[redacted]

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PROJECT

Airport Hangar Door Replacement
Prince Albert, Saskatchewan

[redacted]

PWGSC PROJECT No.	**SET No.**
32/2015	
DATE	
2016-06-24	

[redacted]

LIST OF DRAWINGS

ARCHITECTURAL

A1.1 SITE PLAN, SCHEDULES
A2.1 DEMOLITION PLAN, DEMOLITION ELEVATIONS
A2.2 REVISED FLOOR PLAN, ROOF PLAN, LARGE SCALE PLAN
A3.1 EXTERIOR ELEVATIONS, BUILDING SECTIONS, PARTIAL REFLECTED CEILING PLAN
A6.1 DETAILS
A6.2 DETAILS

STRUCTURAL

S1 TYPICAL DETAILS, FOUNDATION PLAN, PILE SCHEDULE, COLUM SCHEDULE
S2 PLAN – HANGAR DOOR SUPPORT, PLAN - ROOF
S3 FRAMING ELEVATION, SECTIONS / DETAILS

MECHANICAL

M1.1 LOWER AND UPPER LEVEL FLOOR PLANS - MECHANICAL
M1.2 MECHANICAL EQUIPMENT SCHEDULE, HEATING SCHEMATIC ICE-MELT SYSTEM DETAILS

ELECTRICAL

E1 ELECTRICAL PLAN
E2 PANEL SCHEMATICS & MECHANICAL SCHEDULE
E3 EMERGENCY POWER SCHEMATICS

END OF SECTION

Part 1 General

1.1 WORK COVERED BY CONTRACT DOCUMENTS

.1 Work of this Contract comprises removal and replacement of a hangar door system, construction of a new door canopy, associated structural, mechanical, electrical, and utility services work, generator switching, exterior lighting, interior lighting, heating upgrades, and interior floor resurfacing. The site is located in Prince Albert, Saskatchewan and further identified as “Airport Hangar Door Replacement”.

1.2 WORK BY OTHERS

.1 Co-operate with other Contractors in carrying out their respective work and carry out instructions from Departmental Representative.

.2 Co-ordinate work with that of other Contractors. If any part of work under this Contract depends for its proper execution or result upon work of another Contractor, report promptly to Departmental Representative, in writing, any defects which may interfere with proper execution of Work.

.3 Work of Project potentially executed concurrently with Work of this Contract, and which is specifically excluded from this Contract:

.1 Underground fuel tank removal and disposal.

.2 Contaminated soil remediation.

.3 Installation of new above ground fuel storage tank.

1.3 WORK SEQUENCE

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

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

.3 Maintain fire access/control.

.4 Maintain ingress and egress access for the Owner’s aircraft at all times during construction. Co-ordinated with Owner.

1.4 CONTRACTOR USE OF PREMISES

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

.1 Owner occupancy.

.2 Ingress and egress of the Owner’s aircraft.

.2 Co-ordinate use of premises under direction of Departmental Representative.

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

.4 Remove or alter existing work to prevent injury or damage to portions of existing work which remain.

.5 Repair or replace portions of existing work which have been altered during construction operations to match existing or adjoining work, as directed by Departmental Representative.

.6 At completion of operations condition of existing work: equal to or better than that which existed before new work started.

1.5 OWNER OCCUPANCY

.1 Owner will occupy premises during entire construction period for execution of normal operations.

.2 Co-operate with Owner in scheduling operations to minimize conflict and to facilitate Owner usage.

1.6 ALTERATIONS, ADDITIONS OR REPAIRS TO EXISTING BUILDING

.1 Execute work with least possible interference or disturbance to building operations, occupants, adjacent building operations, public and normal use of premises. Arrange with Departmental Representative to facilitate execution of work.

1.7 EXISTING SERVICES

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

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

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

.7 Provide adequate bridging over trenches which cross tarmac to permit normal aircraft traffic and operations.

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

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

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

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

1.8 DOCUMENTS REQUIRED

.1 Maintain at job site, one copy each document as follows:

.1 Contract Drawings.
.2 Specifications.
.3 Addenda.
.4 Reviewed Shop Drawings.
.5 List of Outstanding Shop Drawings.
.6 Change Orders.
.7 Other Modifications to Contract.
.8 Field Test Reports.
.9 Copy of Approved Work Schedule.
.10 Health and Safety Plan and Other Safety Related Documents.
.11 Facility Alteration Permit.
.12 Dig Permits.
.13 Building Permit.
.14 Other documents as specified.

1.9 PERMITS AND FEES

.1 The Contractor shall obtain and pay for all building permits. Obtain and pay for all other permits, licences, certificates, fees and governmental inspections or notices required for the performance of the work.

.2 Permit drawings are the property of the owner. Contractor to forward “approved” permit drawings and a copy of the building permit to the Departmental Representative prior to the submission of the first request for progress payment.”

END OF SECTION

Part 1 General

1.1 ACCESS AND EGRESS

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

.2 Design, construct and maintain temporary "access to" and "egress from" existing hangar for Owner’s continuous use of the airplane. Include bridges, ramps, platforms, or other means, independent of finished surfaces and in accordance with relevant municipal, provincial and other regulations.

1.2 USE OF SITE AND FACILITIES

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

.2 Normal hours of operation are between 07:00 – 16:00, Monday to Friday.

.3 Maintain existing services to building and provide for personnel and vehicle access, including aircraft.

.4 Where security is reduced by work provide temporary means to maintain security.

.5 Contractor to provide sanitary facilities for use by Contractor's personnel. Keep facilities clean.

.6 Closures: protect work temporarily until permanent enclosures are completed.

1.3 ALTERATIONS, ADDITIONS OR REPAIRS TO EXISTING BUILDING

.1 Execute work with least possible interference or disturbance to building operations, occupants, adjacent building operations, public and normal use of premises. Arrange with Departmental Representative to facilitate execution of work.

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 interruptions at times directed by Departmental Representative.

.3 Provide for personnel, pedestrian and vehicular traffic, including aircraft.

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

1.5 SPECIAL REQUIREMENTS

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

.2 Submit documentation to City of Prince Albert Airport in accordance with Section 01 35 13.13 –Special Project Procedures for Airport Facilities.

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

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

.5 Deliver materials during hours of work approved by Departmental Representative.

1.6 SECURITY CLEARANCE REQUIREMENTS (LAW ENFORCEMENT CHECKS)

.1 Security forms and documents are appended at the end of this Section.

.2 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.

.3 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.

1.7 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.

1.8 BUILDING SMOKING ENVIRONMENT

.1 Comply with smoking restrictions. Smoking is allowed only in areas indicated.

END OF SECTION

RCMP Clearance Requirements (Law Enforcement Checks)

.1 All personnel employed on this project will be subject to at a minimum, the RCMP Facilities Access Level 2 clearance requirements by the RCMP.

.2 Prior to the commencement of the on-site activities, all personnel engaged in the execution of the work on the exterior or interior of an RCMP occupied and/or unoccupied building or outside on the grounds, shall have at a minimum, the requisite RCMP Facilities Access Level 2 clearance.

.3 Immediately upon award of the contract, the Contractor shall prepare and submit the attached requisite forms, provided by the Departmental Representative (or failing that the RCMP Project Manager), for each Contractor employee and sub-contractor employee to be engaged in the work on the exterior or interior of an occupied and/or unoccupied building or outside on the grounds. In addition, Contractor's employees and sub-contractor employees must include with their requisite forms, government issued documents (driver's license/photo identification and birth certificate), for each Contractor employee and sub-contractor employee engaged in the work at the RCMP as noted above.

To eliminate delays in the clearance process, all clearance documents completed by the Contractor's employees and sub-contractor employees must be reviewed by the Contractor to ensure that all requested information has been provided, prior to submitting documents to the RCMP. Incomplete forms will be returned to the Contractor.

The Contractor's employees and sub-contractor employees shall only mobilize on site, once the requisite RCMP clearance has been granted.

.4 The Contractor should batch the fully completed submissions, based on priority work on site and allow for a minimum twenty (20) working days processing time in the project schedule for the review to occur (from the date the completed documents are received by the RCMP). The inability to submit the fully completed requisite forms and documents will not be reason for an extension to the project schedule or additional compensation.

.5 The Contractor's employees and subcontractor employees must be escorted at all times by a designate of the RCMP. This designate will be at no cost to the Contractor.

.6 The Contractor shall give the RCMP 72 hours notice for work to be carried out during periods outside of the normal working hours of Monday to Friday, from 06:00 to 18:00 hours.

.7 At the request of the Departmental Representative (or failing that the RCMP Project Manager), Contractor's employees and sub-contractor employees may be requested to undertake additional clearance requirements, to obtain the RCMP Reliability Status clearance. Additional clearance requirements would include submission of the completed TBS 330-60 form and Security Pre-Interview Questionnaire form, fingerprints for verification purposes (at no cost to the Contractor) and undertaking of an interview. This would enable the Contractor's employees or sub-contractor employees, whom have been granted the RCMP Reliability Status clearance, unescorted access to some occupied and/or unoccupied RCMP buildings, or outside on the grounds. Additional processing time (approximately forty working days) will be required for this clearance.

RCMP NORTH WEST REGION
DEPARTMENTAL SECURITY SECTION
Contractor/Consultant Information Sheet
DEPOT CONSTRUCTION SITES

PLEASE PRINT LEGIBLY / ALL INFORMATION MUST BE PROVIDED

CONTRACTORS / CONSULTANTS TO COMPLETE

Contractors/Consultants to provide the requested information below.
This completed form must be returned with the attached clearance forms and 2 copies of personal identification (driver's license/photo identification & Birth Certificate, Passport, Firearms License) to:

RCMP Depot Security Administration
Attention: Security Clearances
Fort Dufferin Dorm, 5600 – 11 Avenue
Regina, SK S4P 3J7

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*)	Depot B Blck-WindowReplacement-Construction **SRCL #2013-11122229** RCMP Project Manager: Allan Currie, NPDO
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 / cannot 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) Please park in designated areas only, as outlined by the RCMP Project Manager.
5) Contractors/Consultants must abide by the RCMP Smoking Policy: *Smoking is not permitted anywhere at Depot except in the designated smoking area within the work site, as approved by the RCMP.*
6) PLEASE NOTE CONTRACTORS ARE NOT PERMITTED TO OBTAIN FOOD AND/OR DRINK IN THE RCMP DIVISION MESS.
7) NO ACCESS TO AREAS THAT YOU HAVE NOT BEEN CLEARED WILL BE ALLOWED AND IF FOUND IN THESE AREAS YOUR CLEARANCE MAY BE REVOKED AND YOU MAY 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) ID MUST include full date of birth and name of the individual (ie. Drivers Licence - Birth Certificate, Passport, Firearms Licence). (One piece of 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 PROVIDED: **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 *AND*
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:*** **1.** If you do not have a Driver's License, please provide other government issued photo identification (passport, treaty card). **2.** 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:*** **1.** 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 *AND*
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:*** 1. If you do not have a Driver's License, please provide other government issued photo identification (passport, treaty card). 2. The photo must be clear.	
1. 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 IN LIEU OF BIRTH CERTIFICATE.**	
2. Two current Passport Style Photographs (do not have to be certified)	
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 ( )	
2	Apartment number	Street number	Street name	Civic number (if applicable)	From Y M	To Y M
	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 (specify, see instructions) 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.

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)

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INSTRUCTIONS FOR PERSONNEL SCREENING CONSENT AND AUTHORIZATION FORM TBS/SCT 330-23E (Rev. 2002/02)
Once completed, this form shall be safeguarded and handled at the level of Protected A.

General:
If space allotted in any portion is insufficient please use separate sheet using same format.

1. Section A (Administrative Information) Authorized Departmental/Agency/Organizational Official
The Official, based on instructions issued by the Departmental Security Officer, may be responsible for determining, based on five year background history, what constitutes sufficient verification of personal data, educational and professional qualifications, and employment history. References are to be limited to those provided on the application for employment or equivalent forms.

SUPPLEMENTAL INFORMATION REQUIREMENTS
Persons who presently hold a SECURITY CLEARANCE and subsequently marry, remarry or commence a common-law partnership, in addition to having to update sections of the *Security Clearance Form (TBS/SCT 330-60)*, are required to submit an original *Personnel Screening, Consent and Authorization Form*, with the following parts completed:

Part A - As set forth in each question
Part B - As set forth in each question, excluding CRIMINAL CONVICTIONS IN AND OUTSIDE OF CANADA.
Part C - Applicant's signature and date only are required

"Other". This should be used to identify if the security screening is for Site Access, NATO, SIGINT etc.

2. Section B (Biographical Information)
To be completed by the ***applicant***. If more space is required use a separate sheet of paper. Each sheet must be signed.

Country of Birth - For "NEW" requests, if born abroad of Canadian parents, please provide a copy of your Certificate of Registration of Birth Abroad. If you arrived in Canada less than five years ago, provide a copy of the Immigration Visa, Record of Landing document or a copy of passport.

- List only criminal convictions for which a pardon has NOT been granted. Include on a separate attached sheet of paper, if more than one conviction. Applicant must include those convictions outside Canada.
- Offences under the *National Defence Act* are to be included as well as convictions by courts-martial are to be recorded.

3. Section C (Consent and Verification)
A copy of Section "C" may be released to institutions to provide acknowledgement of consent.

Criminal record checks (fingerprints may be required) and credit checks are to be arranged through the Departmental Security Office or the delegated Officer.

Consent: may be given only by an applicant who has reached the age of majority, otherwise, the signature of a parent or guardian is mandatory.

The age of majority is:
19 years in NFLD., N.S., N.B., B.C., Yukon, Norhwest Territories and Nunavut;
18 years in P.E.I., Que., Ont., Man., Sask. and Alta.

The applicant will provide initials in the " applicant's initials box".

The official who carried out the verification of the information will print their name, insert their initials and telephone number in the required space.
- Reliability Screening (for all types of screening identified within Section A): complete numbers 1 and 2 and 3 if applicable.
- Security Clearance (for all types of screening identified within Section A): complete numbers 1 to 4 and 5 where applicable.
- Other: number 5 is used only where prior Treasury Board of Canada Secretariat approval has been obtained.

4. Section D (Review)
To be completed by authorized Departmental/Agency/Organizational Official who is responsible for ensuring the completion of sections A to C as requested.

5. Section E (Approval)
Authorized Departmental/Agency/Organizational Security Official refers to the individuals as determined by departments, agencies, and organizations that may verify reliability information and/or approve/not approve reliability status and/or security clearances. Approved Reliability Status and Level I, II and III, as well as the signature of the authorized security official or manager are added for Government of Canada use only. Applicants are to be briefed, acknowledge, and be provided with a copy of the "Security Screening Certificate and Briefing Form (TBS/SCT 330-47)". **Note**: Private sector organizations do not have the authority to approve any level of security screening.

Photographs: Departments/Agencies/Organizations are responsible for ensuring that three colour photographs of passport size are attached to the form for the investigating agency. Maximum dimensions are 50mm x 70mm and minimum are 43mm x 54mm. The face length from chin to crown of head must be between 25mm x 35mm. The photographs must be signed by the applicant and an authorized security official. The photographs must have been taken within the last six months. It is required for new or upgrade Level III security clearances for identification of the applicant during the security screening investigation by the investigating agency. The investigating agency may in specific incidents request a photograph for a Level I or II clearances when an investigation is required.

Surname	Date of birth

RESIDENCE (Additional Information)

	Apartment number	Street Number	Street Name	Civic Numb er (if applicable)	From Y M	To Y M
3	City	Province or state	Postal code	Country	Telephone number	
4	Apartment number	Street Number	Street Name	Civic Numb er (if applicable)	From Y M	To Y M
	City	Province or state	Postal code	Country	Telephone number	
5	Apartment number	Street Number	Street Name	Civic Numb er (if applicable)	From Y M	To Y M
	City	Province or state	Postal code	Country	Telephone number	
6	Apartment number	Street Number	Street Name	Civic Numb er (if applicable)	From Y M	To Y M
	City	Province or state	Postal code	Country	Telephone number	
7	Apartment number	Street Number	Street Name	Civic Numb er (if applicable)	From Y M	To Y M
	City	Province or state	Postal code	Country	Telephone number	
8	Apartment number	Street Number	Street Name	Civic Numb er (if applicable)	From Y M	To Y M
	City	Province or state	Postal code	Country	Telephone number	
9	Apartment number	Street Number	Street Name	Civic Numb er (if applicable)	From Y M	To Y M
	City	Province or state	Postal code	Country	Telephone number	
10	Apartment number	Street Number	Street Name	Civic Numb er (if applicable)	From Y M	To Y M
	City	Province or state	Postal code	Country	Telephone number	
11	Apartment number	Street Number	Street Name	Civic Numb er (if applicable)	From Y M	To Y M
	City	Province or state	Postal code	Country	Telephone number	
12	Apartment number	Street Number	Street Name	Civic Numb er (if applicable)	From Y M	To Y M
	City	Province or state	Postal code	Country	Telephone number	
13	Apartment number	Street Number	Street Name	Civic Numb er (if applicable)	From Y M	To Y M
	City	Province or state	Postal code	Country	Telephone number	

ADDITIONAL INSTRUCTIONS FOR COMPLETION OF GOVERNMENT OF CANADA PERSONNEL SCREENING, CONSENT AND AUTHORIZATION FORM (Form No. TBS 330-23E)

NOTE:

All information requested on TBS 330-23E MUST be provided (do not leave any "blanks", provide partial information, and do not use any abbreviations - ie. CA for Canada).
Failure to provide requested information will result in forms being returned to applicants.

Page 1 of Form:

Section A. Administrative Information.: Do not complete (completed by the RCMP).

Section B. Biographical Info.: ***To be completed by applicant***:

1. Surname: Your Last Name that you currently use – ie. "Smith"

2. Full Given Names (no initials):
   a. Your First Name and Middle Name (s) ie. "Cameron John"
   **If you do not have a middle name, state "no middle name" on the form.
   **Circle or underline your usual name used (whether you go by your first name or middle name).

3. Family Name at Birth: Your Last Name when you were born - ie. "Smith" (do not include "Same")

4. All other names used: Abbreviation(s) of name(s) used (ie."Dave"/David, "Charlie"/Charles) or nicknames.

5. Sex: Place "x" in box beside male or female.

6. Date of Birth: provide the Year, Month and Day you were born ie. 2012-01-01 (must provide all in this format)

7. Country of Birth: - the Country that you were born in ie. Canada (no abbreviations such as "CA")

8. Date of entry into Canada if born outside Canada: - ie. 2012-01-01 (Year, Month, Day format)

9. Daytime telephone number: Your telephone number that the RCMP can reach you at in the daytime, including your area code.

10. E-mail address: Your e-mail address at work, or if you do not have one at work, your home e-mail address.

11. Residence(s): provide addresses where you have permanently or temporarily resided for the last **five years**, starting with the most current home address. Must be consecutive dates – no breaks in time periods.
    **Do not fill in address in grey/shaded area beside "Home address"; fill in current address in the boxes under "Home address".
    a. Apartment Number - fill in if you have one; if you do not live in an apartment, leave blank.

    b. Street Number – your house number ie. "421"

    c. Street Name – ie. "Smith Street/George Avenue; or "4th Street" if no name (no abbreviations)
    If you do not have a street address or you live on a farm/acreage, please provide your legal land descriptions (ie. SW-30-23-45-W4th) – **NO POST OFFICE BOX NUMBERS.

ADDITIONAL INSTRUCTIONS FOR COMPLETION OF GOVERNMENT OF CANADA PERSONNEL SCREENING, CONSENT AND AUTHORIZATION FORM (Form No. TBS 330-23E)

d. From – the year and month that you moved to your current / previous residence(s);
**If you cannot recall the month, please state above the M – "unknown"

e. To – "Present" or the year and month that you moved/vacated your previous residences (not current residence).

f. City – the name of the city or town that you currently and previously resided in.

g. Province or State – the name of the province or state that you currently and previously resided in (no abbreviations ie. "AB" or "SK").

h. Postal Code – your current and previous postal codes.

i. Country – the name of the country that you currently and previously resided in (no abbreviations).

j. Telephone Number – your current and previous home telephone numbers, including area code.

Note: i. If you do not have enough space on the attached form to list all addresses for the last five years, please use the attached form titled "TBS 330-23E Residence Additional Info".

ii. You must include your "Surname" and Date of Birth at the top of the page as requested.

NO POST OFFICE BOX NUMBERS;

DATES MUST BE CONSECUTIVE–NO BREAKS IN TIME PERIODS (as stated in 11.)

12. Have you previously completed a Government of Canada security screening form?:
    a. "No" or
    b. "Yes" – if "Yes", please provide details. If you cannot recall some or all of the details (ie. year of screening, state "cannot recall").

13. Criminal Convictions:
    a. "No" OR
    b. "Yes" - if "Yes", please provide details. If you cannot recall some or all of the details (ie. date of conviction, state "cannot recall").

Page 2 of Form:

Top of Page 2: *To be completed by applicant*:

1. Surname (your last name) followed by a comma – ie. Smith,

2. Full given names – your first name and then your middle name
   **If you do not have a middle name, state "no middle name" on the form.
   **Circle or underline your usual name used (ie. whether you go by your first name or middle name).

