet box in the door frame shall be tucked into the outlet box to protect the cable from damage.

.11 **14** Square Outlet Box

.1 Supply and have door-frame fabricator spot weld one 100H X 100W X **40**Dmm square outlet box on top of the door frame as per attached detail drawing(s) for access controlled doors.

.2 Drill a 19mm hole 75mm (centre point) from the edge of the door casing to allow for door switch installation and access to frame mounted outlet box.

.3 Supply and install conduit from the outlet box in the door frame to a T2 cabinet in the area (as per floor plan)

.4 Supply, install and label **one** 4 pair telephone (Cat3) cable in the conduit from the outlet box in the door frame to a T9 cabinet in the area.

.5 Supply, install and label a second 4 pair telephone (Cat3) cable in the conduit from this outlet box in the door frame **to the T2 cabinet**.

.6 The cable slack at the outlet box in the door frame shall be tucked into the outlet box to protect the cable from damage.

.12 **21** Device Box

.1 Supply and install one recessed 76H X 150W X 63Dmm **three** gang device box c/w blank cover plate centred 1500mm A.F.F..

.2 Supply and install conduit from this device box to another device/junction box in the area **OR** to a T9 cabinet in the area (as per floor plans).

.3 Supply, install and label **one** 4 pair telephone (Cat3) cable in the conduit from this device box to a T9 cabinet in the area.

.13 **31** Conduit to Electric Strike

.1 Supply and install conduit from a point 25mm above the strike plate inside the door frame to a T2 cabinet in the area (as per floor plans).

.2 Supply, install and label **one** 4 pair telephone (Cat3) cable in the conduit from the door frame **to the T2 cabinet**. Leave 600mm of slack inside the door frame.

Note: For more information, see attached detail drawing(s) for access controlled doors.

.14 **41** Octagon Outlet Box

.1 Supply and install one 4" octagon outlet box **located no more than 300mm above** the suspended ceiling. If the ceiling is finished, the outlet box should be recess mounted and supplied with a cover plate.

.2 Supply and install conduit from this outlet box to a device/junction box in the area **OR** to a T9 cabinet in the area (as per floor plans).

.3 Supply, install and label **one** 4 pair telephone (Cat3) cable in the conduit from this outlet box to a T9 cabinet in the area.

Note: Supply no less than 3600mm of cable slack at the outlet box.

.15 **42** Device Box

.1 Supply and install one recessed 76H X 50W X 63Dmm single gang device box c/w blank cover plate. Mount device box 25mm from the corner of the room and 100mm below suspended/finished ceiling but no higher than 2400mm A.F.F..

.2 Supply and install conduit from this device box to another device/junction box in the area **OR** to a T9 cabinet in the area (as per floor plans).

.3 Supply, install and label **one** 4 pair telephone (Cat3) cable in the conduit from this device box to a T9 cabinet in the area.

.16 **43** Device Box

.1 Supply and install one recessed 76H X 50W X 63Dmm single gang device box c/w blank cover plate. Mount device box 100mm below suspended/finished ceiling but no higher than 2400mm A.F.F..

.2 Supply and install conduit from this device box to another device/junction box in the area **OR** to a T9 cabinet in the area (as per floor plans).

.3 Supply, install and label **one** 4 pair telephone (Cat3) cable in the conduit from this device box to a T9 cabinet in the area.

.17 **44** Device Box

.1 Supply and install one recessed 76H X 50W X 63Dmm single gang device box c/w blank cover plate centred 100mm above the top of the door frame on the protected side of the wall as per attached detail drawing(s) for access controlled doors.

.2 Supply and install conduit from this device box to a T2 cabinet in the area (as per floor plans).

.3 Supply, install and label **one** 4 pair telephone (Cat3) cable in the conduit from this device box **to the T2 cabinet**.

Note: For more information, see attached detail drawing(s) for access controlled doors.

.18 **61** Device Box

.1 Supply and install one recessed 76H X 50W X 63Dmm single gang device box c/w blank cover plate centred 1300mm A.F.F..

.2 Supply and install conduit from this device box to a T2 cabinet in the area (as per floor plans).

.3 Supply, install and label **one** Provo 6708 cable (or equivalent) in the conduit from this device box **to the T2 cabinet**.