3. Date of birth - provide – Year, Month, Day ie. 2012-01-01 (must provide all in this format / no blanks)

Section C. Consent and Verification: *To be completed by applicant*:

1. a.) Place a "Checkmark" in Boxes 1. to 5; *then:*
   b.) Initial under "Applicant's Initials" column – **numbers 1. to 5. (you must initial all boxes-1 to 5).**

2. Read the Privacy Act Statement and sign above "Signature" and "Date (Y/M/D)"

Section D. Review: do not complete (completed by RCMP)

Section E. Approval: do not complete (completed by RCMP)

NOTE: RCMP FACILITIES ACCESS LEVEL 2 CLEARANCE – Photographs ARE NOT required.
RCMP "RELIABILITY STATUS CLEARANCES" – Photographs ARE required.

SAMPLE OF COMPLETED DOCUMENT.

Government of Canada / Gouvernement du Canada

PROTECTED (when completed)

PERSONNEL SCREENING, CONSENT AND AUTHORIZATION FORM

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
SMITH	(John) (nomiddle name)	SMITH

All other names used (i.e. Nickname)	Sex	Date of birth (Y M D)	Country of birth	Date of entry into Canada if born outside Canada (Y M D)
Johnny	☒ Male ☐ Female	1960 01 27	CANADA	

RESIDENCE (provide addresses for the last five years, starting with the most current) Home address	Daytime telephone number	E-mail address
	(306) 201-1433	JSmith@telus.net

	Apartment number	Street number	Street name	Civic number (if applicable)	From (Y M)	To present
1		1257	Cooper Avenue		2001 01	

City	Province or state	Postal code	Country	Telephone number
PEACE RIVER	ALBERTA	T63 2X9	CANADA	(780) 261-1493

	Apartment number	Street number	Street name	Civic number (if applicable)	From (Y M)	To (Y M)
2			12-13-57-W2		2009 03	2001 01

City	Province or state	Postal code	Country	Telephone number
GRAND CACHE	ALBERTA	TOG 7X3	CANADA	(780) 234-2102

Have you previously completed a Government of Canada security screening form? ☒ Yes ☐ No

If yes, give name of employer, level and year of screening. CORRECTIONAL SERVICES CANADA 2001 (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
DRIVING UNDER THE INFLUENCE OF ALCOHOL	EDMONTON POLICE SERVICE	EDMONTON

Province/State	Country	Date of conviction ▶ (Y M D)
ALBERTA	CANADA	2001 02 01

Surname: SMITH, John (no middle name) | Date of birth: 1960-01-27 | PROTECTED A (When completed)

RESIDENCE (Additional Information)

	Apartment number	Street Number	Street Name	Civic Numb er (if applicable)	From Y M	To Y M
3			1-87-18-W4		2007 01	2009 03
	City	Province or state	Postal code	Country	Telephone number	
	SASKATOON	SASKATCHEWAN	S0G3C0	CANADA	(306) 231-7192	
4		20	HILL AVENUE		2004 01	2007 01
	CALGARY	ALBERTA	T0G3C0	CANADA	(403) 239-7186	
5						
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PERSONNEL SCREENING, CONSENT AND AUTHORIZATION FORM

PROTECTED (when completed)

Surname and full given names	Date of birth (Y M D)
SMITH, John (no middle name)	1960 01 27

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	JS			( )
2. ☑ Criminal record check	JS			( )
3. ☑ Credit check (financial assessment, including credit records check)	JS			( )
4. ☑ Loyalty (security assessment only)	JS			
5. ☑ Other (Law Enforcement Records Checks)	JS			( )

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.

John Smith — Signature
2011-12-01 — 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)

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INSTRUCTIONS FOR PERSONNEL SCREENING CONSENT AND AUTHORIZATION FORM TBS/SCT 330-23E (Rev. 2002/02)
Once completed, this form shall be safeguarded and handled at the level of Protected A.

General:
If space allotted in any portion is insufficient please use separate sheet using same format.

1. Section A (Administrative Information) Authorized Departmental/Agency/Organizational Official
The Official, based on instructions issued by the Departmental Security Officer, may be responsible for determining, based on five year background history, what constitutes sufficient verification of personal data, educational and professional qualifications, and employment history. References are to be limited to those provided on the application for employment or equivalent forms.

SUPPLEMENTAL INFORMATION REQUIREMENTS
Persons who presently hold a SECURITY CLEARANCE and subsequently marry, remarry or commence a common-law partnership, in addition to having to update sections of the *Security Clearance Form (TBS/SCT 330-60)*, are required to submit an original *Personnel Screening, Consent and Authorization Form*, with the following parts completed:

Part A - As set forth in each question
Part B - As set forth in each question, excluding CRIMINAL CONVICTIONS IN AND OUTSIDE OF CANADA.
Part C - Applicant's signature and date only are required

"Other". This should be used to identify if the security screening is for Site Access, NATO, SIGINT etc.

2. Section B (Biographical Information)
To be completed by the ***applicant***. If more space is required use a separate sheet of paper. → attached "Residence (Additional Information) Form.

Country of Birth - For "NEW" requests, if born abroad of Canadian parents, please provide a copy of your Certificate of Registration of Birth Abroad. If you arrived in Canada less than five years ago, provide a copy of the Immigration Visa, Record of Landing document or a copy of passport.

- List only criminal convictions for which a pardon has NOT been granted. Include on a separate attached sheet of paper, if more than one conviction. Applicant must include those convictions outside Canada. Thereafter sign the separate attached sheet of paper.
- Offences under the *National Defence Act* are to be included as well as convictions by courts-martial are to be recorded.

3. Section C (Consent and Verification)
A copy of Section "C" may be released to institutions to provide acknowledgement of consent.

Criminal record checks (fingerprints may be required) and credit checks are to be arranged through the Departmental Security Office or the delegated Officer.

Consent: may be given only by an applicant who has reached the age of majority, otherwise, the signature of a parent or guardian is mandatory.

The age of majority is:
19 years in NFLD., N.S., N.B., B.C., Yukon, Northwest Territories and Nunavut;
18 years in P.E.I., Que., Ont., Man., Sask. and Alta.

The applicant will provide initials in the " applicant's initials box". – Box 1-5

The official who carried out the verification of the information will print their name, insert their initials and telephone number in the required space (RCMP employee only)
- Reliability Screening (for all types of screening identified within Section A): complete numbers 1 and 2 and 3 if applicable.
- Security Clearance (for all types of screening identified within Section A): complete numbers 1 to 4 and 5 where applicable.
- Other: number 5 is used only where prior Treasury Board of Canada Secretariat approval has been obtained.

4. Section D (Review)
To be completed by authorized Departmental/Agency/Organizational Official who is responsible for ensuring the completion of sections A to C as requested.

5. Section E (Approval)
Authorized Departmental/Agency/Organizational Security Official refers to the individuals as determined by departments, agencies, and organizations that may verify reliability information and/or approve/not approve reliability status and/or security clearances. Approved Reliability Status and Level I, II and III, as well as the signature of the authorized security official or manager are added for Government of Canada use only. Applicants are to be briefed, acknowledge, and be provided with a copy of the "Security Screening Certificate and Briefing Form (TBS/SCT 330-47)".
Note: Private sector organizations do not have the authority to approve any level of security screening.

Photographs: Departments/Agencies/Organizations are responsible for ensuring that three colour photographs of passport size are attached to the form for the investigating agency. Maximum dimensions are 50mm x 70mm and minimum are 43mm x 54mm. The face length from chin to crown of head must be between 25mm x 35mm. The photographs must be signed by the applicant and an authorized security official. The photographs must have been taken within the last six months. It is required for new or upgrade Level III security clearances for identification of the applicant during the security screening investigation by the investigating agency. The investigating agency may in specific incidents request a photograph for a Level I or II clearances when an investigation is required.

* ENSURE ATTACHED "ADDITIONAL INSTRUCTIONS" ARE REVIEWED/FOLLOWED (more detailed information on how to complete TBS 330-23E)

Canada

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 Departmental Representative shall chair the start-up meeting. The Consultant shall chair subsequent 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 Departmental Representative.

.4 Agenda to include the following:

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

END OF SECTION

Part 1 General

1.1 DEFINITIONS

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

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

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

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

.5 Duration: number of work periods (not including holidays or other nonworking periods) required to complete activity or 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 Plan to complete Work in accordance with prescribed milestones and time frame.

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

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

1.3 ACTION AND INFORMATIONAL SUBMITTALS

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

.2 Submit 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.

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 bi-weekly basis reflecting activity changes and completions, as well as activities in progress.

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

1.6 PROJECT MEETINGS

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

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

END OF SECTION

Part 1 General

1.1 ADMINISTRATIVE

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

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

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

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

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

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

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

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

.9 Contractor's responsibility for deviations in submission from requirements of Contract Documents is not relieved by Departmental Representative’s 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 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 hard copies and one electronic copy of shop drawings for each requirement requested in specification Sections and as Departmental Representative may reasonably request.

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

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

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

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

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

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

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

.14 Submit 6 hard copies and one electronic copy 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 hard copies and one electronic copy 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 hard copies and one electronic copy 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 Representative approves detail design inherent in shop drawings, responsibility for which shall remain with Contractor submitting same, and such review shall not relieve Contractor of responsibility for errors or omissions in shop drawings or of responsibility for meeting requirements of construction and Contract Documents.

.2 Without restricting generality of foregoing, Contractor is responsible for dimensions to be confirmed and correlated at job site, for information that pertains solely to fabrication processes or to techniques of construction and installation and for co-ordination of Work of sub-trades.

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.

1.5 PROGRESS PHOTOGRAPHS

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

.2 Project identification: name and number of project and date of exposure indicated.

.3 Submit construction progress photographs as work proceeds. Photographs shall be taken at all construction milestones and anytime a problem arises. The minimum requirement is for photographs to be taken on a weekly basis.

.4 Digital photographs stored on CD-ROM or DVD, shall be submitted with the Operation and Maintenance Manuals. Digital photographs shall be in jpg format.

END OF SECTION

Part 1 General

1.1 SUMMARY

.1 Section Includes:

.1 Movement of equipment and other special procedures that must be considered when construction is being carried out while the airport facility is in use.

1.2 REFERENCES

.1 Canadian Federal Legislation

.1 Canadian Aviation Regulations (CAR) 2012-1.

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

1.3 GENERAL PROTECTION

.1 Do not disrupt airport business except as permitted by City of Prince Albert Airport and Departmental Representative.

.2 Provide temporary protection for safe handling of public, personnel, pedestrians and vehicular traffic: to Section 01 56 00 - Temporary Barriers and Enclosures.

.3 Provide barricades and lights as per Canadian Aviation Regulations and Environment Canada regulations.

1.4 MOVEMENT OF EQUIPMENT AND PERSONNEL

.1 In areas of airport not closed to aircraft traffic:

.1 Obtain City of Prince Albert Airport and Departmental Representative's approval on scheduling of Work.

.2 Control movements of equipment and personnel as directed by Departmental Representative.

.3 Provide qualified field personnel at locations designated by Departmental Representative to relay signals from airport traffic control tower to equipment and personnel wishing to cross live traffic areas.

.4 Immediately obey signals from airport traffic control tower instantly.

1.5 UNSERVICEABLE AREAS

.1 Mark off all excavations and all areas made unserviceable for aircraft by Work of this Contract by providing plainly visible danger markings by day and red lights by night.

.1 During daylight, mark stationary and mobile equipment with international orange and white checkered flags, mark the material, and work with yellow flags.

.2 Vehicles operating in the landing area, must be identified by means of a flag on a staff attached to and flying above the vehicle. Flag size must be not less than 0.9 metres by 0.9 metres and consist of a checkered pattern of international orange and white squares not less than 300 mm by 300 mm. Flags varying in any

dimension by not more than 10 percent of the specified dimensions are considered to comply with the stated requirements.

.3 All excavations and closed areas must be prominently fenced, marked and lighted with red lights. Spacing of lights shall not exceed 3 metres on centre.

.4 During nighttime, which begins 2 hours before sundown and ends 2 hours after sunrise, mark stationary and mobile equipment and material, and work with red lights. Where the Air Traffic Controller determines that the red lights may confuse pilots approaching for landings, the Air Traffic Controller may direct that the red lights be left off or that the colour of the lights to be changed.

.2 Open flames and inflammable fuels are not permitted.

.3 Park equipment not in use and stockpile materials so that stockpile tops are below 50 to 1 ratio from ends of useable landing strip and below 20 to 1 ratio from sides of aircraft traffic areas. Mark tops with red lights and as directed by Departmental Representative.

1.6 TRENCHING

.1 Obtain City of Prince Albert Airport and Departmental Representative's written permission to undertake trenching on pavements open to aircraft traffic which cannot be completed, backfilled and sealed within one working day.

1.7 AIRPORT FACILITIES

.1 Dig permit to be applied for prior to all underground work. Separate dig permits will be required for hangar door installation and underground utility work.

.2 Contractor must stake or indicate locations of all underground facilities such as cables, pipes and ducts. Contact City of Prince Albert for list of contracts and phone numbers required for underground locates.

.3 Notify City of Prince Albert Airport and Departmental Representative of work areas sufficiently in advance of operations so that underground facilities can be located.

.4 Contractor must provide the City of Prince Albert Airport with comprehensive schedules indicating when Work is to be undertaken and when Work is planned.

.5 Contractor must provide the City of Prince Albert Airport with a comprehensive list of all heavy equipment and vehicles planned to be on site.

.6 City of Prince Albert building permit to be applied for and is required for this work.

END OF SECTION

Part 1 General

1.1 REFERENCES

.1 Definitions:

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

.2 Environmental Protection: prevention/control of pollution and habitat or environment disruption during construction.

.2 Reference Standards:

.1 Health Canada/Workplace hazardous Materials Information System (WHMIS)

.1 Material Safety Data Sheets (MSDS).

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 all products and include product characteristics, performance criteria, physical size, finish and limitations.

.2 Submit 2 copies of WHMIS MSDS in accordance with Section 01 35 29.06 - Health and Safety Requirements and 01 35 43 - Environmental Procedures.

.3 Before commencing construction activities or delivery of materials to site, submit Environmental Protection Plan for review and approval by Departmental Representative.

.4 Environmental Protection Plan must include comprehensive overview of known or potential environmental issues to be addressed during construction.

.5 Address topics at level of detail commensurate with environmental issue and required construction tasks.

.6 Include in Environmental Protection Plan:

.1 Names of persons responsible for ensuring adherence to Environmental Protection Plan.

.2 Names and qualifications of persons responsible for manifesting hazardous waste to be removed from site.

.3 Names and qualifications of persons responsible for training site personnel.

.4 Descriptions of environmental protection personnel training program.

.5 Erosion and sediment control plan identifying type and location of erosion and sediment controls to be provided including monitoring and reporting requirements to assure that control measures are in compliance with erosion and sediment control plan, Federal, Provincial, and Municipal laws and regulations.

.6 Drawings indicating locations of proposed temporary excavations or embankments for haul roads, stream crossings, material storage areas, structures, sanitary facilities, and stockpiles of excess or spoil materials including methods to control runoff and to contain materials on site.

.7 Traffic Control Plans including measures to reduce erosion of temporary roadbeds by construction traffic, especially during wet weather.

.1 Plans to include measures to minimize amount of material transported onto paved public roads by vehicles or runoff.

.8 Work area plan showing proposed activity in each portion of area and identifying areas of limited use or non-use.

.1 Plan to include measures for marking limits of use areas and methods for protection of features to be preserved within authorized work areas.

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

.10 Non-Hazardous solid waste disposal plan identifying methods and locations for solid waste disposal including clearing debris.

.11 Air pollution control plan detailing provisions to assure that dust, debris, materials, and trash, are contained on project site.

.12 Contaminant Prevention Plan identifying potentially hazardous substances to be used on job site; intended actions to prevent introduction of such materials into air, water, or ground; and detailing provisions for compliance with Federal, Provincial, and Municipal laws and regulations for storage and handling of these materials.

.13 Waste Water Management Plan identifying methods and procedures for management and discharge of waste waters which are directly derived from construction activities, such as concrete curing water, clean-up water, dewatering of ground water, disinfection water, hydrostatic test water, and water used in flushing of lines.

1.3 FIRES

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

1.4 DRAINAGE

.1 Develop and submit erosion and Sediment Control Plan (ESC) identifying type and location of erosion and sediment controls provided. Plan to include monitoring and reporting requirements to assure that control measures are in compliance with erosion and sediment control plan, Federal, Provincial, and Municipal laws and regulations.

.2 Provide temporary drainage and pumping required to keep excavations and site free from water.

.3 Ensure pumped water into waterways, sewer or drainage systems is free of suspended materials.

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

1.5 SITE CLEARING AND PLANT PROTECTION

.1 Protect trees and plants on site and adjacent properties as indicated.

.2 Protect trees and shrubs adjacent to construction work, storage areas and trucking lanes, and encase with protective wood framework from grade level to height of 2 m minimum.

.3 Protect roots of designated trees to dripline during excavation and site grading to prevent disturbance or damage.

.1 Avoid unnecessary traffic, dumping and storage of materials over root zones.

.4 Minimize stripping of topsoil and vegetation.

1.6 POLLUTION CONTROL

.1 Maintain temporary erosion and pollution control features installed under this Contract.

.2 Control emissions from equipment and plant in accordance with local authorities' emission requirements.

.3 Prevent sandblasting, concrete cutting and other extraneous materials from contaminating air and waterways beyond application area.

.1 Provide temporary enclosures.

.4 Cover or wet down dry materials and rubbish to prevent blowing dust and debris. Provide dust control for temporary roads.

.5 Provide methods, means, and facilities to prevent contamination of soil, water, and atmosphere from discharge of noxious toxic substances and pollutants produced by construction operations.

.6 Be prepared to intercept, clean up, and dispose of spills or releases that may occur whether on land or water. Maintain materials and equipment required for cleanup of spills or releases readily accessible on site.

.7 Promptly report spills and releases potentially causing damage to environment to:

.1 Authority having jurisdiction or interest in spill or release including conservation authority, water supply authorities, drainage authority, road authority, and fire department.

.2 Owner of pollutant, if known.

.3 Person having control over pollutant, if known.

.4 Departmental Representative.

.8 Contact manufacturer of pollutant if known and ascertain hazards involved, precautions required, and measures used in cleanup or mitigating action.

.9 Take immediate action using available resources to contain and mitigate effects on environment and persons from spill or release.

.10 Provide spill response materials including, containers, adsorbent, shovels, and personal protective equipment. Make spill response materials available at all times in which hazardous materials or wastes are being handled or transported. Spill response materials: compatible with type of material being handled.

1.7 EQUIPMENT DECONTAMINATION

.1 Perform equipment decontamination at Work site.

.2 At minimum, perform following steps during equipment decontamination: mechanically remove packed dirt, grit, and debris by scraping and brushing without using steam or high-pressure water. Perform assessment as directed by Departmental Representative to determine effectiveness of decontamination.

.3 Each piece of equipment may be inspected by Departmental Representative after decontamination and prior to removal from site and/or travel on clean areas. Departmental Representative will have right to require additional decontamination to be completed if deemed necessary.

.4 Collect decontamination sediments which accumulate on equipment decontamination area.

.5 Furnish and equip personnel engaged in equipment decontamination with appropriate personal protective equipment.

1.8 NOTIFICATION

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

.2 Contractor: after receipt of such notice, inform Departmental Representative of proposed corrective action and take such action for approval by Departmental Representative.

.1 Take action only after receipt of written approval by Departmental Representative.

.3 No time extensions granted or equitable adjustments allowed to Contractor for such suspensions.

Part 2 Products

2.1 NOT USED

.1 Not Used.

Part 3 Execution

3.1 CLEANING

.1 Progress Cleaning: clean in accordance with Section 01 74 11 - Cleaning.

.1 Leave Work area clean at end of each day.

.2 Ensure public waterways, storm and sanitary sewers remain free of waste and volatile materials disposal.

.3 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment in accordance with Section 01 74 11 - Cleaning.

.4 Waste Management: separate waste materials for reuse and 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.

END OF SECTION

Part 1 General

1.1 REFERENCES AND CODES

.1 Perform Work in accordance with National Building Code of Canada (NBC) 2010 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.

.2 PCB: Polychlorinated Biphenyl: stop work immediately when material resembling Polychlorinated Biphenyl is encountered during demolition work. Notify Departmental Representative.

.3 Mould: stop work immediately when material resembling mould is encountered during demolition work. Notify Departmental Representative.

1.3 BUILDING SMOKING ENVIRONMENT

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

END OF SECTION

Part 1 General

1.1 INSPECTION

.1 Allow Departmental Representative access to Work. If part of Work is in preparation at locations other than Place of Work, allow access to such Work whenever it is in progress.

.2 Give timely notice requesting inspection if Work is designated for special tests, inspections or approvals by Departmental Representative instructions, or law of Place of Work.

.3 If Contractor covers or permits to be covered Work that has been designated for special tests, inspections or approvals before such is made, uncover such Work, have inspections or tests satisfactorily completed and make good such Work.

.4 Departmental Representative will order part of Work to be examined if Work is suspected to be not in accordance with Contract Documents. If, upon examination such work is found not in accordance with Contract Documents, correct such Work and pay cost of examination and correction. If such Work is found in accordance with Contract Documents, Departmental Representative shall pay cost of examination and replacement.

1.2 INDEPENDENT INSPECTION AGENCIES

.1 Independent Inspection/Testing Agencies will be engaged by Departmental Representative and as noted in individual specification sections, for purpose of inspecting and/or testing portions of Work.