Note: For more information, see attached detail drawing(s) for access control on doors with wall mounted readers.

END OF SECTION

PART 1 General

1.1 RELATED SECTIONS

.1 Section 26 05 01 - Common Work Results - Electrical.

1.2 REFERENCES

.1 NBC – 2010, National Building Code of Canada

.2 CSA C22.1-12, Canadian Electrical Code, Part 1, 2012

.3 All equipment shall be listed by Underwriters' Laboratory of Canada. The entire installation shall be in full compliance with the 2010 National Building Code, 2012 Canadian Electrical Code, National Standard of Canada/Underwriters' Laboratory of Canada Standards, and the Saskatchewan Human Rights Commission, Accessibility Standard.

.4 National Standard of Canada/Underwriters' Laboratories of Canada Standards:

.1 CAN/ULC-S524-M06, Installation of Fire Alarm Systems

.2 CAN/ULC-S525-99, Audible Signal Devices

.3 CAN/ULC-S526-02, Visual Signal Devices

.4 CAN/ULC-S528-05, Manual Stations for Fire Alarm Systems including Accessories

.5 CAN/ULC-S529-02, Smoke Detectors

.6 CAN/ULC-S536-04, Inspection and Testing of Fire Alarm Systems

.7 CAN/ULC-S537-04, Verification of Fire Alarm Systems

1.3 DESCRIPTION OF SYSTEM

.1 The existing computer based fire alarm system shall remain in operation throughout the facility during the renovations.

.2 Complete the alterations to the existing fire alarm system within the renovation areas that includes installation of a new network control annunciator NCA panels, fire alarm pre-action releasing panels, automatic detection devices, signal devices, fire modules and other auxiliary devices as shown on the floor plans and noted herein.

.3 Relocate and reconnect existing fire alarm devices as indicated on the floor plans.

.4 Provide a fibre network between the main fire alarm control panel, annunciators and fire alarm pre-action releasing panels.

.5 Provide software upgrades to the existing main fire alarm control panel so that existing network cards are compatible.

.6 Replace the existing remote fire alarm annunciator panel in Room 102.

.7 Future Code Spear System: Provide speaker and speaker/strobes within the renovation areas as located on the floor plans for a future change to an emergency voice communication

evacuation system within the building. Provide the necessary wire of the signal appliances in a separate conduit within the renovation area. Locate junction boxes for final terminations of the speaker and speaker/strobe circuits to be completed outside the renovation areas so as to avoid future work activity inside the completed renovation areas once occupied. The exception of future work activities following occupancy would be for verification purposes only.

1.4 REQUIREMENTS OF REGULATORY AGENCIES

.1 Fire Alarm System:

.1 In accordance with the Authority Having Jurisdiction

.2 System components: listed by ULC and comply with applicable provision of National Building Code and meet requirements of local authority having jurisdiction.

1.5 SYSTEM OPERATION

.1 Two-stage addressable operation.

.2 If an alarm is caused by activation of any of the following devices:

.1 Pulling a manual station;

.2 Operating of a sprinkler flow switch;

.3 Operation of an automatic fire alarm thermal detector;

.4 Operation of a smoke detector (ceiling or duct mounted);

The following shall occur:

.1 A pre-signal audible alarm shall sound on all signal appliances through the building with the pre-signal alarm generated on the fire alarm system. Strobe lights installed as visual alarms shall flash.

.2 The annunciator panels throughout the facility shall display the alarm location (fire zone), alarm type (pull station, smoke detector, sprinkler, thermal, etc.) location description along with time.

.3 The pre-signal alarm shall continue until the alarm is acknowledged and the system is silenced. The device causing the alarm shall cause the systems to remain in alarm until the device is cleared or reset, and the system alarm is acknowledged.

.4 A signal shall be sent to each elevator controllers to home elevators to the main floor.

.5 The system shall automatically send a signal to the municipal fire department via the fire alarm system.

.6 Signals shall be sent to activate the ventilation systems in the correct sequence for the fire zone causing the alarm condition. This sequence shall only occur on an alarm initiation signal from a smoke zone causing the alarm condition.

.7 Release all magnetic door holders in the building.

.8 The fire alarm system shall provide a signal to the access door control systems in the building to disengage electromagnetic locks allowing fail-safe and free egress for doors controlled by the access control systems.