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

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

.4 If defects are revealed during inspection and/or testing, appointed agency will request additional inspection and/or testing to ascertain full degree of defect. Correct defect and irregularities as advised by Departmental Representative at no cost to Departmental Representative. Pay costs for retesting and re-inspection.

1.3 ACCESS TO WORK

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

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

1.4 PROCEDURES

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

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

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

1.5 REJECTED WORK

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

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

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

1.6 REPORTS

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

.2 Provide copies to subcontractor of work being inspected or tested and manufacturer or fabricator of material being inspected or tested.

1.7 TESTS AND MIX DESIGNS

.1 Furnish test results and mix designs as requested.

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

1.8 MOCK-UPS

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

.2 Construct in locations acceptable to Departmental Representative and as specified in specific Sections.

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

.4 Failure to prepare mock-ups in ample time is not considered sufficient reason for extension of Contract Time and no claim for extension by reason of such default will be allowed.

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

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

1.9 EQUIPMENT AND SYSTEMS

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

END OF SECTION

Part 1 General

1.1 ACTION AND INFORMATIONAL 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 DEWATERING

.1 Provide temporary drainage and pumping facilities to keep excavations and site free from standing water.

1.4 WATER SUPPLY

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

1.5 TEMPORARY HEATING AND VENTILATION

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

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

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

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

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

.5 Ventilating:

- .1 Prevent accumulations of dust, fumes, mists, vapours or gases in areas occupied during construction.
- .2 Provide local exhaust ventilation to prevent harmful accumulation of hazardous substances into atmosphere of occupied areas.
- .3 Dispose of exhaust materials in manner that will not result in harmful exposure to persons.

.4 Ventilate storage spaces containing hazardous or volatile materials.

.5 Ventilate temporary sanitary facilities.

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

.6 Refer to Mechanical and Electrical sections for specific requirements regarding temporary use of utilities.

.7 Pay costs for maintaining temporary heat, when not using permanent heating system.

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

.1 Conform with applicable codes and standards.

.2 Enforce safe practices.

.3 Prevent abuse of services.

.4 Prevent damage to finishes.

.5 Vent direct-fired combustion units to outside.

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

1.6 TEMPORARY POWER AND LIGHT

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

.2 Arrange for connection with appropriate utility company. Pay costs for installation, maintenance and removal.

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

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

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

1.7 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.

1.8 FIRE PROTECTION

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

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

END OF SECTION

Part 1 General

1.1 REFERENCES

.1 Canadian Standards Association (CSA International)

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

1.2 ACTION AND INFORMATIONAL SUBMITTALS

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

1.3 INSTALLATION AND REMOVAL

.1 Prepare site plan indicating proposed location and dimensions of area to be fenced and used by Contractor, number of trailers to be used, avenues of ingress/egress to fenced area and details of fence installation.

.2 Identify areas which have to be gravelled to prevent tracking of mud.

.3 Indicate use of supplemental or other staging area.

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

.5 Remove from site all such work after use.

1.4 SCAFFOLDING

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

.2 Provide and maintain scaffolding, ramps, ladders, 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.

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

1.6 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.

1.7 BRIDGING

.1 Provide a means for the Owner's aircraft to safely cross open excavations.

.2 Design, construct, maintain, and remove temporary bridging, consisting of a superstructure and substructure.

.3 Use timber, steel, or other material, or combination of materials that are in sound condition, capable of safely carrying the specified loads.

.4 Prior to construction, the Contractor shall submit drawings and design computations for the temporary bridge superstructure and substructure components, to the Departmental Representative for review.

1.8 CONSTRUCTION PARKING

.1 Parking will be permitted on site but may be limited. No on street parking will be allowed. Parking arrangements to be outlined by Departmental Representative at project start up.

.2 Provide and maintain adequate access to project site.

.3 Clean runways and taxi areas where used by Contractor's equipment.

1.9 SECURITY

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

1.10 OFFICES

.1 Provide 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 the site office is to be coordinated with the Departmental Representative. Maintain in clean condition

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

1.11 EQUIPMENT, TOOL AND MATERIALS STORAGE

.1 Provide and maintain, in clean and orderly condition, lockable weatherproof sheds for storage of tools, equipment and materials.

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

1.12 SANITARY FACILITIES

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

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

.3 Contractor shall be responsible for cleaning and maintenance of designated facilities.

1.13 CONSTRUCTION SIGNAGE

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

1.14 PROTECTION AND MAINTENANCE OF TRAFFIC

.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 City of Prince Albert Airport and Departmental Representative.

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

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

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

.8 Dust control: adequate to ensure safe operation at all times.

.9 Provide snow removal during period of Work.

1.15 CLEAN-UP

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

.2 Clean dirt or mud tracked onto paved or surfaced roadways.

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

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

END OF SECTION

Part 1 General

1.1 REFERENCES

.1 Canadian Standards Association (CSA International)

.1 CSA-O121-M1978(R2003), Douglas Fir Plywood.

1.2 INSTALLATION AND REMOVAL

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

.2 Remove from site all such work after use.

1.3 HOARDING

.1 Erect temporary site enclosure using 1.8 m high chainlink fence with steel posts spaced at maximum 2.4 m on centre. Maintain fence in good repair.

.2 Provide one lockable truck entrance gate, one lockable aircraft entrance gate, and at least one pedestrian door as directed and conforming to applicable traffic restrictions on adjacent streets. Equip gates with locks and keys.

.3 Erect and maintain pedestrian walkways including roof and side covers, complete with signs and electrical lighting as required by law.

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

1.4 GUARD RAILS AND BARRICADES

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

.2 Provide as required by governing authorities.

1.5 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.

.4 Existing hangar door may remain in place for the duration of construction. If existing hangar door is removed prior to the new hangar door being secured, the Contractor must provide weather tight, secure hoarding for the complete hangar door opening.

1.6 DUST TIGHT SCREENS

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

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

1.7 ACCESS TO SITE

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

1.8 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.

1.9 FIRE ROUTES

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

1.10 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.

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

1.12 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. List of standards reference writing organizations is contained in Sections.

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

.3 If there is question as to whether products or systems are in conformance with applicable standards, Departmental Representative reserves right to have such products or systems tested to prove or disprove conformance.

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

1.2 QUALITY

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

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

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

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

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

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

1.3 AVAILABILITY

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

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

1.4 STORAGE, HANDLING AND PROTECTION

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

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

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

.4 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, windows, 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.

1.5 TRANSPORTATION

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

1.6 MANUFACTURER'S INSTRUCTIONS

.1 Unless otherwise indicated within specifications, install or erect products in accordance with manufacturer's instructions. Do not rely on labels or enclosures provided with products. Obtain written instructions directly from manufacturers.

.2 Notify Departmental Representative in writing, of conflicts between specifications and manufacturer's instructions, so that Departmental Representative will establish course of action.

.3 Improper installation or erection of products, due to failure in complying with these requirements, authorizes Departmental Representative to require removal and re-installation at no increase in Contract Price or Contract Time.

1.7 QUALITY OF WORK

.1 Ensure Quality of Work is of highest standard, executed by workers experienced and skilled in respective duties for which they are employed. Immediately notify Departmental Representative if required Work is such as to make it impractical to produce required results.

.2 Do not employ anyone unskilled in their required duties. Departmental Representative reserves right to require dismissal from site, workers deemed incompetent or careless.

.3 Decisions as to standard or fitness of Quality of Work in cases of dispute rest solely with Departmental Representative, whose decision is final.

1.8 CO-ORDINATION

.1 Ensure co-operation of workers in laying out Work. Maintain efficient and continuous supervision.

.2 Be responsible for coordination and placement of openings, sleeves and accessories.

1.9 CONCEALMENT

.1 In finished areas conceal pipes, ducts and wiring in floors, walls and ceilings, except where indicated otherwise.

.2 Before installation inform Departmental Representative if there is interference. Install as directed by Departmental Representative.

1.10 REMEDIAL WORK

.1 Perform remedial work required to repair or replace parts or portions of Work identified as defective or unacceptable. Co-ordinate adjacent affected Work as required.

.2 Perform remedial work by specialists familiar with materials affected. Perform in a manner to neither damage nor put at risk any portion of Work.

1.11 LOCATION OF FIXTURES

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

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

1.12 FASTENINGS

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

.2 Prevent electrolytic action between dissimilar metals and materials.

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

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

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

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

1.13 FASTENINGS - EQUIPMENT

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

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

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

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

1.14 PROTECTION OF WORK IN PROGRESS

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

1.15 EXISTING UTILITIES

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

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

END OF SECTION

Part 1 General

1.1 ACTION AND INFORMATIONAL SUBMITTALS

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

.2 Submit written request in advance of cutting or alteration which affects:

- .1 Structural integrity of elements of project.
- .2 Integrity of weather-exposed or moisture-resistant elements.
- .3 Efficiency, maintenance, or safety of operational elements.
- .4 Visual qualities of sight-exposed elements.
- .5 Work of Owner or separate contractor.
- .6 Site work affecting operations.

.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 the Work may include the following. Forms will be supplied by Departmental Representative or Authority Having Jurisdiction.

- .1 Building permit.
- .2 Dig permit.
- .3 Hot work.
- .4 Ground disturbance.
- .5 Facility Alteration Permit.

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 Remove samples of installed Work for testing.

.6 Provide openings in non-structural elements of Work for penetrations of mechanical and electrical Work.

.7 Execute Work by methods to avoid damage to other Work, and which will provide proper surfaces to receive patching and finishing.

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

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

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

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

.12 At penetration of fire rated wall, ceiling, or floor construction, completely seal voids with firestopping material in accordance with Section 07 84 00 - Firestopping, full thickness of the construction element.

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

.14 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

Part 1 General

1.1 PROJECT CLEANLINESS

.1 Maintain Work in tidy condition, free from accumulation of waste products and debris, other than that caused by Owner or other Contractors.

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

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

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

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

.6 Provide and use marked separate bins for recycling. Refer to Section 01 74 21 - Construction/Demolition Waste Management and Disposal.

.7 Dispose of waste materials and debris off site.

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

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

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

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

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

1.2 FINAL CLEANING

.1 When Work is Substantially Performed remove surplus products, tools, construction machinery and equipment not required for performance of remaining Work.

.2 Remove waste products and debris other than that caused by others, and leave Work clean and suitable for occupancy. Remove debris and surplus materials from accessible concealed spaces.

.3 Prior to final review remove surplus products, tools, construction machinery and equipment.

.4 Remove waste products and debris other than that caused by Owner or other Contractors.

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

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

.7 Clean and polish glass, hardware, wall surfaces, and mechanical and electrical fixtures. Replace broken, scratched or disfigured glass.

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

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

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

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

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

.13 Remove dirt and other disfiguration from exterior surfaces.

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

.15 Sweep and wash clean paved areas.

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

.17 Clean roofs, downspouts, and drainage systems.

.18 Remove snow and ice from access to building.

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.

END OF SECTION

Part 1 General

1.1 WASTE MANAGEMENT GOALS

.1 Prior to start of Work conduct meeting with Departmental Representative to review and discuss Waste Management Plan and Goals.

.2 Departmental Representative's Waste Management Goal 75 percent of total Project Waste to be diverted from landfill sites. Provide Departmental Representative documentation certifying that waste management, recycling, reuse of recyclable and reusable materials have been extensively practiced.

.3 Accomplish maximum control of solid construction waste.

.4 Preserve environment and prevent pollution and environment damage.

1.2 DEFINITIONS

.1 Class III: non-hazardous waste - construction renovation and demolition waste.

.2 Cost/Revenue Analysis Workplan (CRAW): based on information from WRW, and intended as financial tracking tool for determining economic status of waste management practices.

.3 Demolition Waste Audit (DWA): relates to actual waste generated from project.

.4 Inert Fill: inert waste - exclusively asphalt and concrete.

.5 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.

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

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

.8 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.

.9 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.

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

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

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

.13 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.

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

.15 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).

1.3 DOCUMENTS

.1 Maintain at job site, one copy of following documents:

.1 Waste Reduction Workplan.

1.4 ACTION AND INFORMATIONAL SUBMITTALS

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

.2 Prepare and submit following prior to project start-up:

.1 Submit 2 copies of completed Waste Reduction Workplan (WRW): Schedule B.

.3 Submit before final payment summary of waste materials salvaged for reuse, recycling or disposal by project using deconstruction/disassembly material audit form.

.1 Failure to submit could result in hold back of final payment.

.2 Provide receipts, scale tickets, waybills, and show quantities and types of materials reused, recycled, co-mingled and separated off-site or disposed of.

.3 For each material reused, sold or recycled from project, include amount, quantities by number, type and size of items and the destination.

.4 For each material land filled or incinerated from project, include amount of material and identity of landfill, incinerator or transfer station.

1.5 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.

.9 Quantities for materials to be salvaged for reuse or recycled and materials sent to landfill.

.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. Based on information acquired from WA.

.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 by documenting total volume and cost of actual waste removed from project.

1.6 STORAGE, HANDLING AND PROTECTION

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

.2 Unless specified otherwise, materials for removal become Contractor's property.

.3 Protect, stockpile, store and catalogue salvaged items.

.4 Separate non-salvageable materials from salvaged items. Transport and deliver non-salvageable items to licensed disposal facility.

.5 Protect structural components not removed for demolition from movement or damage.

.6 Support affected structures. If safety of building is endangered, cease operations and immediately notify Departmental Representative.

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

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

.9 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.

1.7 DISPOSAL OF WASTES

.1 Do not bury rubbish or waste materials.

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

.3 Keep records of construction waste including:

.1 Number and size of bins.
.2 Waste type of each bin.
.3 Total tonnage generated.
.4 Tonnage reused or recycled.
.5 Reused or recycled waste destination.

.4 Remove materials from deconstruction as deconstruction/disassembly Work progresses.

.5 Prepare project summary to verify destination and quantities on a material-by-material basis as identified in pre-demolition material audit.

1.8 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 provide temporary security measures approved by Departmental Representative.

1.9 SCHEDULING

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

Part 2 Products

2.1 NOT USED

.1 Not Used.

Part 3 Execution

3.1 SELECTIVE DEMOLITION

.1 Reuse of Building Elements: this project has been designed to result in end of project rates for reuse of building elements as follows: do not demolish building elements beyond what is indicated on Drawings without approval by Departmental Representative.

3.2 APPLICATION

.1 Do Work in compliance with WRW.

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

3.3 CLEANING

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

.2 Clean-up work area as work progresses.

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

3.4 WASTE REDUCTION WORKPLAN (WRW)

.1 Schedule B:

(1) Material Category	(2) Person(s) Respon-sible	(3) Total Quantity of Waste (unit)	(4) Reused Amount (units) Projected	Actual	(5) Recycled Amount (unit) Projected	Actual	(6) Material(s) Destina-tion
Wood and Plastics Material Description							
Chutes							
Warped Pallet Forms							
Plastic Packaging							
Card- board Packaging							
Other							
Doors and Windows Material Description							
Painted Frames							
Glass							
Wood							
Metal							
Other							

3.5 CANADIAN GOVERNMENTAL DEPARTMENTS CHIEF RESPONSIBILITY FOR THE ENVIRONMENT

.1 Schedule E - Government Chief Responsibility for the Environment:

Province	Address	General Inquires	Fax
Saskatchewan	Saskatchewan Environment and Resource Management 3211 Albert Street Regina SK S4S 5W6	306-787-2700	306-787-3941

END OF SECTION

Part 1 General

1.1 ADMINISTRATIVE REQUIREMENTS

.1 Acceptance of Work Procedures:

.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 submit verification that corrections have been made.

.2 Request Departmental Representative’s inspection.

.2 Departmental Representative's Inspection:

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

.2 Contractor to correct Work as directed.

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

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

.2 Defects: corrected and deficiencies completed.

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

.4 Certificates required by Boiler Inspection Branch, Fire Commissioner, and Utility companies: submitted.

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

.6 Work: complete and ready for final inspection.

.4 Final Inspection:

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

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

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

.6 Final Payment:

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

.7 Payment of Holdback: after issuance of Certificate of Substantial Performance of Work, submit application for payment of holdback amount in accordance with contractual agreement.

1.2 FINAL CLEANING

.1 Clean in accordance with Section 01 74 11 - Cleaning.

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

.2 Waste Management: 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 ACTION AND INFORMATIONAL 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 2 DVD or 2 CD.

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

.4 CD or DVD: closed session format, write protected and free from errors and viruses.

.5 When multiple binders and discs 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 – PROJECT RECORD DOCUMENTS

.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.

.7 Training: refer to Section 01 79 00 - Demonstration and Training.

1.4 AS-BUILT DOCUMENTS AND SAMPLES

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

.1 Contract Drawings.

.2 Specifications.

.3 Addenda.

.4 Change Orders and other modifications to Contract.

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

.6 Field test records.

.7 Inspection certificates.

.8 Manufacturer's certificates.

.2 Store record documents and samples in field office apart from documents used for construction. 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 INFORMATION ON PROJECT RECORD DOCUMENTS

.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, 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 MAINTENANCE MATERIALS

.1 Spare Parts:

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

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

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

.4 Receive and catalogue items.

.1 Submit inventory listing to Departmental Representative.

.2 Include approved listings in Maintenance Manual.

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

.2 Extra Stock Materials:

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

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

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

.4 Receive and catalogue items.

.1 Submit inventory listing to Departmental Representative.

.2 Include approved listings in Maintenance Manual.

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

.3 Special Tools:

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

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

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

.4 Receive and catalogue items.

.1 Submit inventory listing to Departmental Representative.

.2 Include approved listings in Maintenance Manual.

1.9 PROGRESS PHOTOGRAPHS

.1 Provide two (2) DVDs or CDs.

.2 DVD or CD: closed session format, write protected and free from errors and viruses.

.3 Provide printed title on DVD/CD version to coincide with title on Operation and maintenance manuals.

.4 Digital photographs shall be in jpg format.

.5 Arrange contents chronologically by date photographs were taken.

.6 Digital photographs stored on CD-ROM or DVD, shall be submitted with the Operation and Maintenance Manuals.

1.10 DELIVERY, STORAGE, AND HANDLING

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

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

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

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

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

1.11 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 Conduct joint 10 month warranty inspection, measured from time of acceptance, by Departmental Representative.

.5 Include information contained in warranty management plan as follows:

.1 Roles and responsibilities of personnel associated with warranty process, including points of contact and telephone numbers within the organizations of Contractors, subcontractors, manufacturers or suppliers involved.

.2 Listing and status of delivery of Certificates of Warranty for extended warranty items, to include hangar doors.

.3 Provide list for each warranted equipment, item, feature of construction or system.

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

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

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

1.12 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 ADMINISTRATIVE REQUIREMENTS

.1 Demonstrate operation and maintenance of equipment and systems to Owner's personnel two weeks prior to date of substantial performance.

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

.3 Preparation:

.1 Verify conditions for demonstration and instructions comply with requirements.

.2 Verify designated personnel are present.

.3 Ensure equipment has been inspected and put into operation.

.4 Ensure testing, adjusting, and balancing have been performed and equipment and systems are fully operational.

.4 Demonstration and Instructions:

.1 Demonstrate start-up, operation, control, adjustment, trouble-shooting, servicing, and maintenance of each item of equipment at scheduled times, at the equipment location.

.2 Instruct personnel in phases of operation and maintenance using operation and maintenance manuals as basis of instruction.

.3 Review contents of manual in detail to explain aspects of operation and maintenance.

.4 Prepare and insert additional data in operations and maintenance manuals when needed during instructions.

.5 Time Allocated for Instructions: ensure sufficient amount of time required for instruction of each item of equipment or system.

1.2 ACTION AND INFORMATIONAL SUBMITTALS

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

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

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

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

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

1.3 QUALITY ASSURANCE

.1 When specified in individual Sections requiring manufacturer to provide authorized representative to demonstrate operation of equipment and systems:

.1 Instruct Owner's personnel.

.2 Provide written report that demonstration and instructions have been completed.

END OF SECTION

Part 1 General

1.1 REFERENCES

.1 CSA International

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

1.2 ACTION AND INFORMATIONAL SUBMITTALS

.1 Submit in accordance with Section 01 33 00 - Submittal Procedures and 01 74 21 - Construction/Demolition Waste Management Disposal.

.2 Submit demolition drawings:

.1 Prior to proceeding with demolition of load bearing walls, other walls, structural components, and where required by Authority Having Jurisdiction, submit for review and approval by Departmental Representative shoring and underpinning drawings stamped and signed by professional engineer registered or licensed in the Province of Saskatchewan, Canada, showing proposed method.

.3 Sustainable Design Submittals:

.1 Construction Waste Management:

.1 Submit project Waste Reduction Workplan highlighting recycling and salvage requirements.

.2 Erosion and Sedimentation Control: submit erosion and sedimentation control plan in accordance with authorities having jurisdiction.

1.3 SITE CONDITIONS

.1 Take precautions to protect environment. Existing “Geotechnical Investigation” Report may be made available to the successful contractor.

.2 If material resembling spray or trowel-applied asbestos or other designated substance is encountered, stop work, take preventative measures, and notify Departmental Representative immediately.

.1 Proceed only after receipt of written instructions has been received from Departmental Representative.

.3 Notify Departmental Representative before disrupting building access or services.

Part 2 Products

2.1 NOT USED

.1 Not used.

Part 3 Execution

3.1 EXAMINATION

.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.

3.2 PREPARATION

.1 Temporary Erosion and Sedimentation Control:

.1 Provide temporary erosion and sedimentation control measures to prevent soil erosion and discharge of soil-bearing water runoff or airborne dust to adjacent properties and walkways, according to: requirements of authorities having jurisdiction.

.2 Inspect, repair, and maintain erosion and sedimentation control measures during demolition.

.3 Remove erosion and sedimentation controls and restore and stabilize areas disturbed during removal after completion of demolition work..

.2 Protection of In-Place Conditions:

.1 Prevent movement, settlement, or damage to adjacent structures, utilities, landscaping features, 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.

.3 Demolition/Removal:

.1 Remove items as indicated.

.2 Removal of Pavements, Curbs and Gutters:

.1 Square up adjacent surfaces to remain in place by saw cutting or other method approved by Departmental Representative.

.2 Protect adjacent joints and load transfer devices.

.3 Protect underlying and adjacent granular materials.

.3 Remove parts of existing building to permit new construction.

.4 Trim edges of partially demolished building elements to tolerances as defined by Departmental Representative to suit future use.

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 Refer to demolition drawings and specifications for items to be salvaged for reuse.

.4 Waste Management: separate waste materials for reuse and 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.

END OF SECTION

Part 1 General

1.1 REFERENCES

.1 Definitions:

.1 Dangerous Goods: product, substance, or organism specifically listed or meets hazard criteria established in Transportation of Dangerous Goods Regulations.

.2 Hazardous Material: product, substance, or organism used for its original purpose; and is either dangerous goods or material that will cause adverse impact to environment or adversely affect health of persons, animals, or plant life when released into the environment.

.3 Hazardous Waste: hazardous material no longer used for its original purpose and that is intended for recycling, treatment or disposal.

.2 Reference Standards:

.1 Canadian Environmental Protection Act,1999 (CEPA 1999)

.1 Export and Import of Hazardous Waste and Hazardous Recyclable Material Regulations (SOR/2005-149).

.2 Department of Justice Canada (Jus)

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

.2 Transportation of Dangerous Goods Regulations (T-19.01-SOR/2001-286).

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

.1 Material Safety Data Sheets (MSDS).

.4 National Research Council Canada Institute for Research in Construction (NRC-IRC)

.1 National Fire Code of Canada-2005.

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 hazardous materials and include product characteristics, performance criteria, physical size, finish and limitations.

.2 Submit two copies of WHMIS MSDS in accordance with Section 01 35 29.06 - Health and Safety Requirements to Departmental Representative for each hazardous material required prior to bringing hazardous material on site.

.3 Submit hazardous materials management plan to Departmental Representative that identifies hazardous materials, usage, location, personal protective equipment requirements, and disposal arrangements.

.3 Sustainable Design Submittals:

.1 Construction Waste Management:

.1 Submit project Waste Reduction Workplan highlighting recycling and salvage requirements.

.2 Low-Emitting Materials: submit listing of adhesives and sealants, paints and coatings used in building, comply with VOC and chemical component limits or restrictions requirements.

1.3 DELIVERY, STORAGE AND HANDLING

.1 Deliver, store and handle materials in accordance with manufacturer's written instructions.

.2 Delivery and Acceptance Requirements: deliver materials to site in original factory packaging, labelled with manufacturer's name and address.

.3 Transport hazardous materials and wastes in accordance with Transportation of Dangerous Goods Act, Transportation of Dangerous Goods Regulations, and applicable provincial regulations.

.4 Storage and Handling Requirements:

.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 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 Transfer flammable and combustible liquids away from open flames or heat-producing devices.

.7 Solvents or cleaning agents must be non-flammable or have flash point above 38 degrees C.

.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 stored in separate containers.

.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.

.5 Develop Waste Reduction Workplan related to Work of this Section.

Part 2 Products

2.1 MATERIALS

.1 Description:

.1 Bring on site only quantities hazardous material 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.

.3 Sustainability Characteristics:

.1 Adhesives and Sealants in accordance with Section 07 92 00 - Joint Sealants.

.2 Primers, paints, and coatings in accordance with manufacturer's recommendations for surface conditions and Section 09 91 99 – Painting for Minor Works.

.1 Primer: maximum VOC limit 250 g/L.

.2 Paints: maximum VOC limit 50 g/L.

.3 Coatings: maximum VOC limit 50 g/L.

Part 3 Execution

3.1 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 reuse and recycling in accordance with Section 01 74 21 - Construction/Demolition Waste Management and 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 Form for all cast-in-place concrete indicated on drawings and subsequently remove all such forms.

1.3 RELATED WORK

.1	Concrete Reinforcing	Section 03 20 00
.2	Cast-in-Place Concrete	Section 03 30 00
.3	Concrete Finishing	Section 03 35 00
.4	Structural Steel for Buildings	Section 05 12 23

1.4 DESIGN AND CODE REQUIREMENTS

.1 Formwork and supporting falsework shall be designed and constructed in accordance with the requirements of CAN/CSA S269.3-M92 (R2013) and CAN/CSA-A23.1-14 as applicable to the work.

.2 Assume full responsibility for the design and for the adequacy and safety of all formwork and falsework.

.3 Retain a professional engineer to design falsework which consists of shoring more than one tier in height or which is a framed structure.

.4 The design and erection of formwork and related supporting works shall comply with construction safety legislation and regulations.

1.5 HANDLING AND STORAGE

.1 Deliver, handle and store formwork materials to prevent weathering, warping or damage detrimental to the strength of the materials or to the surface to be formed.

.2 Ensure that formwork surfaces which will be in contact with concrete are not contaminated by foreign matter. Handle and erect the fabricated formwork so as to prevent damage.

Part 2 Products

2.1 QUALITY AND STRENGTH

.1 The quality and strength of formwork material shall comply with the requirements set forth in this Specification and CAN/CSA A23.1-14.

2.2 FINISHES

.1 Form materials for concrete surfaces which will be exposed to view, or which require smooth and uniform surfaces for applied finishes or other purposes, shall consist of square edges, smooth panels of plywood, metal or plastic to approval of the Consultant. The panels shall be square and made in a true plane, clean, free of holes, surface markings and defects.

.2 Square edged, tongue and groove or shiplap lumber may be used to form concrete which will not be exposed to view or which does not require smooth uniform surface for other purposes.

2.3 MATERIALS

.1 Form plywood: exterior grade, Douglas Fir conforming to CSA Standard O121-08 (R2013). Plywood shall be resin coated one side (in contact with concrete). Use sound undamaged plywood with clean true edges. Make up or patching strips between panels shall be kept to a minimum.

.2 Lumber for forms, falsework, shoring and bracing: conform to CAN/CSA O141-05 (R2014) for Softwood Lumber, and the applicable authorized grading authority. All lumber shall be a grade to which allowable unit stresses may be assigned in accordance with the National Building Code. All lumber shall be grade marked by the authorized grading authority.

.3 Form Ties: Fabricated units having a minimum working strength when assembled of 21 MPa and shall be adjustable in lengths to permit tightening and alignment of forms. Ties shall be made with breakback ends or other means of removing the tie end to a depth of at least 25 mm from the concrete surface, after the forms are removed. Flat tie for Architectural exposed concrete to include plastic cones leaving no metal within 20 mm of surface.

.4 Form release agent: Proprietary material which will not stain the concrete or impair the natural bonding or colour characteristics of coating intended for use on the concrete.

.5 Waterstops: Purpose made polyvinyl chloride; 12 MPa minimum tensile strength, -46^0 C. to $+70^0$ C working temperature range, conforming to CGSB 41 GP 35M, Type 2.

.6 Pre-moulded joint fillers:

- .1 Bituminous impregnated fibreboard: ASTM D1751-04 (2013).
- .2 Vinyl Foam: to ASTM D1752-04a (2013) Type I, flexible grade.
- .3 Standard Cork: to ASTM D1752-04a (2013) Type II.

Part 3 Execution

3.1 CONDITION OF SURFACES

.1 Examine the excavations and foundations for adequate working room and support for the work of this section.

.2 Verify lines, levels and centre lines before proceeding with the work and ensure that dimensions agree with drawings.

.3 Report to the Consultant discrepancies in other work which affect the work of this section.

3.2 PREPARATION

.1 Coat the inside surfaces of forms with a form release agent, used in accordance with the manufacturer's instructions.

.2 Apply the agent prior to placing reinforcing steel, anchoring devices and embedded parts.

3.3 ASSEMBLY AND ERECTION

.1 Construct the formwork and shoring and bracing to meet the design and code requirements, accurately so that the resultant finished concrete shall conform to the shapes, lines and dimensions shown on the drawings, within the specified tolerances.

.2 Formwork shall be so arranged and assembled as to permit easy dismantling and stripping so that the concrete will not be damaged during its removal.

.3 Review locations of ties and form panels for exposed concrete work with the Consultant.

.4 Check and correct formwork as required, both horizontally and vertically, during the placing of the concrete.

.5 Construct formwork to maintain the following maximum tolerances:

.1 Deviation from horizontal and vertical lines:
6 mm in 3000 mm
20 mm in 12000 mm.

.2 Deviation of building dimensions indicated on Drawings and position of columns, walls and partitions:
6 mm.

.3 Deviation in cross sectional dimensions of columns or beams or in thickness of slabs and walls:
± 6 mm.

.6 Obtain Consultant's approval for use of earth forms.

3.4 JOINTS IN FORMS

.1 Make form joints tight in order to prevent leakage of mortar.

.2 Clean all edges and contact surfaces before erection.

.3 Where required, install pvc waterstop to manufacturer's instructions and without displacing reinforcement. Do not distort or pierce waterstop.

3.5 SHORING AND BRACING

.1 Provide bracing to ensure the stability of the formwork as a whole.

.2 Prop or strengthen all previously constructed parts liable to be overstressed by construction loads.

.3 Arrange forms to allow stripping without removal of the principal shores, where these are required to remain in place.

3.6 EMBEDDED PARTS AND OPENINGS

.1 Provide formed openings where required for pipes, conduit, sleeves and other work to be embedded in and passing through concrete members. Accurately locate and set in place items which are to be cast directly into the concrete. Co-ordinate the work of other sections and co-operate with the trade involved in the forming and setting of openings, slots, recesses, chases, sleeves, bolts, anchors and other inserts. No such forming or setting of openings, slots, recesses, chases, sleeves, or parts shall be done unless specifically shown on the drawings or approved prior to installation.

.2 Obtain Consultant's approval before framing openings in concrete beams or columns not specifically detailed on structural drawings.

.3 Provide temporary ports or openings where required to facilitate cleaning and inspection. Openings at the bottom of forms shall be located so that flushing water will drain from the forms.

.4 Close the temporary ports or openings with tight fitting panels, flush with the inside face of the forms, neatly fitted so that the joints will not be apparent in exposed concrete surfaces.

.5 Do not eliminate or displace reinforcement to accommodate hardware. If inserts cannot be located as specified, obtain approval in writing or all modifications from the Consultant before placing concrete.

3.7 FIELD QUALITY CONTROL

.1 Inspect and check the completed formwork, shoring and bracing to ensure that the work is in accordance with the formwork design, and that the supports, fastenings, wedges, ties and parts are secure. The Engineer responsible for the design of the formwork shall assist in this inspection.

.2 Inform the Consultant when the formwork is complete and has been cleaned. Obtain the approval of the engineer responsible for the design of the formwork and the general approval of the Consultant before placing concrete.

3.8 CLEANING

.1 Clean the forms as erection proceeds to remove foreign matter.

.2 Remove cuttings, shavings and debris from within the forms.

.3 Flush the completed forms with water or air jet to remove remaining foreign matter. Ensure that water and debris drain to the exterior through the clean-out ports.

3.9 WINTER CONSTRUCTION

.1 Remove ice and snow from within the forms.

.2 The use of de-icing salts will not be permitted.

.3 Unless formwork and concrete construction proceed within a heated enclosure, do not use water to clean out completed forms. Use compressed air or other means to remove foreign matter.

3.10 REMOVAL OF FORMWORK

.1 Notify the Consultant before removing formwork.

.2 Remove formwork progressively and in accordance with the reference code requirements, and so that no shock loads or imbalanced loads are imposed on the structure.

.3 Do not remove forms and shoring before concrete has attained sufficient strength to ensure safety of structure. If evidence to verify concrete strength is not available, the forms and shores shall not be removed before the following minimum intervals after concrete is placed.

.1	Grade beams	- 4 days.
.2	Slabs	- 21 days.

.4 Loosen forms carefully. Do not wedge pry bars, hammers or tools against concrete surfaces.

.5 Leave forms loosely in place, against vertical surfaces, for protection until complete removal is approved by Consultant.

.6 Store removed forms, for exposed architectural concrete, in a manner that surfaces to be in contact with fresh concrete will not be damaged. Marked or scored forms will be rejected.

.7 Re-shore structural members where required due to design requirements or construction conditions and as required to permit progressive construction.

.8 Remove forms not directly supporting weight of concrete as soon as stripping operations will not damage concrete.

.9 Re-use of formwork and falsework is subject to the requirements of CAN/CSA A23.1-14.

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 a part of this section.

1.2 WORK INCLUDED

.1 Furnish and install all bonded reinforcement and associated items required and/or indicated on the Drawings for all cast-in-place concrete and reinforced masonry work.

1.3 RELATED WORK

.1	Concrete Forming and Accessories	Section 03 10 00
.2	Cast-in-Place Concrete	Section 03 30 00
.3	Concrete Finishing	Section 03 35 00

1.4 INSPECTION AND TESTING

.1 Upon request, provide certified copy of mill test report of steel supplied, showing physical and chemical analysis.

1.5 REFERENCE STANDARDS

.1 Do reinforcing work in accordance with CAN/CSA A23.1-14 and welding of reinforcement with CSA W186-M1990 (R2012).

1.6 SUBMITTALS

.1 Prepare, check and submit reinforcing steel and mesh placing drawings and bar bending and cutting schedules for all steel reinforcement shown or specified in accordance with Submittal Procedures Section 01 33 00.

.2 All drawings and schedules shall be prepared and checked under the direct supervision of a qualified professional engineer who is experienced in this work.

.3 Clearly indicate bar sizes, spacing, location and quantities of reinforcement, mesh, chairs, spacers and hangers with identifying code marks to permit correct placement without reference to structural drawings; to ACI - 315 Manual of Standard Practice and Metric Supplement 1977 by Reinforcing Steel Institute of Ontario.

.4 Design and detail lap lengths and bar development lengths to CAN3 A23.3-14, unless specified on drawings.

.5 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 SUBSTITUTES

.1 Substitution of different size bars permitted only upon written approval of the Consultant.

1.8 DELIVERY AND STORAGE

.1 Reinforcing steel, welded wire fabric and accessories shall be delivered, handled and stored in a manner which prevents contamination from bond reducing or foreign matter and damage to its fabricated form.

Part 2 Products

2.1 MATERIALS

.1 *All reinforcing steel:* unless noted otherwise on the drawings or herein shall be deformed bars of new billet steel conforming to the current CAN/CSA G.30.18-09 (R2014) Grade 400, plain finish for all bars. Minimum splice for 10 M bars to be 450 mm. Minimum lap splice for all other bars to be 36 bar diameters or 675 mm, whichever is greater.

.2 *Weldable reinforcing bars:* high strength ductile, deformed bars to CSA G30.18-09 (R2014), Grade 400.

.3 *Column ties and beam stirrups:* shall conform to the current CAN/CSA G30.18-09 (R2014), Grade 300.

.4 *Welded wire fabric:* to CSA G30.5-M1983 (R1998). Provide in the flat sheets only.

.5 *Tie wires:* shall be 1.29 mm or heavier annealed wire or a patented system approved by the Consultant.

.6 *Reinforcing steel supports:* shall conform to ACI Standard 315 unless otherwise approved by the Consultant.

.7 *Mechanical splices:* subject to the approval of the Consultant.

2.2 FABRICATION

.1 Fabricate bends, splices and ties and supply bar supports and accessories in accordance with the requirements of CAN-A23.3-14. Spacing and arrangements of supports in accordance with ACI 315.

.2 All intermediate grade reinforcing bars shall be bent cold without hickeying. All high strength steel shall be preheated.

.3 Reinforcing bars shall not be straightened or rebent.

.4 Location of reinforcement splices not shown on the drawings subject to approval by the Consultant and shall, for beams and slabs be away from points of maximum stress in the steel.

.5 *Welding of reinforcing bars:* use only weldable bars, preheat and weld to CSA W186-1990 (R2012).

Part 3 Execution

3.1 EXAMINATION

.1 Examine the work upon which this section depends and report any discrepancies to the Consultant.

.2 Commencement of the work shall imply acceptance of conditions.

3.2 PLACING

.1 Reinforcement of the size and shapes shown on the drawings shall be accurately placed in accordance with the approved shop drawings, the structural drawings and the requirements of the current National Building Code.

.2 Clear distances between parallel bars shall be not less than 1.4 times the diameter of the bar, or 30 mm or 1.4 times the maximum size of the coarse aggregate. Bars placed in two or more layers shall be placed directly above and below each other.

.3 Reinforcing steel shall, where not otherwise shown on the structural drawings, be protected by the clear cover of concrete over the reinforcement as follows:

.1 Where concrete is formed against earth, not less than 75 mm.

.2 Where concrete placed against forms is to be exposed to the weather or be in contact with the ground, not less than 50 mm for bars larger than 15 M, and not less than 40 mm for bars 15 M and smaller.

.3 In slabs and walls not exposed to the ground or weather, not less than 20 mm.

The foregoing clear covers shall be maintained within 5 mm.

.5 Reinforcement shall be adequately supported by metal chairs, spacers or hangers and secured against displacement within the tolerance permitted and in accordance with the latest ACI Standard 315.

.6 For slabs on grade, footings or similar construction, concrete blocks may be used in place of metal chairs.

.7 Unless detailed otherwise, all exterior slabs, walks and pads abutting building foundations to be dowelled with 15 M at 400 on centre, extending minimum 750 into slab.

.8 Review with the Consultant, placement of reinforcement prior to concreting.

.9 Notify the Consultant twenty-four (24) hours prior to placing concrete.

3.3 CLEANING

.1 All materials shall be clean and free of all form oil or deleterious materials.

.2 All deleterious material shall be removed from the surface of the reinforcing steel in a manner acceptable to the Consultant.

3.4 WELDING

.1 Do welding to meet requirements of CSA W186-M1990 (R2012). Have welding performed by workmen qualified under CSA W47.1-09 (2014). Welding only by written authority of the Consultant.

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 Beams
.2 Concrete Slabs
.3 Concrete Toppings
.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

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-A23.1-14 - "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-A23.2-14 "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 A23.2-14.

1.7 SHOP DRAWINGS

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

Part 2 Products

2.1 CONCRETE MATERIALS

.1 *Cement:* Normal - Symbol 10 and Sulphate Resistant - Symbol 50 Portland Type, to CSA A3000-13 - "Portland Cements".

.2 *Fine and Coarse Aggregates:* conforming to CAN/CSA-A23.1-14 - "Concrete Material and Methods of Concrete Construction".

.3 *Water:* clean and free from injurious amounts of oil, alkali, organic matter, or other deleterious material.

2.2 ADMIXTURES

.1 *Air Entrainment:* to ASTM C260-10 - "Air-Entraining Admixtures for Concrete".

.2 *Chemical:* to ASTM C494-15a - "Chemical Admixtures for Concrete"; water reducing, strength increasing type WN - normal setting.

.3 *Pozzolanic Mineral:* to CSA A3000-13 "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 51-34, 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 *Void Form:* **to comply with either of the following:**

.1 Biodegradable Void Form: biodegradable, 150 mm deep, structurally sufficient to support weight of wet concrete and other superimposed loads without collapsing until concrete has gained sufficient strength to support these loads after which time the form must promptly degrade. Do not wrap void form. Do not place void form on poly ground sheet. The onus is entirely on the Contractor and Supplier to ensure that the void form is installed to perform as intended.

.2 Compressible Void Form: GeoVoid (below slabs) or Geospan (below grade beams) compressible void form by Plasti-Fab designed for 150 mm soil heave, installed to supplier’s specifications.

.5 *Joint Filler:* pre moulded bituminous impregnated cane fibre board Flexcell as manufactured by Sternson or approved equal.

.6 *Vertical Joint Sealant:* non-sag polyurethane sealant designed for use on vertical surfaces. Vulkem 116 as manufactured by Mameco Ltd. or approved equal. Install strictly in accordance with manufacturer's recommendations.

.7 *Horizontal Joint Sealant:* three component chemically curing, self-levelling, polyurethane joint sealant, THC-900 as manufactured by Tremco. Colour selection by Consultant. Install strictly in accordance with manufacturer's recommendations.

.8 *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.

.9 *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.

.10 *Concrete Patching Material:* pre-packaged, polymer modified, cementitious product containing graded natural aggregate, EMACO R300 - Rapid Setting Mortar as manufactured by Master Builders.

.11 *Bonding Agent:* Approved high polymer polyvinyl acetate emulsion applied in strict accordance with manufacturer's recommendations for proposed application. Daraweld-C, Acrylbond by Allied or approved equal. Mix bonding agent with Portland cement, sand and water to manufacturer's recommendation to achieve a uniform slurry and scrubbed into the surface. Ensure surface is free from all laitance, dirt, dust, debris, grease or other substances. Clean surface with acid etching and hosing down. Neutralize acid if necessary.