.9 The operator will acknowledge the alarm. Input/output device designation, data and time shall be printed, indicating the alarm has been acknowledged.

.10 A subsequent alarm from any receiving circuit (device) shall cause the audible signals to sound again. Subsequent alarms shall be displayed on the network annunciators in order of priority and then in the order in which they occur. Subsequent alarms may occur prior to acknowledgement of initial alarm.

.11 The pre-signal or first stage signal shall continue until a general alarm key switch in any manual station or a variable 0 – 5 minute time delay activates the general evacuation signal. The general alarm key switches on the manual stations in each fire zone shall be connected as a unique separate zone per fire compartment. When a key switch is operated, all signal zones in that fire compartment shall sound an evacuation alarm. Other signals zones throughout the remainder of the complex shall continue to sound the pre-signal alarm until silenced at the firefighter's command station. When the variable 0 – 5 minutes time delay activates the evacuation alarm, it shall sound throughout the entire complex.

.12 The evacuation alarm shall continue until the alarm is acknowledged and the system is silenced. The device causing the alarm shall cause the system to remain in alarm until the device is cleared or reset, and the system is acknowledged.

.3 The entire system shall be electrically supervised against opens, shorts and grounds of any wire on the alarm initiating circuits or any wire on the signal circuits. Trouble conditions shall display as a lower priority than an alarm.

.4 All new points shall be included in the computer software program, and the software program shall be regenerated twice. This first regeneration shall be provided during the completion of the addition and renovations. The second regeneration shall be provided approximately three months after the first regeneration and shall reflect any contract changes and any owner initiated changes.

.5 Maintain the existing interconnection to the telephone system to signal the municipal fire department on activation of the fire alarm system.

.6 Maintain the existing wiring and controls that have been provided to accommodate fire alarm interconnections with the sprinkler and mechanical control systems.

.7 The existing interconnection to the elevator controllers to home elevators on activation of the building fire alarm system shall be maintained.

.8 All new fire alarm equipment shall be powered from a single source as shown on the drawings, connected to dedicated circuits fed from the existing emergency power supply system unless otherwise noted.

1.6 SPRINKLER PROTECTION SYSTEMS

.1 Sprinkler valves shall have a tamper switch with shall be connected to a separate fire alarm system address. Tamper switches shall cause a trouble indication when the shut-off valve is closed. Coordinate final location and quantity with the sprinkler system supplier.

.2 **Sprinkler Pre-Action Systems (Double Interlock Pre-action Systems, Electric/Pneumatic Release):** Activation of new pre-action sprinkler systems shall initiate an alarm on the fire alarm system. Within the protected area of the pre-action sprinkler system, the fire detection devices shall act as follows:

.1 Any one detector within the protected area shall initiate a pre-signal alarm on the building fire alarm system and cause the signal appliance(s) within the protected area to sound. The pre-action sprinkler system's solenoid valve shall remain closed.

.2 A matrix of any two or more detectors activated within the protected area shall initiate a pre-signal alarm on the building fire alarm system. The pre-action sprinkler solenoid valve shall be opened by the fire alarm pre-action releasing panel when a matrix of any two or more detectors within the protected area. The sprinkler system's deluge valve will not open until a sprinkler head opens relieving supervisory pressure from the sprinkler system. Once the deluge valve clapper opens to allow water to flow into the system piping, the system's alarm switch monitored by the pre-action releasing panel shall initiate an evacuation alarm throughout the building.

.3 The pulling of a manual pre-action system dual action agent release station within the protected pre-action sprinkler area or zone shall initiate an evacuation alarm on the building fire alarm system and open the solenoid valve within the protected area. The sprinkler system's deluge valve will not open until a sprinkler head opens relieving supervisory pressure from the sprinkler system.

.4 In the event of inadvertent loss of air pressure in the pre-action sprinkler line, a trouble advisory alarm shall be indicated at the fire alarm control panel and annunciator panels. The pre-action sprinkler solenoid valve shall remain closed to prevent water flow until such time any two or more detectors in the protected area are activated which then shall cause an evacuation alarm due to water flow.