.12 *Cement Grout Capsules:* reinforcing steel detailed to be installed in pre-placed concrete to be anchored using Lafarge Fondu Cement Grout Capsules M3RR.

2.4 CONCRETE MIXES

.1 Mechanical mix concrete in accordance with the requirements of CAN/CSA A23.1-14.

.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. Piling	S-2	32 @ 56 d	40	3 – 6	80 ± 30
2. Grade Beams	S-2	32 @ 56 d	20	4 – 7	80 ± 30
3. Structural Slabs	N	25 @ 28 d	20	0	80 ± 30
4. Interior Topping	N	25 @ 28 d	10	0	80 ± 30
5. Exterior Grade Supported Slabs	C-2	32 @ 28 d	20	5 – 8	80 ± 30

Minimum cement content for Type 50 cement to be 280 kg/m3.
Maximum free water/cement ratio for Type 50 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.

All slabs finished with dry shake hardener to contain no artificially entrained air.

.3 Submit proposed mix design to Inspection and Testing Firm and to Consultant two (2) weeks prior to commencement of work. Provide certification that mix proportions selected will produce concrete of specified quality and that strength will comply with CAN/CSA A23.1-14.

.4 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.

.5 Use accelerating admixtures in cold weather only when approved by Consultant. If approved, the use of admixture will not relax cold weather placement requirements. Use calcium chloride only as approved by the Consultant.

.6 Use set-retarding admixtures during hot weather only when approved by the Consultant.

.7 Use of plasticizers only when approved by Consultant.

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 A23.1-14 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°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°C.

.4 The temperature of the concrete at all surfaces shall be maintained at not less than 15°C for three (3) days, or at not less than 10°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 A23.1-14.

.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^{o}C, 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^{o}.

.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 CONSTRUCTION JOINTS AND WATERSTOPS

.1 The location and detail of all construction joints not detailed on the structural drawings shall be approved by the Consultant.

.2 Where fresh concrete is to be placed against concrete which has set or has partially set, the surface of the set or partially set concrete shall be roughened, cleaned of all laitance, and thoroughly soaked with water prior to the placement of fresh concrete.

3.8 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 A23.2-14. The test results shall be indicative of the in-place concrete.

.3 Load testing of the structural elements in accordance with CAN3 A23.3-14.

.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.

3.9 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.

3.10 ANCHOR BOLTS AND WELDMENTS

.1 Set anchor bolts and weldments to the following tolerances:

.1 Alignment: ± 3mm of location, plumb and true.
.2 Projection: ± 6mm of elevations called for.

3.11 BASE PLATES GROUTING

.1 Mix and place as per Manufacturer's specifications. Pack grout tightly under plates and leave no voids. Neatly finish edges.

3.12 EQUIPMENT PADS

.1 Provide concrete pads for equipment where and as indicated on Drawings.

.2 Insert bolts and sleeves and pack solidly with non-shrink grout, in accordance with setting details and templates.

.3 Steel trowel top surfaces smooth. Tool edges.

3.13 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 A23.1-14, Clause 7.8.3.2.
.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 A23.1-14, Clause 7.8 and Section 03 35 00.

3.14 SIDEWALKS

.1 Unless specifically detailed otherwise on drawings or in specifications, sidewalks shall be constructed to the following details.

.2 Use forms for edges of concrete walls to provide straight lines and smooth curves.

.3 Locate asphalt impregnated fibreboard joint filler at 4.5 metre centres and where walks abut walls and other vertical surfaces. Joint filler to be full area of concrete section.

.4 Slabs to be 125 thick cast over 6 mil poly and 200 compacted granular fill. Reinforce with 10 M at 300 mm on centre each way at mid-depth of slab.

.5 Install tooled joints at 1.5 metres on centre.

.6 Round all edges, including edges of control joints and tooled joints, with 12 mm radius edging tool.

.7 Provide exposed surfaces of all sidewalks with medium broomed finish.

.8 Slope walks and slabs as detailed on 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 *Curing Compound:* chlorinated liquid rubber to CGSB 90-GP-1a, Type 1.

.2 *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.

.3 *Horizontal Joint Sealer*: three component, chemically curing, self-levelling polyurethane joint sealant. THC-900 as manufactured by Tremco. Color selection by Consultant. Install strictly in accordance with manufacturer's recommendations.

.4 *Bonding Agent:* Approved high polymere polyvinyl acetate emulsion applied in strict accordance with manufacturer's recommendations for proposed application. Daraweld - C or approved equal.

Part 3 Execution

3.1 FLOOR FINISHING

.1 Finish concrete floor surfaces in accordance with CAN/CSA A23.1-14.

.2 Uniformly spread, screed and float concrete. Do not use grate tampers or mesh rollers. Do not spread concrete by vibration. Bring surfaces to levels indicated on Drawings.

.3 Unless otherwise noted, all concrete floors which are noted in Architect's Room Finish Schedule as exposed concrete, or as receiving carpeting, resilient flooring or hardener are to be final finished to a hard, smooth dense trowelled surface free from blemishes. Final finish to achieve a "flat" floor in accordance with CAN3 A23.1-14, Table 21 Class A straight edge method to produce floor surface of pleasing characteristics.

3.2 TOPPINGS

.1 All new concrete slabs which are to receive topping or thick set tile finish are to be screeded and mechanically floated to achieve surface flatness with maximum variation of 8 mm in 3 M. Depress slabs to accommodate finish where required. Provide a scratch finish in accordance with CAN/CSA A23.1-14, Clause 7.8 to all concrete slabs receiving topping or thickset tile finish.

.2 All concrete slabs which are to receive a concrete topping shall be cleaned free of oil and loose material.

.3 Place dividers, edge strips, reinforcing, expansion joint assemblies and other cast-in items shown.

.4 Just prior to placing topping, apply cement bonding agent slurry coat in accordance with CAN/CSA A23.1-09, Clause 7.8 or approved bonding agent to base slab.

.5 Apply bonded concrete topping over prepared concrete base slab to CAN/CSA A23.1-14.

.6 All concrete toppings to receive insulation or roofing system shall be final finished by hand or mechanical floating to within a tolerance of 8 mm in 3 M.

.7 All concrete toppings to serve as floor surfaces are to be final finished in accordance with Item 3.1 Floor Finishing.

3.3 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 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 Erection.

1.3 RELATED WORK

.1	Cast-in-Place Concrete	Section 03 30 00
.2	Steel Decking	Section 05 31 00

1.4 QUALITY ASSURANCE

.1 Structural steel fabricator to be certified as minimum Division 2 Company under CSA W47.1-09 (R2014) - "Certification of Companies for Fusion Welding of Steel Structures" or CSA Standard W55.3-08 (R2013) "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-S16-14 - "Design of Structural Steel Buildings".

.2 CSA G40.21-13 - "Structural Quality Steel".

.3 ASTM Standard A325M - "High Strength Bolts for Structural Steel Joints including Suitable Nuts and Plane Hardened Washers".

.4 CSA Standard W59-13 - 'Welded Steel Construction".

.5 CSA Standard W47.1-09 (R2014) - "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 Submittal Procedures Section 01 33 00.

.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 Prepare shop drawings under direction of a qualified 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 G40.21-13, Grade 350W.

.2 *Hollow Structural Sections:* new material conforming to CSA G40.21-13, Grade 350W, Class C.

.3 *Steel Pipe Sections:* new material conforming to ASTM Standard A53, Grade 241.

.4 *Base and Cap Plates:* new material conforming to CSA G40.21-13, Grade 300W.

.5 *Beam End Plates, Ledger Angles and Miscellaneous Steel:* new material conforming to CSA G40.21-13, Grade 300W.

.6 *Anchor Bolts:* new material conforming to CSA G40.21-13, Grade 260W.

.7 *Bolts, Nuts and Washers:* high strength type recommended for structural steel joints, conforming to requirements of ASTM A325M-14.

.8 *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.

.9 *Shop and Field Studs:* shall be Nelson headed anchors to ASTM A108-13 or approved equivalent. Sizes as detailed on drawings.

2.2 FABRICATION

.1 Fabricate structural steel members in accordance with building design drawings and all requirements of CAN/CSA S16-14. Welding to conform to CSA W59-13 "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 Tolerances

.1 Tolerances of structural steel shall be maintained strictly in accordance with CAN/CSA S16-14.

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 All structural steel shall be prepared in accordance with SSPC Standard SP2 "Hand Tool Cleaning" and have one coat of specified shop applied primer.

Part 3 Execution

3.1 ERECTION

.1 Erect structural steel in accordance with building design drawings and all requirements on CAN/CSA S16-14.

.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 structural steel shall be maintained strictly in accordance with CAN/CSA S16-14.

.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 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.

1.3 RELATED WORK

.1 Structural Steel for Buildings Section 05 12 23

1.4 REFERENCE STANDARDS

.1 Canadian Sheet Steel Building Institute (CSSBI) - "Standard Steel Roof Deck" and "Steel Roof Deck".

.2 CAN/CSA S136-12 - "Cold Formed Steel Structural Members".

.3 ASTM A653 - "Standard Specification for Steel Sheet, Zinc Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot Dip Process".

.4 Welding to CSA W59-13 except where specified elsewhere.

1.5 SHOP DRAWINGS

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

.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 A653.

2.2 DECKING/RELATED ACCESSORIES

.1 *Roof Decking:* RD38 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 Any substitution of specified material to be approved in writing by the Consultant.

.3 *Closure Strips, Flashings, Cover Plates and Related Accessories:* minimum 1.6 mm (16 gauge) sheet steel.

.4 *Primer:* Zinc rich, ready mix to CGSB-1-GP-181M.

.5 *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 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 ASTM International

.1 ASTM C1396/C1396M-11, Standard Specification for Gypsum Board.

.2 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 O112.9-10, Evaluation of Adhesives for Structural Wood Products (Exterior Exposure).

.4 CSA O121-08, Douglas Fir Plywood.

.5 CAN/CSA O122-06(R2011), Structural Glued-Laminated Timber.

.6 CSA O141-05(R2009), Softwood Lumber.

.7 CSA O151-09, Canadian Softwood Plywood.

.8 CSA O325-07, Construction Sheathing.

.3 National Lumber Grades Authority (NLGA)

.1 Standard Grading Rules for Canadian Lumber 2010.

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 wood products and accessories and include product characteristics, performance criteria, physical size, finish and limitations.

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 Deliver, store and handle materials in accordance with Section 01 61 00 - Common Product Requirements and 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 off ground, in dry location and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.

.2 Store and protect wood from nicks, scratches, and blemishes.

.3 Replace defective or damaged materials with new.

.4 Develop Waste Reduction Workplan related to Work of this Section.

Part 2 Products

2.1 FRAMING STRUCTURAL AND PANEL MATERIALS

.1 Lumber: softwood, S4S, moisture content 19% (S-dry) or less in accordance with following standards:

.1 CSA O141.

.2 NLGA Standard Grading Rules for Canadian Lumber.

.2 Framing and board lumber: in accordance with NBC.

.3 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.

.4 Plywood, OSB and wood based composite panels: to CSA O325.

.5 Douglas fir plywood (DFP): to CSA O121, standard construction.

.6 Canadian softwood plywood (CSP): to CSA O151, standard construction.

.7 Glass fibre board sheathing: non-structural, rigid, faced, fiberglass, insulating exterior sheathing board.

.8 Gypsum sheathing: to ASTM C1396/C1396M.

2.2 ACCESSORIES

.1 Sealants: in accordance with Section 07 92 00 - Joint Sealants.

.1 Sealants: VOC limit 250 g/L maximum.

.2 General purpose adhesive: to CSA O112.9.

.1 VOC limit 140 g/L maximum.

.3 Nails, spikes and staples: to CSA B111.

.4 Bolts: 12.5 mm diameter unless indicated otherwise, complete with nuts and washers.

.5 Proprietary fasteners: toggle bolts, expansion shields and lag bolts, screws and lead or inorganic fibre plugs, recommended for purpose by manufacturer.

.6 Nailing discs: flat caps, minimum 25 mm diameter, minimum 0.4 mm thick, formed to prevent dishing. Bell or cup shapes not acceptable.

.7 Fastener Finishes:

.1 Galvanizing: to CAN/CSA-G164, use galvanized fasteners for exterior work interior highly humid areas, pressure-preservative, and fire-retardant lumber.

Part 3 Execution

3.1 EXAMINATION

.1 Verification of Conditions: verify conditions of substrates previously installed under other Sections or Contracts are acceptable for product installation in accordance with manufacturer's written instructions.

.1 Visually inspect substrate in presence of Departmental Representative

.2 Inform Departmental Representative of unacceptable conditions immediately upon discovery.

.3 Proceed with installation only after unacceptable conditions have been remedied and after receipt of written approval to proceed from Departmental Representative.

3.2 MATERIAL USAGE

.1 Electrical equipment mounting boards:

.1 Plywood, or DFP, A grade, square edge 19 mm thick.

.2 Mechanical equipment mounting boards:

.1 Plywood, or DFP, A grade, square edge 19 mm thick.

3.3 INSTALLATION

.1 Install members true to line, levels and elevations, square and plumb.

.2 Construct continuous members from pieces of longest practical length.

.3 Install spanning members with "crown-edge" up.

.4 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.

.5 Install furring and blocking as required to space-out and support wall and ceiling finishes, facings, fascia, soffit, siding, electrical equipment mounting boards, mechanical equipment mounting boards, and other work as required.

.6 Install rough bucks, nailers and linings to rough openings as required to provide backing for frames and other work.

.7 Use dust collectors and high quality respirator masks when cutting or sanding wood panels.

.8 Frame, anchor, fasten, tie and brace members to provide necessary strength and rigidity.

.9 Countersink bolts where necessary to provide clearance for other work.

.10 Use nailing disks for soft sheathing as recommended by sheathing manufacturer.

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 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 reuse and 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.

3.5 PROTECTION

.1 Protect installed products and components from damage during construction.

.2 Repair damage to adjacent materials caused by rough carpentry installation.

END OF SECTION

Part 1 General

1.1 REFERENCES

.1 ASTM International

.1 ASTM C1289-14, Standard Specification for Faced Rigid Cellular Polyisocyanurate Thermal Insulation Board.

.2 Canadian General Standards Board (CGSB)

.1 CGSB 71-GP-24M-AMEND-77(R1983), Adhesive, Flexible, for Bonding Cellular polystyrene Insulation.

.3 CSA Group

.1 CSA B149 PACKAGE-10, Consists of B149.1, Natural Gas and Propane Installation Code and B149.2, Propane Storage and Handling Code.

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

.1 Material Safety Data Sheets (MSDS).

.5 Underwriters Laboratories of Canada (ULC)

.1 CAN/ULC-S604-2012, Standard for Factory-Built Type A Chimneys.

.2 CAN/ULC-S701-11, Standard for Thermal Insulation, Polystyrene, Boards and Pipe Coverings.

.3 CAN/ULC-S702-2012, Standard for Mineral Fibre Insulation for Buildings.

.4 CAN/ULC-S704-11, Standard for Thermal Insulation Polyurethane and Polyisocyanurate, Boards, Faced.

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 board insulation and include product characteristics, performance criteria, physical size, finish and limitations.

.2 Submit 2 copies of WHMIS MSDS in accordance with Section 01 35 29.06 - Health and Safety Requirements. Indicate VOC's during application and curing.

.3 Certificates:

.1 Submit product certificates signed by manufacturer certifying materials comply with specified performance characteristics and criteria and physical requirements.

.4 Manufacturer's Instructions:

.1 Submit manufacturer's installation instructions.

1.3 DELIVERY, STORAGE AND HANDLING

.1 Deliver, store and handle materials in accordance with Section 01 61 00 - Common Product Requirements and with manufacturer's written instructions.

.2 Delivery and Acceptance Requirements: deliver materials to site in original factory packaging, labelled with manufacturer's name and address.

.3 Storage and Handling Requirements:

.1 Store materials off ground and in dry location and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.

.2 Store and protect specified materials from nicks, scratches, and blemishes.

.3 Replace defective or damaged materials with new.

.4 Develop Waste Reduction Workplan related to Work of this Section.

Part 2 Products

2.1 INSULATION

.1 Extruded polystyrene (XPS): to CAN/ULC-S701.

.1 Grade beams:

.1 Type: 4.

.2 Thickness: as indicated in drawings.

.3 Edges: shiplapped.

.2 Under slab

.1 Type: 4.

.2 Thickness: as indicated in drawings.

.3 Edges: shiplapped

.4 Fastening: insulation clips and discs.

.2 Rigid Cellular Polyisocyanurate.

.1 Exterior wall and roofing:

.2 Faced: to CAN/ULC-S704.

.1 Closed cell polyisocyanurate foam core bonded to inorganic glass fibre reinforced faces, 2 sides per ASTM C1289 Type II, Class 1, Grade 2.

.2 Shape: flat.

.3 RSI (R-value): as indicated in drawings.

.3 Mineral fibre board: to CAN/ULC-S702.

.1 Purpose made, dual density fibre board for use in cavity and rainscreen applications and hangar door cavity.

.2 R-Value: RSI 0.76/ 25.4mm (R4.3/inch)

.3 Hangar door cavity as noted in drawings:

.1 Type: 1.

.2 Density: Outer layer 100 kg/m³, Inner layer approximately 60 kg/m³.

.3 Thickness: as indicated.

.4 Zero formaldehyde content.

.5 Flame spread: 0.

.6 Smoke developed: 0.

.7 Approved products:

.1 Roxul – “Cavityrock DD”

.2 Approved substitution.

2.2 ADHESIVE

.1 Adhesive (for polystyrene): to CGSB 71-GP-24M.

.2 Compatible with roofing membrane and polystyrene insulation.

2.3 ACCESSORIES

.1 Insulation clips: impale type, perforated 50 x 50 mm cold rolled carbon steel 0.8 mm thick, adhesive back, spindle of 2.5 mm diameter annealed steel, length to suit insulation, 25 mm diameter washers of self-locking type.

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 board insulation application in accordance with manufacturer's written instructions.

.1 Visually inspect substrate in presence of Departmental Representative.

.2 Inform Departmental Representative of unacceptable conditions immediately upon discovery.

.3 Proceed with installation only after unacceptable conditions have been remedied and after receipt of written approval to proceed from Departmental Representative.

3.2 INSTALLATION

.1 Install insulation after building substrate materials are dry.

.2 Install insulation to maintain continuity of thermal protection to building elements and spaces.

.3 Fit insulation tight around electrical boxes, plumbing and heating pipes and ducts, around exterior doors and windows and other protrusions.

.4 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.

.5 Cut and trim insulation neatly to fit spaces. Butt joints tightly, offset vertical joints. Use only insulation boards free from chipped or broken edges. Use largest possible dimensions to reduce number of joints.

.6 Offset both vertical and horizontal joints in multiple layer applications.

.7 Do not enclose insulation until it has been inspected and approved by Departmental Representative.

3.3 RIGID INSULATION INSTALLATION

.1 Apply adhesive to insulation board in accordance with manufacturer's recommendations.

.2 In addition to adhesive, install mineral fibre insulation boards with insulation clips and disk, 2 per 600 x 1200 mm board minimum, fit boards tight, and cut off fastener spindle 3 mm beyond disk.

3.4 PERIMETER FOUNDATION INSULATION

.1 Exterior application: extend boards as indicated. Install on exterior face of perimeter foundation wall with adhesive.

.2 Under slab application: extend boards as indicated. Lay boards on level void form.

.3 Install mineral fibre insulation boards with insulation clips and disk, 2 per 600 x 1200 mm board minimum, fit boards tight.

3.5 HANGAR DOOR CAVITY INSTALLATION

.1 Install mineral fibre insulation boards in hangar door cavity as recommended by manufacturer.

3.6 EXTERIOR WALL INSTALLATION

.1 Install rigid cellular polyisocyanurate as recommended by manufacturer.

3.7 ROOF INSTALLATION

.1 Rigid Cellular Polyisocyanurate.

.1 Refer to Section 07 61 00 – Sheet Metal Roofing.

3.8 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 reuse and 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.

END OF SECTION

Part 1 General

1.1 REFERENCES

.1 ASTM International

.1 ASTM E1677; Specification for Air Retarder Material or System for Framed Building Walls

.2 Canadian General Standards Board (CGSB)

.1 CAN/CGSB-51.33-M89, Vapour Barrier Sheet, Excluding Polyethylene, for Use in Building Construction.

.2 CAN/CGSB-51.34-M86, Vapour Barrier, Polyethylene Sheet, for Use in Building Construction.

1.2 ACTION AND INFORMATIONAL SUBMITTALS

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

.2 Product Data:

.1 Submit manufacturer's printed product literature, specifications and datasheets.

1.3 QUALITY ASSURANCE

.1 Mock-Ups:

.1 Submit mock-ups in accordance with Section 01 45 00 - Quality Control.

.2 Convene pre-installation meeting prior to construction of mock-up, include major sub-trades..

.3 Install mock-up using approved air barrier assemblies including fasteners, flashing, tape and related accessories per manufacturer’s current printed instructions and recommendations.

.1 Mock-up size: approximately 4 meters by 4 meters including wall opening.

.4 Mock-up will be used to judge workmanship, substrate preparation, and material application.

.2 When accepted, mock-up will demonstrate minimum standard of quality required for this work. Approved mock-up may remain as part of finished work.

.3 Allow 48 hours for inspection of mock-up by Departmental Representative before proceeding with air/vapour barrier Work.

1.4 SEQUENCING

.1 Sequence work to permit installation of materials in conjunction with related materials and seals.

Part 2 Products

2.1 Air and Vapour Barrier membrane for Roofing is specified in Section 07 61 00 – Sheet Metal Roofing.

2.2 POLY VAPOUR BARRIER

.1 Polyethylene film: to CAN/CGSB-51.34, 0.15 mm thick.

2.3 AIR VAPOUR BARRIER

.1 Self-Adhesive SBS rubberized asphalt laminated to high-density polyethylene film, minimum nominal total thickness of 1.0 mm.

.1 Henry Company: Blueskin SA or SA LT.

.2 Soprema: Sopraseal Stick 1100T.

.3 IKO: Aquabarrier AVB.

.4 Carlisle: CCW 705 A/V Barrier.

.5 Approved substitution.

2.4 VAPOUR PERMEABLE AIR BARRIER

.1 Self-adhered water resistive, vapour permeable, air barrier membrane to ASTM E 2178. Consisting of tri-laminate of modified polyolefin with two layers of non-woven polyethylene, suitable for full wall assemblies. Permeable self-adhesive layer with release film. Refer to details on drawings for locations and assembly.

.1 Henry Company: BlueskinVP 100

.2 Approved substitution.

2.5 ACCESSORIES – POLYETHYLENE VAPOUR BARRIER

.1 Joint sealing tape: air resistant pressure sensitive adhesive tape, type recommended by vapour barrier manufacturer, 50 mm wide for lap joints and perimeter seals, 25 mm wide elsewhere.

.2 Sealant: compatible with vapour retarder materials, recommended by vapour retarder manufacturer. To Section 07 92 00 - Joint Sealing .

.3 Moulded box vapour barrier: factory-moulded polyethylene box for use with recessed electric switch and outlet device boxes.

2.6 ACCESSORIES-SHEET VAPOUR BARRIERS

.1 Sealant: compatible with air barrier materials, recommended by air barrier manufacturer. Refer to Section 07 92 00 - Joint Sealing.

.2 Foam Seal: Spray-applied medium density spray polyurethane foam insulation/air/vapour barrier.

.3 Sheet steel: Galvanized steel, Z275 zinc coating; 0.8 mm thick core steel.

.4 Attachments: Galvanized steel bars and anchors.

.5 Primer: Appropriate to application.

Part 3 Execution

3.1 EXAMINATION

.1 Verify substrate and surface conditions are in accordance with manufacturer recommended tolerances prior to installation of barrier and accessories.

3.2 INSTALLATION - POLY VAPOUR BARRIER

.1 Refer to Wall Types and details on drawings for location and assembly.

.2 Ensure services are installed and inspected prior to installation of retarder.

.3 Install sheet vapour retarder on warm side of exterior wall and ceiling assemblies prior to installation of gypsum board to form continuous retarder.

.4 Use sheets of largest practical size to minimize joints.

.5 Inspect for continuity. Repair punctures and tears with sealing tape before work is concealed.

.6 Exterior Surface Openings

.1 Cut sheet vapour retarder to form openings and ensure material is lapped and sealed to frame using sealant recommended by manufacturer.

.7 Perimeter Seals

.1 Seal perimeter of sheet vapour barrier as follows:

.1 Apply continuous bead of sealant, minimum 6mm wide and high, to substrate at perimeter of sheets.

.2 Lap sheet over sealant and press into sealant bead.

.3 Install staples through lapped sheets at sealant bead into wood substrate.

.4 Ensure that no gaps exist in sealant bead. Smooth out folds and ripples occurring in sheet over sealant.

.8 Lap Joint Seals

.1 Seal lap joints of sheet vapour barrier as follows:

.1 Attach first sheet to substrate.

.2 Apply continuous bead of sealant over solid backing at joint.

.3 Lap adjoining sheet minimum 150 mm and press into sealant bead.

.4 Install staples through lapped sheets at sealant bead into wood substrate.

.5 Ensure that no gaps exist in sealant bead. Smooth out folds and ripples occurring in sheet over sealant.

.9 Electrical Boxes

.1 Seal electrical switch and outlet device boxes that penetrate vapour barrier as follows:

.1 Install moulded box vapour barrier Wrap boxes with film sheet providing minimum 300 mm perimeter lap flange.

.2 Apply sealant to seal edges of flange to main vapour barrier and seal wiring penetrations through box cover.

3.3 INSTALLATION - AIR VAPOUR BARRIER AND VAPOUR PERMEABLE AIR BARRIER

.1 Refer to Wall Types and drawings for locations of air vapour barrier and vapour permeable air barrier.

.2 Preparation

.1 Remove loose or foreign matter which might impair adhesion of materials.

.2 Ensure all substrates are clean of oil or excess dust; all masonry joints struck flush, and open joints filled; and all concrete surfaces free of large voids, spalled areas or sharp protrusions.

.3 Ensure all substrates are free of surface moisture prior to application of self-adhesive membrane and primer.

.4 Ensure metal closures are free of sharp edges and burrs.

.5 Prime substrate surfaces to receive adhesive in accordance with manufacturer's instructions.

.3 Installation

.1 Install materials in accordance with manufacturer's instructions to create a continuous seal between all material junctions within the building envelope.

.2 Apply sealants and primers within recommended application temperature ranges. Consult manufacturer when products cannot be applied within these temperature ranges.

.3 Install membrane using a consecutive weatherboard method starting at base of wall and working upward, provide minimum 50mm side laps and 80mm end laps.

.4 Position membrane for alignment, remove protective film and firmly apply pressure to ensure adhesion. Eliminate all gaps and wrinkles.

.5 Roll entire membrane surface, including seams, to ensure full contact and adhesion.

.6 Seal membrane terminations, heads of mechanical fasteners, masonry tie fasteners, around penetrations, duct work, electrical and other apparatus extending through the water resistive air barrier membrane and around the perimeter edge of membrane terminations at window and door frames with manufacturer recommended sealant.

3.4 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.

3.1 PROTECTION OF FINISHED WORK

.1 Protect finished work in accordance with Section 01 61 00 - Common Product Requirements.

.2 Do not permit adjacent work to damage work of this section.

END OF SECTION

Part 1 General

1.1 REFERENCES

.1 American Society for Testing and Materials International, (ASTM).

.1 ASTM A653/A653M-10, 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 CGSB 19-GP-14M-76 (R1984), Sealing Compound, One Component, Butyl Polyisobutylene Polymer Base, Solvent Curing.

.2 CGSB 93.5-92, Installation of Metal Residential Siding, Soffits and Fascia.

1.2 DESIGN AND PERFORMANCE REQUIREMENTS

.1 Components: Design and size to withstand dead and live loads caused by positive and negative wind pressure acting normal to plane of panel as calculated in accordance with National Building Code of Canada.

.2 Maximum Allowable Deflection of Panel: 1/180.

.3 Movement: Accommodate movement within system without damage to system, components, or deterioration of seals; movement between system and perimeter components when subject to seasonal temperature cycling; dynamic loading and release of loads; deflection of structural support framing.

.4 Tolerances: Accommodate tolerances of building structural framing.

.5 Products: Provide continuity of thermal barrier at building enclosure elements.

1.3 ACTION AND INFORMATIONAL SUBMITTALS

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

.2 Product data:

.1 Submit manufacturer's instructions, printed product literature and data sheets for metal siding 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 01 33 00 - Submittal Procedures.

.3 Shop Drawings:

.1 Indicate dimensions, profiles, attachment methods, schedule of wall elevations, trim and closure pieces, soffits, fascia, metal furring, fasteners, and related work.

.4 Samples:

.1 Submit duplicate 300 x 300 mm samples of siding material, of colour and profile specified.

.5 Manufacturer's Instructions:

.1 Submit manufacturer's installation instructions.

1.4 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.

1.5 DELIVERY, STORAGE AND HANDLING

.1 Deliver, store and handle materials in accordance with Section 01 61 00 - Common Product Requirements and with manufacturer's written instructions.

.2 Delivery and Acceptance Requirements: deliver materials to site in original factory packaging, labelled with manufacturer's name and address.

.3 Storage and Handling Requirements:

.1 Store materials off ground and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.

.2 Store and protect metal siding from nicks, scratches, and blemishes.

.3 Replace defective or damaged materials with new.

.4 Packaging Waste Management: remove for reuse and return of pallets, crates, padding, and packaging materials as specified in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.

Part 2 Products

2.1 STEEL CLADDING AND COMPONENTS

.1 Zinc coated steel sheet: 0.8 mm thickness, ASTM A792M minimum Grade 230, minimum aluminium-zinc alloy coating designation AZ180 (galvalume); or commercial quality to ASTM A653/A653M with Z275 (galvanized) designated zinc coating.

.1 Factory preformed steel sheet.

.2 Minimum 0.76mm (22ga) base steel thickness.

.3 Finish coating: prefinished steel with factory applied zinc phosphate pre-treatment and ceramic pigmentation.

.4 Colour: QC #8260 ‘Slate Blue.’

.5 Profile: fluted smooth finish, 914mm x 32 mm deep with 79mm (tapered to 25mm) x 32mm tapered flutes.

.1 Behlen ‘Delta Span’

.2 VicWest ‘Shado'

.3 Approved alternate.

.2 Subgirts: gauge to suit intended application, profile as required and as indicated; to attach panel system to building structure.

.3 Expansion Joints: As recommended by manufacturer.

2.2 FASTENERS

.1 Nails: CSA B111. Screws: ASME B18.6.3. Purpose made stainless steel.

.2 Manufacturer's standard type suitable for use with installation of system; with soft neoprene washers; fastener cap same colour as exterior panel. Exposed fasteners same finish as panel system

2.3 CAULKING

.1 Sealants: as recommended by manufacturer and in accordance with Section 07 92 00 - Joint Sealants.

.2 Concealed sealants: one component, butyl polyisobutylene polymer base, solvent curing to CGSB 19 GP 14M. Sealant Type 4.

.3 Exposed sealants: one component, silicone base, solvent curing, colour to match panel. Sealant Type 3.

2.4 ACCESSORIES

.1 Interior liner panel (vapour barrier):

.1 Factory preformed steel sheet, minimum 0.61 mm (24ga) base steel thickness.

.2 ASTM A653/A653M, minimum Grade 230, Z275 minimum zinc coating designation,

.3 Prefinished from manufacturer's standard profile with interlocking side lap. Install sealant material in interlocking lap for vapour barrier applications.

.4 Liner panels shall function as a vapour barrier and must be suitably detailed, including field applied sealants to provide continuous vapour seal at all side laps, end laps, openings and penetrations. Cut ends of sheets square and clean.

.5 Prefinished from manufacturer's standard profiles.

.1 Colour – QC5712 Liner White.

.6 Sub-girts and clips: as recommend by supplier.

.2 Exposed trim: inside corners, outside corners, cap strip, drip cap, undersill trim, starter strip and window/door trim, brake or ben to shape, of same material, colour and gloss as cladding, with fastener holes pre-punched.

.3 Insulation: Rigid Cellular Polyisocyanurate: thickness as indicated in drawings. Refer to Section 07 21 13 – Board Insulation.

.4 Internal and External Corners: Same material, thickness, and finish as exterior sheets; profile to suit system; shop cut and factory mitered to required angles as recommended by manufacturer.

.5 Include closures, gaskets, caulking, flashing and fasteners to effect weathertight installation. Cut ends of sheets square and clean.

Part 3 Execution

3.1 EXAMINATION

.1 Verification of Conditions: verify that conditions of substrate previously installed under other Sections or Contracts are acceptable in accordance with manufacturer's written instructions.

.1 Visually inspect substrate in presence of Departmental Representative.

.2 Inform Departmental Representative of unacceptable conditions immediately upon discovery.

.3 Proceed with installation only after unacceptable conditions have been remedied and after receipt of written approval to proceed from Departmental Representative.

3.2 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.

3.3 INSTALLATION

.1 Install cladding in accordance with CGSB 93.5, and manufacturer's written instructions

.2 Install cladding in locations and orientations indicated in drawings.

.3 Install continuous starter strips, inside and outside corners, edgings, drip, cap, sill and window/door opening flashings as indicated.

.4 Install outside corners, fillers and closure strips with carefully formed and profiled work.

.5 Install soffit and fascia cladding as indicated.

.6 Maintain joints in exterior cladding, true to line, tight fitting, hairline joints.

.7 Attach components in manner not restricting thermal movement.

.8 Caulk junctions with adjoining work with sealant. Do work in accordance with Section 07 92 00 - Joint Sealants.

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 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 reuse and 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.

3.5 PROTECTION

.1 Protect installed products and components from damage during construction.

.2 Repair damage to adjacent materials caused by preformed metal siding installation.

END OF SECTION

Part 1 General

1.1 SECTION INCLUDES

.1 Materials and installation for sheet metal roofing for conventional installation over insulation installed on sloped metal deck.

.2 The work of this section includes the installation of the complete roof assembly including the air vapour barrier, insulation, protection board, roof membrane, and metal roof.

1.2 REFERENCES

.1 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 A792/A792M-10, Standard Specification for Steel Sheet, 55% Aluminum-Zinc Alloy-Coated by the Hot Dip Process.

.3 ASTM D523-89(2008), Standard Test Method for Specular Gloss.

.4 ASTMC1177 Standard Specification for Glass Mat Gypsum Substrate for Use as Sheathing.

.5 ASTM D1970, Standard Specification for Self-Adhering Polymer Modified Bituminous Sheet Materials Used as Steep Roofing Underlayment for Ice Dam Protection.

.2 Canadian Sheet Steel Building Institute Standards

.1 CSSBI S8-2001, Quality & Performance Specification for Prefinished Sheet Steel Used for Building Products

.2 CSSBI 10M and 20M.

1.3 ROOF DESCRIPTION

.1 Roof Type 1 (R1) – as noted on drawings.

1.4 DESIGN CRITERIA

.1 Roofing Panels manufactured, fabricated and installed to withstand structural and thermal movement, wind load, snow build-up and weather exposure without defects, damage, and infiltration of water.

.2 Design roof system in accordance with:

.1 CAN/CSA Standard S136 latest edition for the Design of Cold Formed Steel Structural Members.

.2 Canadian Sheet Steel Building Institute Standards 10M and 20M.

.3 National Building Code of Canada (latest edition).

.3 Design fastener systems to withstand wind uplift on the roof and sliding forces induced by environmental loads.

1.5 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 sheet metal roofing and include product characteristics, performance criteria, physical size, finish and limitations.

.2 Indicate arrangement of prefinished roof sheets including joints, types and locations of supports, fasteners, sealants and all metal components related to the roof installation.

.3 Submit 2 copies of WHMIS MSDS in accordance with Section 01 35 29.06 - Health and Safety Requirements.

.3 Shop Drawings:

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

.4 Samples:

.1 Submit duplicate 300 x 300 mm samples of each sheet metal material.

1.6 QUALITY ASSURANCE

.1 Manufacturer and installer of the metal roof system must have a minimum of 5 years' experience in fabrication and installation of architectural metal roofing projects similar in scope.

1.7 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 in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.

.2 Store and protect sheet metal roofing from nicks, scratches, and blemishes.

.3 Replace defective or damaged materials with new.

1.8 ENVIRONMENTAL REQUIREMENTS

.1 Do not install roofing materials or adhesives when temperature is below manufacturer's recommendations.

.2 Install roofing on dry deck, free of snow and ice, use only dry materials and apply only during weather that will not introduce moisture into roofing system.

1.9 QUALIFICATIONS

.1 Applicator: Company specializing in performing work of this section with minimum 5 years documented experience in installation of roof systems. Roofing contractor will supply and install materials to acceptance of manufacturer in order to qualify for manufacturer's warranty.

1.10 WARRANTY

.1 Contractor shall warrant that the sheet metal roofing and companion flashing will stay in place and remain leak proof in accordance with the General Conditions, but for two years.

Part 2 Products

2.1 COMPATIBILITY

.1 Compatibility between components of system and adjacent materials is essential. Provide a written declaration to Consultant stating that materials and components, as assembled in system, meet this requirement and are eligible for system warranty.

2.2 SHEET METAL MATERIALS

.1 Aluminum-zinc alloy coated steel sheet: to ASTM A792/A792M, Grade 230, with AZ150 coating (Galvalume), regular spangle surface, unoiled, thermally cured clear organic resin passivation coating for unpainted finish.

2.3 PROFILE

.1 Standing Seam:

.1 T-style standing seam, 38mm high, 400mm wide panels.

.2 Seam Cap:

.1 Provide seam caps for full length of the roof panel with sealant of non-skinning, non-drying sealant on the unexposed side. Caps to be mechanically seamed onto panel side-laps. Fabricated from Z275 galvanized (zinc coated) sheet steel conforming to ASTM A653M structural quality Grade 230 having a nominal core thickness 0.61mm (0.024").

.2 Finish and colour to match roof sheet.

.3 Profile equivalent to Vicwest, "Tradition 150"

2.4 VAPOUR RETARDER

.1 SBS Modified Bitumen to ASTM D5147.

.2 SBS self-adhered modified bitumen. Top surface is a high-density polyethylene grid laminated between two layers of polyethylene film. Silicone release plastic film covers the self-adhesive back side.

.3 Vapour retarder must be suitable for installation directly on metal deck.

.1 Thickness: min 0.8mm

.2 Air permeability: ASTM E2853 (75 Pa).

.3 Water vapour permeance: ASTM E96 (procedure B).

.4 Top face: high density polyethylene grid laminated between two layers of polyethylene film.

.5 Thickness: 0.8 mm.

.6 Self-adhesive with silicone plastic release liner.

2.5 BOARD INSULATION

.1 Refer to Section 07 21 13 – Board Insulation.

2.6 GYPSUM BOARD

.1 Glass Mat, Gypsum Board: to ASTM C1177 12.7 mm thick

2.7 UNDERLAYMENT MEMBRANE

.1 High temperature, slip resistant, self-adhesive waterproofing membrane composed of SBS modified bitumen and a nonslip tri-laminated woven polyethylene top surface. Specially developed bituminous formulation designed to withstand service temperatures up to 115C (239F) degrees.

2.8 ACCESSORIES

.1 Roof Panel Support System: Hidden fastener, purpose-made, thermally responsive full height clip system, designed to accommodate full insulation depth and allow for full thermal expansion and contraction of the exterior roof sheet. Clips to be fabricated from a minimum of 0.61mm steel, with minimum Z275 galvanized coating.

.2 Roof fasteners as specified by manufacturer to resist wind uplift and sliding snow forces.

.3 Flashing: in accordance with Section 07620 and manufacturer recommendations. Formed from same materials (thickness and finish) as the Metal Roofing Sheet. Flashings to be custom fabricated to suit architectural details, as required.

.4 Closures: Foam and metal closures to suit profiles selected, to manufacturer's recommendations.

.5 Sealants: In accordance with manufacturer's recommendation and Section 07 92 00.

.6 Isolation coating: alkali resistant bituminous paint.

.7 Touch-up paint: as recommended by sheet metal roofing manufacturer.

2.9 FABRICATION

.1 Form sections square, true and accurate to size, free from distortion and other defects detrimental to appearance or performance.

.2 Fabricate Metal Roofing System components to comply with dimensions, profiles, gauges and details as shown on the approved shop drawings, including all companion flashings.

.3 Fabricate all components of the system in the factory, ready for field installation.

.4 Provide roof sheet and all accessories in longest practicable length to minimize field lapping.

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 sheet metal roofing installation in accordance with manufacturer's written instructions.

.1 Inform Departmental Representative of unacceptable conditions immediately upon discovery.

.2 Proceed with installation only after unacceptable conditions have been remedied.

3.2 VAPOUR RETARDER

.1 Install the self-adhesive vapour retarder membrane in conformance with the manufacturer’s recommended methods.

.2 Apply primer to roof substrates as recommended by membrane manufacturer. All surfaces to be primed must be free of rust, dust or any residue that may hinder adherence. Cover primed surfaces with roofing membrane as soon as possible.

.3 Hold the membrane in place, remove the siliconized release film from the underside by pulling diagonally. Apply pressure with a roller to ensure positive adhesion to the surface. Install subsequent rolls in the same manner and overlap the side laps a minimum of 75 mm. Roll all laps for positive adhesion.

.4 Ensure the membrane end lap is overlapped a minimum of 150mm (6”) and roll the lap for positive adhesion.

.5 Install vapour retarder membrane to vertical surfaces at perimeters, curbs, and other roof projections to permit a sealed connection with the base sheet layer. Vapour retarder extensions on vertical surfaces to be installed not more than 25mm above the level of the field base sheet membrane.

.6 Metal Decking

.1 Unroll vapour retarder membrane directly onto metal decking, parallel with the direction of the flutes. Ensure the metal deck surface is clean, dry, and free of any loose material. Align the longitudinal edge of the membrane with the edge of the top flute.

.2 Affix a metal plate 150mm x 1066mm to support the membrane end lap between the flutes of the deck. Ensure the membrane end lap is overlapped a minimum of 150mm and roll the lap for positive adhesion.

.3 Roll two membrane end laps to ensure a complete end lap seal.