.3 Existing sprinkler pre-action assemblies present within the facility vary. The existing connections, monitoring and control of the existing pre-action systems shall be maintained during the construction period. Sprinkler pre-action systems equipped with 120-volt AC solenoid valve (fed from emergency or uninterrupted power supplies, non-supervised circuits) or 24-volt DC solenoid valves (fed from the existing fire alarm panel or remote power booster panel, supervised circuits) shall remain and be maintained. Existing monitor modules connected to the tamper switch or shut-off valve shall remain, and the relay module installed to release the solenoid valve shall remain. Where installed, existing monitor modules for loss of air pressure (supervisory alarm) and water flow (initiating device) shall remain.

1.7 SHOP DRAWINGS

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

.2 Shop drawings shall include but not be limited to complete floor plans, riser, equipment, control schematics and wiring diagrams. Each component shall be identified as to manufacture, type, description and catalogue number.

1.8 CLOSEOUT SUBMITTALS

.1 Provide operation and maintenance data for Fire Alarm System for incorporation into manual specified in Section 01 78 00 - Closeout Submittals.

.2 Include:

.1 Overall system riser wiring diagram identifying control equipment, initiating addresses, signalling circuit; identifying terminations, terminal numbers, conductors and raceways.

.2 Details and performance specification of devices added for control, annunciation and peripherals with item by item cross reference to specification for compliance.

.3 Operation and maintenance instructions for complete fire alarm system to permit effective operation and maintenance.

.4 Technical data - illustrated parts lists with parts catalogue numbers.

.5 Copy of approved shop drawings.

.6 List of recommended spare parts for system.

.7 Certification of tests, upon completion, shall be issued in writing to the Consultant by the manufacturer's representative.

1.9 MAINTENANCE

.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 Engineer.

PART 2 Products

2.1 MATERIALS

.1 Equipment and devices: ULC listed and labelled and supplied by single manufacturer.

.1 Annunciator Panels

.2 Fire Alarm Pre-action Releasing Control Panel

.3 Detectors

.4 Monitor and Relay Modules

.5 Fault Isolator Modules

.6 Audible and Visual Signal Appliances and Speakers

.7 Pre-action System, Dual Action Agent Release Station

.8 Pre-action System, Signal Device

.2 All devices shall be installed in outlet boxes

.3 All wiring runs in conduit raceway.

.4 All new equipment and devices shall be manufactured by **Notifier** as supplied by Alsask Fire Equipment.

.5 The new materials are as specified herein.

2.3 ANNUNCIATOR PANELS

.6 **Network Control Annunciator (NCA) Panels:** Intelligent network annunciator panels shall be located as shown on the floor plans. Network annunciator panels shall include the following features:

.1 640-character backlit LCD display with backlighting.
.2 ACS bus for LED or graphic annunciators
.3 11 LED status indicators: Power, Controls Active, Fire Alarm, Pre-Alarm, Security, Alert, Supervisory, Trouble, Signal, Silence, CPU Failure, Point Disabled, Other Event.
.4 Alphanumeric rubber keypad with audible feedback
.5 Status Relays (Form-C): Alarm, Trouble, Supervisory, Security
.6 Non-volatile memory
.7 Non-volatile real-time clock synchronized with network master node.
.8 Mimic all display information on the fire alarm control panel.
.9 Switches for Acknowledge, Signal Silence, System Reset, and Lamp Test.
.10 Fixed Function Keys: Acknowledge, Signal Silence, System Reset, and scroll/display function keys for Fire Alarm, Security, Supervisory, Trouble and other events.
.11 Special Function Keys including lamp test, next selection/previous selection for setting parameters at the panel, battery level.
.12 Remote data port (RDP) Port for LCD-160 or terminal mode for LCD-80 annunciators.

.7 Functional Features for the NCA panels shall include:

.1 Individual or Group enable/disable
.2 Control ON/OFF
.3 Read status networked series panel control points and zones
.4 Network paging control, HVAC control
.5 Network-wide: Acknowledge, Silence, Reset

.8 The network connection shall be fibre cable.

.9 The NCA panel requires a 15 amp 120-volt emergency power supply connection, fed by mineral insulated cable. The panel is equipped with integral 24-volt DC power for operation of the LCD display.

.10 Network Control Annunciator Panels shall be Notifier ONYX series NCA-2.

.11 Each DVC Control Panel shall include an integral NCA annunciator control panel. All LCD displays shall mimic the displays at the DVC panels.

.12 **Remote LCD Annunciator Panels:** A 640 character Liquid Crystal Display (LCD) annunciator and remote control panel, which shall mimic the top portion (160 characters) of the fire alarm control panel. The remote LCD annunciator provides the event and pre-

programmed custom messages as displayed on the main panel. The remote LCD annunciator shall include the following features:

.1 640-character backlit LCD display with backlighting.

.2 LED Status Indicators: Power, Fire Alarm, Pre-Alarm, Security, Supervisory, System Trouble, other Event, Signals Silence, Point Disabled and Control Active.

.3 Diagnostic LED Indicators: Status, Receive, Transmit, Microfail.

.4 Rubberized keypad.

.5 Input for AKS-1B key switch.

.6 Mimic all display information on the fire alarm control panel.

.7 Fixed Function Keys: Acknowledge, Signal Silence, System Reset, Drill, and scroll/display function keys for Fire Alarm, Security, Supervisory, Trouble and other events.

.8 Soft Keys: Total of (6) six keys to select commands that appear on the display for each different screen.

.9 Status LED Indicators: Power, Fire Alarm, Pre-Alarm, Security, Supervisory, System Trouble and Other Event.

.13 Communication between the main fire alarm control panel and remote LCD annunciator shall occur over a remote data port (RDP) interface. The RDP interface communication is supervised by the Fire Alarm Control Panel. A 2-wire daisy-chain connection plus insulated ground between the LCD annunciator and fire alarm control panel, with the last annunciator panel requiring an end-of line resistor. Maximum 32 LCD annunciators per RDP bus.

.14 Each LCD annunciator panel shall be powered by the fire alarm control panel at 24-volt DC. The power circuit is supervised by the main fire alarm control panel.

.15 The Remote LCD Annunciator Panels shall be Notifier LCD-160.

.16 Remote LCD Annunciator Panels shall be compact design, semi-flush cabinets for mounting in new and existing partitions. The cabinet shall include hinged door with key lock.

.17 Cabinet for the remote LCD Annunciator Panel shall be sized to accept the annunicator and future paging microphone.

.18 A lock-box shall be located adjacent the remote LCD Annunciator Panel.

2.2 FIRE ALARM PRE-ACTION RELEASING CONTROL PANELS

.1 The fire alarm pre-action releasing control panel shall be modular and solid state design for ease of expansion and serving. The control panel shall continuously supervise all field wiring and control panel modules connected to alarm initiating devices and alarm signalling devices associates with the protected area of the pre-action sprinkler system. The panel shall include annunciator indications for open-circuits, shorts, grounds and placement.

.2 The enclosure shall be surface mounted as located on the drawings. The cover shall be hinged, and shall have clear windows and a locking mechanism to prevent tampering.

.3 All controls shall be labelled, all fire alarm devices shall be identified, and the control panel shall be provided with permanently mounted operating instructions.

.4 The control panel shall include the following features:

.1 All required hardware and software to allow the panel configuration and operation to be changed. Field programmable at the panel.

.2 One, isolated intelligent Signalling Line Circuit (SLC)

.3 640-character backlit LCD display with backlighting.

.4 6.0 amp power supply with four Class A/B built-in Notification Appliance Circuits (NAC). Selectable System Sensor, Wheelock or Gentex strobe synchronization.

.5 Built-in Alarm, Trouble, Security, and Supervisory relays.

.6 80-character remote annunciator

.7 Alarm selection per point, with automatic counter.

.8 Pre-signal/Positive alarm sequence.

.9 11 LED status indicators: Power, Controls Active, Fire Alarm, Pre-Alarm, Security, Alert, Supervisory, Trouble, Signal, Silence, CPU Failure, Point Disabled, Other Event.

.10 Alphanumeric rubber keypad with audible feedback.

.11 Status Relays (Form C): Alarm, Trouble, Supervisory, Security

.12 Non-volatile memory

.13 Non-volatile real-time clock synchronized with network master node.

.14 Switches for Acknowledged, Signal Silence, System Reset, and Lamp Test.