3.3 BOARD INSULATION

.1 Refer to Section 07 21 13 – Board Insulation.

3.4 GYPSUM BOARD

.1 Mechanically fastened as recommended by roof system manufacturer to meet specified design requirements.

3.5 UNDERLAYMENT MEMBRANE

.1 Apply primer to the substrate as required at a rate of 0.15 to 0.25L/sqM. All surfaces to be primed must be free of rust, dust or any residue that may hinder adherence. Cover primed surfaces with roofing membrane as soon as possible.

.2 Starting at slope bottom, unroll each roll dry. Position roll and let stand for a few minutes before removing the release paper. Once the roll is in position, remove a small length of protective film at one end of the roll and adhere firmly to the substrate. While holding the membrane tight, remove the release paper from the underside of the membrane by pulling diagonally. Apply adequate pressure on the membrane surface with a steel membrane roller to ensure positive adhesion. Avoid wrinkles or trapped air bubbles in the finished installation.

.3 Install subsequent rolls in the same manner. Overlap side laps a minimum of 50 mm and end laps a minimum of 150mm. Stagger end laps by at least 300 mm.

.4 Inspect the finished application. Ensure laps are well sealed and do not contain any wrinkles or fish mouths. Apply manufacturer recommended caulking around any protrusions through the membrane prior to installation of cover panels.

3.6 INSTALLATION – ROOF PANEL SYSTEM

.1 Provide metal roofing sheets in longest standard length available from manufacturer.

.2 Install exterior prefinished roof panels on panel support clips, using manufacturer's proper construction procedure. Ensure metal roofing sheet side-lap is positively retained by clips, and proper sheet coverage is maintained.

.3 Install the seam-cap at all side laps as shown on the approved shop drawings. Add sealant as required. Mitre snap-cap as required to resist water entry.

.4 Where indicated on approved shop drawings, secure the end-lap of metal roofing sheets in accordance with the manufacturer’s specifications and details to provide a weather-tight seal. Exposed fasteners to match colour of the roof sheet.

.5 Provide notched and formed closures, sealed against weather penetration, at changes in pitch, at ridges and eaves and vertical walls where required.

.6 Install all companion flashing as shown on the shop drawings. Use concealed fasteners when possible. Exposed fasteners to match colour of roof sheet.

3.7 GUTTER

.1 At roof edges extend prefinished metal under metal roofing 150 mm minimum and as indicated on drawings.

3.8 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.

3.9 PROTECTION

.1 Protect installed products and components from damage during construction.

.2 Repair damage to adjacent materials caused by sheet metal roofing installation.

END OF SECTION

Part 1 General

1.1 REFERENCES

.1 American Society for Testing and Materials International (ASTM)

.1 ASTM A653/A653M-11, Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.

.2 ASTM D523-08, Standard Test Method for Specular Gloss.

.3 ASTM D822-01(2006), Standard Practice for Filtered Open-Flame Carbon-Arc Exposures of Paint and Related Coatings.

.2 Canadian Roofing Contractors Association (CRCA)

.1 Roofing Specifications Manual 2011.

.3 Canadian Standards Association (CSA International)

.1 CSA A123.3-05(R2010), Asphalt Saturated Organic Roofing Felt.

.2 CSA B111-1974(R2003), Wire Nails, Spikes and Staples.

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

.1 Material Safety Data Sheets (MSDS).

1.2 ACTION AND INFORMATIONAL SUBMITTALS

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

.2 Product Data:

.1 Submit manufacturer's printed product literature for sheet metal flashing systems materials, specifications and datasheet and include product characteristics, performance criteria, physical size, finish and limitations.

.2 Submit two copies WHMIS MSDS - Material Safety Data.

.3 Shop Drawings:

.1 Shop drawings: submit drawings stamped and signed by professional engineer registered or licensed in Provinces of Saskatchewan, Canada.

.2 Indicate details of construction, profiles, materials, material thickness, finishes, fastening, and other related details.

.4 Samples:

.1 Submit 150 x 150 mm samples of each type of sheet metal material, finishes and colours.

.5 Quality assurance submittals: submit following in accordance with Section 01 45 00 - Quality Control.

.1 Manufacturer's Instructions: submit manufacturer's installation instructions and special handling criteria, installation sequence, and cleaning procedures.

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.

Part 2 Products

2.1 SHEET METAL MATERIALS

.1 Zinc coated steel sheet: 0.80 mm thickness, commercial quality to ASTM A653/A653M, with Z275 designation zinc coating.

2.2 PREFINISHED STEEL SHEET

.1 Prefinished steel with factory applied polyvinylidene fluoride.

.1 Class F1S.

.2 Profile: match existing profiles.

.3 Colour: to match existing fascia, eavestrough and downspouts.

.4 Specular gloss: 30 units +/- in accordance with ASTM D523.

.5 Coating thickness: not less than 22 micrometres.

.6 Resistance to accelerated weathering for chalk rating of 8, colour fade 5 units or less and erosion rate less than 20% to ASTM D822 as follows:

.1 Outdoor exposure period 2500 hours.

.2 Humidity resistance exposure period 5000 hours.

2.3 ACCESSORIES

.1 Isolation coating: alkali resistant bituminous paint.

.2 Underlay for metal flashing: No. 15 perforated asphalt felt to CSA A123.3.

.3 Sealants: in accordance with Section 07 92 00 - Joint Sealants.

.1 Maximum VOC limit 50 g/L.

.4 Cleats: of same material, and temper as sheet metal, minimum 50 mm wide. Thickness same as sheet metal being secured.

.5 Fasteners: of same material as sheet metal, to CSA B111, ring thread flat head roofing nails of length and thickness suitable for metal flashing application.

.6 Washers: of same material as sheet metal, 1 mm thick with rubber packings.

.7 Touch-up paint: as recommended by prefinished material manufacturer.

.1 Maximum VOC limit 50 g/L.

2.4 FABRICATION

.1 Fabricate metal flashings and other sheet metal work in accordance with applicable CRCA 'FL' series details and as indicated.

.2 Form pieces in 2400 mm maximum lengths.

.1 Make allowance for expansion at joints.

.3 Hem exposed edges on underside 12 mm.

.1 Mitre and seal corners with sealant.

.4 Form sections square, true and accurate to size, free from distortion and other defects detrimental to appearance or performance.

.5 Apply isolation coating to metal surfaces to be embedded in concrete or mortar.

2.5 METAL FLASHINGS AND CAP FLASHINGS

.1 Form flashings, copings and fascias to profiles indicated of 0.7 mm prefinished steel.

.2 Sizes and profiles to match existing.

2.6 EAVES TROUGHS AND DOWNPIPES

.1 Form eaves troughs and downpipes from 0.6 mm thick prefinished steel sheet metal.

.2 Sizes and profiles to match existing.

Part 3 Execution

3.1 MANUFACTURER'S INSTRUCTIONS

.1 Compliance: comply with manufacturer's written recommendations, including product technical bulletins, handling, storage and installation instructions, and datasheets.

3.2 INSTALLATION

.1 Install sheet metal work in accordance with CRCA FL series details, FL and as detailed.

.2 Use concealed fastenings except where approved before installation.

.3 Provide underlay under sheet metal.

.1 Secure in place and lap joints 100 mm.

.4 Counterflash bituminous flashings at intersections of roof with vertical surfaces and curbs.

.1 Flash joints using standing seams forming tight fit over hook strips.

.5 Lock end joints and caulk with sealant.

.6 Install pans, where shown around items projecting through roof membrane.

3.3 EAVES TROUGHS AND DOWNPIPES

.1 Install eaves troughs and secure to building at 750 mm on centre with eaves trough fasteners through spacer ferrules.

.1 Slope eaves troughs to downpipes.

.2 Seal joints watertight.

.2 Install downpipes and provide goosenecks from eaves trough back to wall.

.1 Secure downpipes to wall with straps at 1800 mm on centre; minimum two straps per downpipe.

.3 Install concrete splash pads as indicated. Direct splash pads towards existing catch basins.

3.4 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.

3.5 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 Leave work areas clean, free from grease, finger marks and stains.

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 CAN/ULC-S101-07, Standard Methods of Fire Endurance Tests of Building Construction and Materials

.2 CAN/ULC-S102, Standard Method of Test for Surface Burning Characteristics of Building Materials and Assemblies

.3 CAN/ULC-S115-11, Standard Method of 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 noncombustible construction or have "0" annular space in buildings of combustible construction.

.1 Words "tightly fitted" should ensure that integrity of fire separation is such that it prevents passage of smoke and hot gases to unexposed side of fire separation.

1.3 ACTION AND INFORMATIONAL 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.

.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 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 approved by manufacturer with 5 years documented experience.

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 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.

.2 Fire stop system rating: as indicated in drawings.

.2 Re-penetrable fire stop system for power and communication cables and cable trays

.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 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.

3.5 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.

3.6 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.

3.7 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 ASTM International

.1 ASTM C919-08, Standard Practice for Use of Sealants in Acoustical Applications.

.2 Canadian General Standards Board (CGSB)

.1 CAN/CGSB-19.13-M87, Sealing Compound, One-component, Elastomeric, Chemical Curing.

.2 CGSB 19-GP-14M-1984, Sealing Compound, One Component, Butyl-Polyisobutylene Polymer Base, Solvent Curing (Reaffirmation of April 1976).

.3 CAN/CGSB-19.24-M90, Multi-component, Chemical Curing Sealing Compound.

.3 General Services Administration (GSA) - Federal Specifications (FS)

.1 FS-SS-S-200-E(2)1993, Sealants, Joint, Two-Component, Jet-Blast-Resistant, Cold Applied, for Portland Cement Concrete Pavement.

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

.1 Material Safety Data Sheets (MSDS).

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 joint sealants and include product characteristics, performance criteria, physical size, finish and limitations.

.2 Manufacturer's product to describe:

.1 Caulking compound.

.2 Primers.

.3 Sealing compound, each type, including compatibility when different sealants are in contact with each other.

.3 Submit 2 copies of WHMIS MSDS in accordance with Section 01 35 29.06 - Health and Safety Requirements.

.3 Manufacturer's Instructions:

.1 Submit instructions to include installation instructions for each product used.

.4 Sustainable Design Submittals:

.1 Construction Waste Management:

.1 Submit project Waste Reduction Workplan highlighting recycling and salvage requirements.

1.3 CLOSEOUT SUBMITTALS

.1 Submit in accordance with Section 01 78 00 - Closeout Submittals.

.2 Operation and Maintenance Data: submit operation and maintenance data for 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 and 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 off ground and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.

.2 Store and protect joint sealants from nicks, scratches, and blemishes.

.3 Replace defective or damaged materials with new.

.4 Develop Waste Reduction Workplan related to Work of this.

1.5 SITE CONDITIONS

.1 Ambient Conditions:

.1 Proceed with installation of joint sealants only when:

.1 Ambient and substrate temperature conditions are within limits permitted by joint sealant manufacturer or are above 4.4 degrees C.

.2 Joint substrates are dry.

.3 Conform to manufacturer's recommended temperatures, relative humidity, and substrate moisture content for application and curing of sealants including special conditions governing use.

.2 Joint-Width Conditions:

.1 Proceed with installation of joint sealants only where joint widths are more than those allowed by joint sealant manufacturer for applications indicated.

.3 Joint-Substrate Conditions:

.1 Proceed with installation of joint sealants only after contaminants capable of interfering with adhesion are removed from joint substrates.

1.6 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 Health Canada.

.2 Ventilate area of work as directed by Departmental Representative by use of approved portable supply and exhaust fans.

Part 2 Products

2.1 SEALANT MATERIALS

.1 Do not use caulking that emits strong odours, contains toxic chemicals or is not certified as mould resistant in air handling units.

.2 When low toxicity caulks are not possible, confine usage to areas which off gas to exterior, are contained behind air barriers, or are applied several months before occupancy to maximize off gas time.

.3 Where sealants are qualified with primers use only these primers.

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 standard range of manufacturer's colours.

.2 Type 2 - Urethanes one part:

.1 Non-sag: to CAN/CGSB-19.13, Type 2, colour as selected by Departmental Representative from standard range of manufacturer's colours.

.3 Type 3 - Silicones one part:

.1 To CAN/CGSB-19.13, colour as selected by Departmental Representative from standard range of manufacturer's colours.

.4 Type 4 - Butyl: to CAN/CGSB 19-GP-14M

.1 Colour matched to adjacent finishing material.

.5 Type 5 - Aviation fuel resistant:

.1 To FS-SS-S-200E, Type 2.

.6 Type 6 - Elastomeric Single or Multicomponent

.1 To ASTM C90, Type S or Type M, Grade NS, Class 12.5.

.7 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.

2.3 SEALANT SELECTION

.1 Perimeters of exterior openings where frames meet exterior facade of building (i.e. metal cladding): sealant type: 2.

.2 Coping joints and coping-to facade joints: sealant type: 1 or 2.

.3 Seal interior perimeters of exterior openings as detailed on drawings: sealant type: 1 or 2.

.4 Interior control and expansion joints in floor surfaces: sealant type: Refer to Structural Specifications or type 4.

.5 Perimeters of interior frames, as detailed and itemized: sealant type: 3

.6 Hangar door and door components: sealant type: 6

.7 In additional locations as noted in the drawings: confirm with Departmental Representative.

2.4 JOINT CLEANER

.1 Non-corrosive and non-staining type, compatible with joint forming materials and sealant in accordance with sealant manufacturer's written recommendations.

.2 Primer: in accordance with sealant manufacturer's written recommendations.

Part 3 Execution

3.1 EXAMINATION

.1 Verification of Conditions: verify that conditions of substrate previously installed under other Sections or Contracts are acceptable for joint sealants installation in accordance with manufacturer's written instructions.

.1 Visually inspect substrate in presence of Departmental Representative.

.2 Inform Departmental Representative of unacceptable conditions immediately upon discovery.

.3 Proceed with installation only after unacceptable conditions have been remedied and after receipt of written approval to proceed from Departmental Representative.

3.2 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.

3.7 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 adjacent surfaces immediately.

.3 Remove excess and droppings, using recommended cleaners as work progresses.

.4 Remove masking tape after initial set of sealant.

.2 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment in accordance with Section 01 74 11 - Cleaning.

.3 Waste Management: separate waste materials for reuse and 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.

3.8 PROTECTION

.1 Protect installed products and components from damage during construction.

.2 Repair damage to adjacent materials caused by joint sealants installation.

END OF SECTION

Part 1 General

1.1 REFERENCES

.1 American Society for Testing and Materials International (ASTM)

.1 ASTM A653/A653M-10, 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-G40.20-04/G40.21-04, General Requirements for Rolled or Welded Structural Quality Steel/Structural Quality Steel.

.2 CSA W59-03(R2008), Welded Steel Construction (Metal Arc Welding).

.4 Canadian Steel Door Manufacturers' Association (CSDMA)

.1 CSDMA, Recommended Specifications for Commercial Steel Doors and Frames, 2006.

.5 National Fire Protection Association (NFPA)

.1 NFPA 80-07, Standard for Fire Doors and Fire Windows.

.6 Underwriters' Laboratories of Canada (ULC)

.1 CAN/ULC-S704-11, Standard for Thermal Insulation, Polyurethane and Polyisocyanurate Boards, Faced.

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.

1.3 ACTION AND INFORMATIONAL SUBMITTALS

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

.2 Provide shop drawings

.1 Indicate each type of door, material, steel core thicknesses, mortises, reinforcements, location of exposed fasteners, openings, glazed, arrangement of hardware and finishes.

.2 Indicate each type frame material, core thickness, reinforcements, location of anchors and exposed fastenings and reinforcing 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 Stiffened: face sheets welded, insulated core.

.1 Polyurethane: to CAN/ULC-S704 rigid, modified poly/isocyanurate, closed cell board. Density 32 kg/m^3.

2.3 ADHESIVES

.1 Polystyrene and polyurethane cores: heat resistant, epoxy resin based, low viscosity, contact cement.

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 Section 09 91 99 – Painting for Minor Works. Protect weatherstrips from paint. Provide final finish free of scratches or other blemishes.

.1 Maximum VOC emission level 50 g/L.

2.6 ACCESSORIES

.1 Exterior top and bottom caps: steel.

.2 Metallic paste filler: to manufacturer's standard.

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 Exterior frames: 1.6 mm welded, thermally broken type construction.

.4 Blank, reinforce, drill and tap frames for mortised, templated hardware, and electronic hardware using templates provided by finish hardware supplier. Reinforce frames for surface mounted hardware.

.5 Protect mortised cutouts with steel guard boxes.

.6 Prepare frame for door silencers, 3 for single door, 2 at head for double door.

.7 Manufacturer's nameplates on frames and screens are not permitted.

.8 Conceal fastenings except where exposed fastenings are indicated.

.9 Provide factory-applied touch up primer at areas where zinc coating has been removed during fabrication.

.10 Insulate exterior frame components with polyurethane insulation.

2.8 FRAME ANCHORAGE

.1 Provide appropriate anchorage to hangar door structure.

.2 Locate each 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.

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 Exterior doors: insulated core construction.

.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.

.7 Provide factory-applied touch-up primer at areas where zinc coating has been removed during fabrication.

.8 Manufacturer's nameplates on doors are not permitted.

2.11 DOORS: INSULATED CORE CONSTRUCTION

.1 Form face sheets for exterior doors from 1.6 mm sheet steel with polyurethane core laminated under pressure to face sheets.

2.12 THERMALLY BROKEN DOORS AND FRAMES

.1 Fabricate thermally broken doors by using insulated core and separating exterior parts from interior parts with continuous interlocking thermal break.

.2 Thermal break: rigid polyvinylchloride extrusion conforming to CGSB 41-GP-19Ma.

.3 Fabricate thermally broken frames separating exterior parts form interior parts with continuous interlocking thermal break.

.4 Apply insulation.

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.

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 thresholds as follows.

- .1 Hinge side: 1.0 mm.
- .2 Latchside and head: 1.5 mm.
- .3 Thresholds: 13 mm.

.3 Adjust operable parts for correct function.

3.5 FINISH REPAIRS

.1 Touch up with primer finishes damaged during installation.

.2 Fill exposed frame anchors and surfaces with imperfections with metallic paste filler and sand to a uniform smooth finish.

END OF SECTION

Part 1 General

1.1 SUMMARY

.1 Provide an unobstructed opening, electrically operated, horizontal, slide to one side, bottom rolling hangar door.

.2 The door assembly shall consist of one anchored group of 4 leaves, each of which when fully closed, will provide a weather tight enclosure of the entire opening.

.3 Work under this Section includes the following:

.1 All structural design of the hangar doors and all collateral work shall be provided including the top door guides, bottom rails with structural supports and anchors, connection and setting door frames, bracket pick-up system, all seals, bumpers and hardware, hanging head flashing and all other flashing as required for an operable and weather tight installation, girts for support of insulation, exterior and interior metal wall panels, framed openings for personnel door, and openings for rotating beacon warning lights.

.2 All electrical work required for the operation of the doors to the indicated source of power at the hangar wall, including but not limited to; all necessary wiring, conduit, fittings, junction boxes, limit switches, devices, push buttons, control panels, warning lights, audible alarms, control trolley busway, power busway, disconnect switches and electrical cables.

.3 Structural steel framing and bracing for door leaves.

.4 Bracket door pick up system.

.5 Bottom wheels, axles and bearings.

.6 Top guide roller assemblies.

.7 Top guide tracks, top guide roller access panels, closure plates, weather-stripping and stops.

.8 Bumpers, tractor pulls, interleaf bumpers, and track cleaners.

.9 Electrical controls, pushbuttons, limit switches, and interlocks.

.10 Electrification trolley, contacts, and other items required for complete power system.

.11 Emergency operation by on-site emergency power.

.12 Field wiring materials and field wiring labour on the doors.

.13 Prime coat of shop paint.

.14 Erection, installation and commissioning of doors.

.15 Maintenance and operation manuals.

.16 Guarantee of complete installation.

.17 Coordination with related trades and approval of door track rail system and top guide supporting steel installation.

.18 The door manufacturer shall position the doors in the full closed position to ensure full engagement of the weathering and mark the finished floor with tape for finishing.

1.2 REFERENCES

.1 American Gear Manufacturers Association (AGMA).

.1 AGMA No. 7 (ISO Viscosity Grade 460).

.2 American Institute of Steel Construction (AISC).

.1 AISC Steel Construction Manual, 14th edition.

.3 American Society of Civil Engineers (ASCE).

.1 ASCE 7-05, Minimum Design Loads for Buildings and Other Structures.

.4 American Society for Testing Materials International (ASTM).

.1 ASTM A36/A36M-08, Standard Specification for Carbon Structural Steel.

.2 ASTM A572/A572M-12, Standard Specification for High-Strength Low-Alloy Columbium-Vanadium Structural Steel.

.3 ASTM A653/A653M-11, Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.

.5 Canadian General Standards Board (CGSB).

.1 CAN/CGSB-1.105-M91, Quick-Drying Primer.

.6 Canadian Standards Association (CSA International).

.1 CSA-G40.20/G40.21-13, General Requirements for Rolled or Welded Structural Quality Steel/Structural Quality Steel.

.2 CSA S16-14. Design of steel structures.

.3 CSA-S136-07(R2012), Cold Formed Steel Structural Members.

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

.1 Material Safety Data Sheets (MSDS).

.8 Institute of Electrical and Electronics Engineers (IEEE).