.15 Fixed Function Keys: Acknowledge, Signal Silence, System Reset, and scroll/display function keys for Fire Alarm, Security, Supervisory, Trouble and other events.

.16 Special Function Keys including lamp test, next selection/previous selection for setting parameters at the panel, battery level.

.5 The releasing control panel shall initiate the shut-down of the mechanical ventilation systems to the protected area through the building's fire alarm system.

.6 The control panel shall initiate the release of the sprinkler pre-action solenoid valve when any two or more detectors are active or the pulling of the dual action agent release station located within the protected area.

.7 Network connections to the main building fire alarm control panel shall be fibre media.

.8 Provide battery back-up to control panel sufficient to provide supervisory power for a minimum 24-hours and sufficient to operate the entire system, including all signal devices for a minimum 60-minutes.

2.3 FIBRE NETWORK

.1 The existing fire alarm control panel, network control annunciator panels and pre-action releasing panels shall be interconnected by fibre cable run in separate EMT conduit. All fibre cable shall be as pre-manufactured cables and tested by the manufacturer.

.2 Fibre Cable:

.1 Fibre Loop Connection: 2 runs of 6-strand 9/125um single mode fibre cable with 30dB maximum attenuation and wavelength of 1310 nanometers.

.2 Fibre Terminations: 'LC' connectors

2.4 DEVICES

.1 **Detectors:** Provide multi-sensor low-profile intelligent detectors designed to increase immunity to false alarms. The detectors shall be microprocessor-based, combination photoelectric and thermal technology, addressable analog type detector. The detector shall adjust its sensitivity automatically without needing operator intervention or control panel programming. The thermal sensing rating shall be fixed-temperature set point 135°F (57°C). Includes LED red indicator when in alarm; flashes green in standby for normal conditions.

.2 **Monitor, Control and Relay Modules:** Provide addressable monitor, control and relay modules to interface to convenience non-addressable devices.

.1 Monitor modules shall be installed to supervise a circuit of dry-contact input devices, such as conventional heat detectors and pull stations, or monitor and power a circuit of two-wire smoke detectors. Powered directly by the SLC loop, high-noise (EMF/RFI) immunity, LED flashes green for normal operation and latches on steady red to indicate alarm.

.2 Control modules provide the control panels a circuit for operating horns, strobes, speakers, etc., or to monitor a telephone circuit. Addressability allows the control module to be activated, either manually or through panel programming on a select zone or area of coverage. LED blinks green each time a communication is received from the control panel and turns on in steady red when activated.

.3 Relay modules provide the system with a dry-contact output for activating a variety of auxiliary devices, such as fans, dampers, control equipment, etc. Addressability allows the dry contact to be activated, either manually or through panel programming. LED blinks green each time a communication is received from the control panel and turns on in steady red when activated.

.3 **Fault Isolators:** Provide fault isolator modules to detect and isolate short-circuited segments on the SLC loops. The module shall automatically determine a return-to-normal condition of the loop and restore the isolated segment. Integral LED blinks to indicate normal condition, illuminates steady when short circuit condition is detected. Provide fault isolator modules on each loop after every (20) twenty devices and after every floor penetration or penetrations of fire barriers.

.4 The plug-in module shall be supervised against removal, improper module position and incorrect module type. The control panel shall provide absolute electronic protection of all circuitry such that any module may be inserted or removed, while the control panel is fully powered without causing an alarm condition or any damage to the equipment.

.5 **End of Lines:** End-of-line devices for signalling zones and sprinkler flows and tampers shall be mounted in separate single gang box with red cover plate.

.6 **Fire Alarm Horns and Horn Strobes:** Audible and visual signaling appliances shall be provided to meet code requirements, ADA/NFPA/ANSI compliant, and shall be ULC listed for the purpose of fire alarm signaling. The signaling appliances shall be horns and

combination horn/strobe types. The horns shall produce a code-3 temporal pattern. The horn shall be have a minimum dBAoutput of approximately 92 dBA. The horns shall be provided with adjustable audible output with High setting for 98 dBA output or Low setting for 94 dBA sound output.

.7 The synchronizing strobe shall produce white light with a minimum of 15 candela across all viewing angles in common areas, but shall be field selectable for other ratings.

.8 All audible and visual signaling appliances shall be combination horn/strobe of the following types:

.1 Wall mounted horn/strobes: 2-wire horn/strobe, standard cd, RED textured housing with clear polycarbonate lens for strobes. The device shall be labeled with 'FIRE' in WHITE text.

.2 Ceiling mounted horn/strobes: 2-wire horn/strobe, standard cd, low profile, WHITE textured housing and clear polycarbonate lens for strobes. The device shall be labeled with 'FIRE' in WHITE text.

.9 **Speaker and Speaker Strobes for Future Code Spear:** Audible and visual signaling appliances shall be provided to meet code requirements, ADA/NFPA/ANSI compliant, and shall be ULC listed for the purpose of fire alarm signaling and emergency voice communication. The signal device shall be separate speaker, combination speaker/strobe, and shall be flush mounted in suspended T-bar ceilings or surface wall mounted types as indicated on the floor plans.

.10 The speakers shall operate on an input voltage of 25 or 70.7 Vrms. The speakers shall be the high fidelity type and shall have a frequency response of 100 Hz to 10,000 Hz even with a UL listing of only 400 Hz to 40,000 Hz. The speakers shall power taps of ¼, ½, 1 and 2 watts. The speakers shall have a minimum dBA output of approximately 78dBA at ¼ watt tap setting (UL Anechoic test).

.11 Initially set power tap to ¼ watt for all speakers.

.12 The synchronizing strobe shall produce white light with a minimum of 15 candela across all viewing angles in common areas, but shall be field selectable for other ratings.

2.5 PRE-ACTION SYSTEM DEVICES

.1 **Dual Action Agent Release Station:** Non-coded, dual action operation for use with the Pre-action Releasing Control Panel. Device includes power-on indication, released indication and manual release (dual-action). Station shall be supplied with back-box for flush mounted installation.

.2 **Signal Device (Horn):** Multi-tone electronic signal device with a variety of alert tones as noted herein: Code-3 Horn, to alert staff within the immediate area of the activation of the fire alarm releasing control panel. March Time Horn to alert staff the release of the sprinkler solenoid valve. Standard dBA sound level, non-strobe version. The appliance shall be finished in RED.

.3 **Detectors:** Install multi-sensor low-profile intelligent detectors.

.4 **Monitor and Relay Modules:** Install addressable monitor and relay modules to interface to convenience non-addressable devices.

PART 3 Execution

3.1 INSTALLATION

.1 The contractor must make available to the Owners a local service department of the equipment manufacturer, which shall stock the manufacturer's standard parts. The service department shall have at least one factory trained repairman available to the Owner on a 24 hours' notice. The systems shall be guaranteed for a period of one year. Refer to section 260501. Provide, during the guarantee period, all service, maintenance, parts, etc., required for the normal operation of the systems, such that the Owner need not purchase additional maintenance agreement or contracts. The manufacturer shall visit the jobsite a minimum of once every four (4) months during the guarantee period to perform above noted maintenance.

.2 The overall system co-ordination shall be the responsibility of the contractor, and he shall ensure that all of the necessary system components are installed to result in a complete, workable system.

.3 All field devices including manual pull stations, detectors, monitor, control and relay modules shall be externally labelled showing the address and device controlled and monitored. The self-adhesive identification labels shall be 12mm **WHITE** laminated marker tape with black typed lettering. Identification shall be placed on the inside of doors where doors are either controlled by magnetic door holders, electric locks, or magnetic locks.

.4 All ceiling mounted fire detection devices shall be installed as close as possible to the centre of the rooms, stair shafts and portions of the corridors, or as noted on the drawings. Detectors shall be mounted at highest point of area to be protected. Ensure that these detectors are sufficiently spaced from supply air diffusers, light fixtures, and other ceiling mounted items that might block the movement of heat or smoke to the detectors. Smoke detectors shall not be located within 900mm of the peak of a vaulted ceiling.

.5 Detectors shall be mounted in suitable mounting plates with finish ring. Where shown in proximity to unit heaters, detectors shall be located at least 3000mm from such unit heaters, and out of line of direct heat. Detectors shall be located 1500mm from any air handling diffusers or grilles.

.6 Install T-bar mounting bars to support speaker and speaker strobes in suspended acoustic ceilings. In areas where t-bar ceilings are not present, speakers shall be suspended to the underside of the finished wood ceiling panels.

3.2 WIRING

.1 Perform tests in accordance with Section 26 05 01 - Common Work Results - Electrical and CAN/ULC-S537.

.2 All wiring shall be color coded. Wire and conduit necessary to make the system operable shall be provided and installed as instructed by the manufacturer of the fire alarm system. All wiring shall be installed in conduit with a maximum conduit fill of 40%. All conduit shall be installed in accordance with Section 260534.

.3 Wiring shall be as follows:

.1 Wiring for signal device circuits (horn and horn/strobes) shall be a minimum #14 gauge RW90, 300 volt, solid copper. Run in separate conduit from initiating circuits.

.2 Addressable devices shall be #18 gauge, twisted shielded jacketed pair. Shielding must be continuous throughout and isolated from ground except at the control panel. All existing shielded wiring being reused for the addressable loops shall be taped at every termination point.

.3 Ancillary circuits shall be #14 gauge RW90, 300 volt, solid copper. Run in separate conduit.

.4 Annunciator wiring shall be as per manufacturer's recommendations.

.4 Provide conduit and wiring for the speaker and speaker/strobe signal devices in the renovation areas.

.1 Run in separate conduit from initiating circuits.

.2 Wiring for speaker circuits shall be a minimum 2 conductor #16 gauge twisted shielded pair, solid copper, 300-volt.

.3 Wiring for strobe circuits shall be minimum 2 conductor #14 gauge RW90, 300 volt, solid copper.

.5 All wiring and its installation must comply with all appropriate codes including CAN/ULC-S524-M06. Refer to Appendix 'A' of CAN/ULC-S524-M06 for further requirements.

3.3 FIELD QUALITY CONTROL

.1 Perform tests in accordance with Section 26 05 01 - Common Work Results - Electrical and CAN/ULC-S537.

.2 Manufacturer shall allow for a required amount of on-the-job site assistance for the contractor during the construction period.

.3 The entire installation shall be performed under the supervision of the manufacturer. Upon completion of the installation, the manufacturer shall check the entire system to the approval of the Consultant. The manufacturer shall verify the entire system and demonstrate its complete operation to those having jurisdiction.

.4 The manufacturer shall perform a complete verification and inspection of all installed equipment, including each and every component, such as manual stations, automatic detectors, sprinkler switches, audible signalling appliances, station indicating lamps, control equipment, remote peripherals, etc., to ensure the following:

.1 That the type of equipment installed is that designated by the Consultant's specifications and plans;

.2 That the wiring connections to all equipment are correct and in accordance with CSA and ULC requirements;

.3 That the equipment is installed in accordance with the manufacturer's recommendations;

.4 That the regulations concerning the supervision of components have been adhered to (e.g. stations, detectors, signal devices, etc.), and are properly wired and supervised;

.5 That any subsequent changes necessary to conform to the above will be done by the contractor, with technical advice supplied by the manufacturer.

.5 During the period of inspection, the Contractor shall supply to the manufacturer, one (1) electrician and one (1) helper.

.6 The contractor shall also supply any required equipment such as ladders, scaffolding, etc.

.7 To assist the installer in preparing his bid, the manufacturer shall indicate the number of hours necessary to complete this inspection.

.8 Upon completion of the inspection, and when all of the above conditions have been compiled with, the manufacturer shall issue to the Consultant the following:

.1 A copy of the inspecting technician's report, showing the location of each device, and certifying the test results of each device.

.2 A certificate of verification confirming that the inspection has been completed, and showing the condition upon which such inspection and certification have been rendered.

.3 Proof of liability insurance for the inspection.

.9 All verification certificates shall include the testing of the audibility of the signal devices to confirm compliance with the 2010 National Building Code.

3.4 TRAINING

.1 Arrange and pay for on-site lecture and demonstration by the fire alarm equipment manufacturer to train operational personnel in use and maintenance of the fire alarm system.

.2 The Owner’s operating and maintenance personnel shall be instructed in the operation and maintenance of the system for a minimum period of one two-hour session.

.3 Written documentation bearing name and signature of Owner’s personnel who received the above instructions shall be included in the operating instructions and service manuals.

END OF SECTION