.9 National Electrical Code (NEC).

.10 National Electrical Manufacturers Association (NEMA).

.1 NEMA-ICS 6-1993(R2006), Enclosures.

.11 National Fire Protection Association (NFPA).

.1 NFPA 70-2011, National Electrical Code.

1.3 DESIGN CRITERIA

.1 The hangar doors shall be designed by the manufacturer in accordance with the criteria specified. Doors shall operate without binding, interference, or damage to weather stripping. Doors shall fit closely and be free from warping.

.2 Design Load:

.1 External wind loads to be based on 50 year mean recurrence and internal wind load of not less than one-half of the external wind load.

.2 The maximum deflection of the door leaves, due to design wind loads, shall be limited to the height of the door divided by 240. The deflection due to design wind load shall not exceed length divided by 240 for any door member.

.3 Fiber stresses due to combined dead load and wind load shall not exceed the recommended design stresses for the material used and type of loading sustained.

.4 Each horizontal rolling door leaf acting as a unit and all components of the leaf shall be designed to resist all wind and seismic loads indicated or specified. The doors shall be designed so they will not flutter more than plus or minus 6 mm from the vertical position at the top of the horizontal rolling doors. The doors shall be complete with all collateral structural steel and related anchorages and shall include, but not be limited to, bottom door rails, top door guides, end closure pieces, and door guide bracing.

.5 Design doors as a system to withstand the upward and downward deflections of the cantilevered structure supporting and bracing the top of the hangar door system.

.1 Positive deflection (wind uplift): 80 mm.

.2 Negative deflection (live load): 150 mm.

.3 North-South lateral deflection: 60 mm wind and 60 mm seismic.

.4 East-West lateral deflection: 60 mm wind and 60 mm seismic.

.3 Connections: Design connections at top and bottom guide rails to withstand an external and internal wind load of not less than 171 kg/m² (35 psf), or the design wind load for the building, whichever is greater, and a seismic load equal to 0.5 times the weight of the door.

.4 Performance: Maximum leakage rate of installed shall not exceed 6.8 m³/hr per lineal 300mm (4 cfm per lineal foot) of door leaf. Flow rates are at a pressure difference of 7.6mm (0.30 inch) of water.

.5 Engineering design: provide calculations for structural members covering components and collateral work, including computer programmed designs, with complete explanation of computer programs used. Submittals shall be accompanied by stress values, the design criteria and procedures used and attesting to the adequacy and accuracy of the design.

.6 All design calculations and drawings shall be signed and sealed by a qualified professional engineer registered or licensed in the Province of Saskatchewan.

.7 Anchored group doors: each group of leaves shall have a traction-drive operating unit located in the lead leaf of the group and driving both wheels of the lead leaf. The leaves in each group shall start to move at the same time and arrive at their fully open or fully closed positions simultaneously. Necessary cables, fittings, sheaves, housings, guards, pickups, brackets, anchors, and miscellaneous hardware shall be provided. Provide doors that require operating personnel to walk with the leaf as it moves.

1.4 ACTION AND INFORMATIONAL SUBMITTALS

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

.2 Product Data:

.1 Submit manufacturer's instructions, printed product literature and data sheets for hangar door and include product characteristics, performance criteria, physical size, finish and limitations

.2 Submit two copies of WHMIS MSDS - Material Safety Data. Indicate VOC's:

.1 For caulking materials during application and curing.

.2 For door materials and adhesives.

.3 Shop Drawings:

.1 Indicate each type of door, structural connections, structural properties of members, fasteners, all collateral work, operating systems, operating mechanisms, braking systems, electrical controls, warning and safety devices, emergency operating systems, arrangement of hardware, required clearances, and openings.

.2 Indicate engineering design calculations for structural members covering components and collateral work.

.3 Indicate motors, all electrical control devices, and all electrical control panels, including schematic diagrams, dimensional drawings of control panels, details of control panel installations, internal wiring diagrams of control panels, and wiring diagrams indicating all external connections between control panels and from control panels to remote control devices.

.4 Size, spacings, anchor bolt setting patterns and material requirements for the bottom rails.

.4 Manufacturer's Instructions: submit manufacturer's installation instructions.

.5 Manufacturers' Field Reports: submit copies of manufacturers' field reports.

.6 Sustainable Design Submittals:

.1 Construction Waste Management:

.1 Submit project Waste Reduction Workplan highlighting recycling and salvage requirements.

1.5 CLOSEOUT SUBMITTALS

.1 Provide operation and maintenance data for hangar doors for incorporation into manual specified in Section 01 78 00 - Closeout Submittals. Manuals to contain:

.1 Operating instructions.

.2 Maintenance instructions.

.3 Location of all points to be lubricated, type of lubricant required and frequency of servicing.

.4 Checklist of parts to be serviced and adjusted and the frequency of servicing and adjustment.

.5 List of spare parts.

.6 Manufacturer’s catalog for each component in and on the hangar doors.

1.6 QUALITY ASSURANCE

.1 Regulatory Requirements:

.1 Hangar 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.

.4 Pre-Installation Meetings: conduct pre-installation meeting to verify project requirements, manufacturer's installation instructions and manufacturer's warranty requirements.

1.7 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 as recommended by the manufacturer and label each item as to item definition and location.

.2 Storage and Protection:

.1 Store packaged materials in original containers or wrapping with manufacturer's seals and labels intact. Store in locations free of dust and moisture.

.2 Prevent damage to materials during handling and storage. Keep materials under cover and free from dampness. Remove damaged items and replace.

.3 Store materials in area of installation for minimum period of 48 hours prior to installation.

1.8 WARRANTY

.1 Provide five-year manufacturer’s warranty for hangar doors and all components.

.2 Include coverage of repair or replacement of components of entire units which fail in materials and workmanship. Failures include, but are not necessarily limited to, structural failures including excessive deflection, excessive leakage or air infiltration, faulty operation of operators and hardware.

.3 During warranty period, provide repair services when required, and replace any defective or inoperative equipment at no expense to the Owner, including all labour, material, travel or expenses of personnel brought in, and any other costs associated with the solution and correction of the problem.

1.9 MAINTENANCE SERVICE

.1 Furnish complete service and maintenance of hangar door system components during warranty period.

.2 Systematically; yearly, examine, clean, adjust, and lubricate equipment as per planned maintenance tasks and frequencies.

.3 Maintenance to include systematic examination, adjustment and lubrication of hangar door equipment; repair or replace parts whenever required. Use genuine parts produced by the manufacturer of specific equipment.

.4 Perform maintenance work using competent personnel, under supervision and direction of an authorized representative of the hangar door manufacturer.

.5 Do not assign or transfer maintenance service to any agent or subcontractor without prior written consent of Departmental Representative.

Part 2 Products

2.1 ACCEPTABLE MANUFACTURERS

.1 Only hangar door manufacturers with a minimum of 15 years' experience in the manufacture of hangar doors and who are now regularly engaged in the design and manufacturing of the type of door specified and can submit evidence of ten (10) actual installations of comparable design, construction and size with proven durability will be qualified for work of this section

.2 The installation supervisor shall be an authorized representative of the door manufacturer. Installers shall be skilled and experienced in the erection of hangar doors of type and size required for this project.

2.2 MATERIALS

.1 Structural Steel: to ASTM A36/A36M, ASTM A572/A572M, CAN/CSA G40.20/G40.21, CSA S16.

.2 Cold-Formed Steel: to CSA-S136.

.3 Galvanized Steel Sheet: to ASTM A653/A653M, coating designation G90 galvanized steel sheet, commercial quality.

.4 Top Guide Rails:

.1 Provide hot rolled structural I-beam, wide flange, H-beam, or similar configuration conforming to ASTM A36/A36M. Size, weight, and length shall be as required for door design, wind loads, and building requirements. Bottom flange of upper guide rail shall act as a retainer in conjunction with upper guide roller assemblies so as to prevent doors from accidental disengagement. Web of rail shall be sized to accommodate building deflection, permitting unopposed operation of doors under maximum live load conditions.

.2 Top guide rails to hold the top rollers of the hangar doors captive, with other structural steel as required to transfer all design loading to the building structure. The nominal elevation shall be maintained within plus or minus 6 mm. The nominal centre-to-centre dimension shall be maintained within plus or minus 3 mm, with variation from nominal at no greater rate than 3 mm in 6.1 metres. Joints of head guides shall be welded and ground so that adjoining guide surfaces have a smooth transition.

.3 Hangar top door guides shall be installed after truss shoring is removed. Top guide tolerances shall be met after dead load is imposed upon building frame.

.5 Bottom Rails:

.1 Shall be designed by the door manufacturer based on standard ASCE rails as defined in the AISC Steel Construction Manual, unless as a result of the door supplier's analysis, heavier rails are required to bear weight to accommodate the design, thrust and weight loads for the installation. Standard ASCE rail weighting not less than 13.6 kg/m.

.2 Anchor bolts: to CAN/CSA G40.20/G40.21, Grade 300W, suitable for use intended with double nuts and levelling bottom rail supports.

.3 Rails shall be set to elevation within plus or minus 6 mm with variations from elevation at no greater than 3 mm in 6.1 metres. The nominal design relationship between top guides and bottom rails shall be maintained without exception. The nominal centre-to-centre dimension shall be maintained within plus or minus 3 mm, with variation from nominal at no greater rate than 3 mm in 6.1 metres.

.4 Rail supports are factory cut to size and punched hot or cold rolled angles or channels of minimum yield strength of 250 MPa (36,000 psi) for leveling and supporting rails to prevent movement during normal erection, concrete pouring and finish operations.

.6 Door Frame:

.1 Jambs shall be cold formed steel channels having a minimum yield strength of 345 MPa (50,000 psi) or hot rolled structural channels per ASTM A36/A36M. Deflection at maximum wind loading shall not exceed L/240. Vertical members shall be continuous throughout the height of the door.

.2 Door headers shall be cold formed channels having minimum yield strength of 345 MPa (50,000 psi) or hot rolled structural channels per ASTM A36, meeting specified design load requirements. Door header to be fabricated to accept upper guide roller assembles without modification or alteration.

.3 Door girts shall be cold formed or hot rolled structural tubing per CSA G40.21 Grade 350W properly spaced to accommodate specified wind load conditions as required. Girts shall be designed for simple span condition and sized to permit exterior cladding, interior sheeting and blanket insulation, without causing jamb interference, abrasion or wear.

.4 Frames and framing members shall be true to dimensions and square in all directions; no leaf shall be bowed, warped or out of line in the vertical or horizontal plane of the door opening by more than 3 mm in 6.1 metres.

.5 Diagonal bracing shall be provided for strength, stability, squareness and so that the completed leaf assembly will be adequately braced to withstand assembly, shipping, installation, and operational loads.

.6 Full depth vertical and horizontal framing members shall be provided at each pedestrian door and each rough window opening.

.7 Provide necessary structural framing and holes in the door leaf for exit lights, interlock switches, alarm signals and similar items of electrical equipment.

.8 Provide necessary structural framing for bracket door pick-up system. Provide 60 durometer neoprene bolted to interior pick-up brackets. A minimum of two interior pick-up brackets per leaf shall be installed. Interior pick-up brackets shall be installed a minimum of 2.4 metres above the floor. Coordinate

installation of the pick-up brackets with the safety edge installation. Pick up brackets shall not interfere with the correct functioning of the safety edges or weatherstripping.

.7 Door Stops: Provide two mechanical bumpers of 60 durometer neoprene bolted to stop beams imbedded in concrete at the end of each door rail to prevent the leaves from coming in contact with upper end walls. The bumpers shall be mounted parallel to one another on the bumper posts at an elevation above the floor such that they contact only the main bottom horizontal channels of the leaves, which shall be steel reinforced at the points of impact. Provide neoprene bumpers with suitable stops also at the door guides above, to make similar contact with the upper part of the door leaves.

.8 Wheel Assemblies:

.1 Wheels shall be fabricated of carbon steel conforming to ASTM A36/A36M.

.2 Provide each door leaf with a minimum of two bottom steel plate wheel assemblies, having a minimum tread diameter as required for the actual wheel loading. Wheels shall be designed to adequately carry the load and to permit removal without taking the door leaves from their position on the rails. Where the height-to-width ratio of the door leaf exceeds three, wheel assemblies shall be vertically adjustable. Provide removable access panels at all wheel assemblies.

.3 Treads: Shall be machined concentric with the bearing seats and to fit ASCE rails. The clear distance between flanges shall not exceed the width of the rail by more than 3 mm at the tread, and no more than 6 mm at the edge of the flange. Machine internal bearing seats accurately for a press fit. Heat treat all wheels to obtain a rim hardness of 320 Brinnel. Minimum bottom wheel size to be 250mm.

.4 Bearings: Each wheel shall be provided with two tapered roller or spherical bearings. Bearing units shall be mounted in the wheel assembly so that both the vertical dead loads and the horizontal wind loads can only be transmitted from the leaf to the wheel through the bearings. Bearings shall be provided with seals to retain the grease and prevent the entrance of dirt and shall be equipped with approved type non-leak, high-pressure throat or surface check lubricating fittings recessed into the interior metal wall panels, convenient for lubrication without removing covers.

.9 Top Guide Rollers:

.1 Each rolling door leaf shall be provided with a minimum of two telescoping or vertical floating type top roller assemblies. Rollers shall have factory-sealed, lifetime-lubricated roller or ball bearings. Each assembly shall consist of horizontal and vertical steel rollers held captive by the top roller guides and mounted on a track connected to a vertical steel post, which in turn slides within sleeve bearings attached to the door leaf framing.

.2 Roller assemblies shall be capable of resisting the required wind and operating loading and shall be designed to permit vertical movement of the structure above in addition to the movement attributable to the required wind and dead loading.

.3 Roller assemblies shall be accessible and removable through the top of the guide system.

.10 Supports:

.1 Wheel Carriages: the wheels for each leaf shall be mounted in specially constructed, welded and machined-wheel carriages, stress relieved after welding

and before boring. The ends of the finished and full assembled wheel carriages shall be 100% welded or bolted into the bottoms of the main vertical framing members of the door leaf sections.

.2 Motor-Operator Drive Base Supports: bases shall be supported on rigid structural leaf framing designed to prevent deflection or torsional rotation under the loads imposed during operation of the rolling doors. The supports shall locate the bottom of the operating equipment high enough above the driven wheels so that the wheels can be removed from the leaves. The drive base support framing shall be designed so that the drive base and operating equipment can be easily adjusted with separate pressure and tension members to maintain proper tension in the roller chain drive. Slotted hole adjustments are not acceptable.

.11 Hardware:

.1 Weatherstripping:

.1 Design weatherstripping and components to prevent rubbing, wiping abrasion or similar defacing of exposed finished surfaces of the hangar doors or other parts of the building during operation of the hangar door system.

.2 Provide adjustable and readily replaceable material. Provide on vertical edges, sills and heads to provide a weather tight installation.

.3 Neoprene: Use flap-type, two-ply, cloth-inserted neoprene or extruded, double flap, single or dual opposed solid neoprene material on vertical edges and sills. The two-ply material shall have a minimum thickness of 3 mm and shall be retained continuously for its full length and secured with rust-resistant fasteners 300 mm on centre. Extruded weather stripping with heavy center section shall be attached at 300 mm on centre, but continuous bar may be omitted. Clearance between metal parts on vertical edges of leaves and between leaves and jambs which are to be weather-stripped shall be as indicated.

.4 Metallic: Form head weather stripping material between each leaf and the top guide system of not lighter than 1.61 mm (16ga) galvanized sheet steel or flap-type, cloth-inserted neoprene.

.5 Hanging Head Flashing: Provide cloth-inserted neoprene weathering fastened to top of door leaves to engage the hanging head flashing when doors are closed.

.6 Rail Wipes: Suitable and removable rail wipers shall be provided to clear debris from the railhead and the wheel flange grooves as the leaves are moving. The wipers shall be located at the ends of each leaf.

.7 Toe Guards: Attach an adjustable, full-length, flexible toe guard, reaching to the floor, to the interior bottom edge of each door leaf.

.8 Weathering: Each door leaf shall be weather tight over the entire surface exposed to the exterior, in all door configurations. Spaces between and all around each door leaf, including spaces adjacent to the fixed opening jambs, heads and floor, shall be tightly closed with flexible material with an average crack opening of not more than 1.6 mm.

.2 Fasteners: Self-drilling zinc-coated or cadmium-plated steel.

.3 Tractor Pulls: Provide tractor pulls so that leaves can be towed by a tractor or similar equipment in the event of complete power failure. The tractor pulls shall

be designed for drive force to tow doors or 2270 kg whichever is greater. Minimum thickness steel plate shall be 10 mm.

.12 Access Panels: provide flat metal access panels on interior side of door leaves, at motor operator, and at each wheel as required for maintenance and servicing. Access panels shall be removable type at wheels and hinged type at operator units and storage compartments. All edges of access panels shall be sealed. Removable type panels shall be fastened on all edges. Hinged type access panels shall be equipped with keyed alike locks to limit unauthorized access to operator units. Fabricate access panels of minimum 3mm galvanized steel sheet. The clear unsupported area of access panels shall not exceed 2.3 square metres.

.13 Insulation: in accordance with Section 07 21 13 - Board Insulation.

.14 Prefinished metal siding on exterior: in accordance with Section 07 46 13 - Preformed Metal Siding.

.15 Prefinished metal liner panel on interior: in accordance with Section 07 46 13 - Preformed Metal Siding.

.16 Sealants: in accordance with Section 07 92 00 - Joint Sealants.

.17 Personnel doors and frame: in accordance with Section 08 11 00 - Metal Doors and Frames.

.1 Provide each personnel door with an electrical interlock switch.

.18 Windows: in accordance with Section 08 50 00 - Windows.

.19 Personnel door hardware: in accordance with Section 08 71 00 - Door Hardware.

.20 Glazing: in accordance with Section 08 80 50 - Glazing.

.21 Shop primer: to CAN/CGSB-1.105.

2.3 ELECTRICAL

.1 Electrical motors, controller units, remote pushbutton stations, relays and other electrical components: to CSA approval.

.2 Drive unit: mount on lead panel of door system so as to drive both of the bottom rollers of each powered leaf. Unitized assembly, consisting of a separate motor and gear reducers or a gearhead motor, high-speed shaft brake, and necessary roller chains and sprockets. After the components are mounted, aligned and tightened into position on the drive bases, steel blocks shall be fitted around the feet of the components and welded to the drive base to prevent the components from changing alignment.

.3 Drive system: designed to move powered leaf at an approximate speed of 14 metres per minute at zero wind load conditions, operable at full speed up to and including a maximum wind load of 39 kg per square metre.

.4 Motor: ball-bearing, totally enclosed, squirrel cage type of sufficient size and horsepower to operate the door leaves at not more than 75 percent of rated capacity.

.5 Gear reducers: helical bevel, high-efficiency type, fan-cooled, internally lubricated, with an AGMA service factor of 1.5. A high helix angle shall allow reversal of effort through the gears without damage to the units. The gears shall be non-self-locking. The reducers shall be furnished with the proper quantity of AGMA No. 7 compound gear-reduces oil. The reducers shall be filled in the field after installation in the doors.

.6 Drive and pinion sockets: shall be highest quality hardened steel of suitable size, thickness, and number of hardened cut teeth for the speed and service.

.7 Roller chains: shall be precision stainless steel single strand, fatigue resistant, heat treated, and shall have a minimum 5:1 safety factor under normal operating conditions.

.8 Drive bases: shall be adjustable and shall be designed to rigidly support drive components without deflection or torsional rotation under operating loads.

.9 Variable-frequency drive: VFD shall produce an adjustable-frequency, adjustable-voltage, pulse width modulated three phase, 600V, sine wave output when powered from a three-phase, 600V 60Hz input. The drive shall be suitable for use with NEMA Design B, AC induction motors with a 1.15 service factor. Drives shall be designed, constructed, and tested in accordance with NEMA, UL, NEC, and IEEE standards. Drives and all supplied options shall be UL approved and listed according to UL 508. Drives shall be solid state, reversing motor, electronic, and programmable for time and value of motor speeds and shall maintain constant torque characteristics over the motor speed range. Drives shall be factory wired, with overload and under voltage protection, equipped with electrical interlocks and with transformers and relays for control circuits, all enclosed in a (NEMA ICS6, Type 4, wet location) enclosure with a disconnect switch, capable of being locked in the OFF/OPEN position. Power voltage shall be 600V, three-phase and control voltage shall be 60 hertz. One complete variable frequency drive will be provided for each power operator.

.10 Relay: a programmable relay which will allow the hangar doors to start from a full closed position and run at half speed for 1 metre, then ramp up to full speed. At 1 metre from full open position, doors are to ramp down and run at half speed before stopping.

.11 Operating mechanism: covered on interior of door leaf by a hinged covered door at operator locations.

.12 Trolley duct: provide the required number of trolley duct conductors for the hangar door's door system, including warning and safety devices.

.13 Power supply: 600V, 3 phase, 60 Hz.

.14 Mounting brackets: galvanized steel, size and thickness to suit conditions.

.15 Control transformer: for 24 VAC control voltage.

.16 Braking System: Shall be designed to ensure stoppage of the door leaves under normal, dry rail conditions, within the safety edge over travel limit. The braking system shall be a magnetic, spring-set, solenoid-released brake. Provide a hand release to release the brake when it becomes necessary to move the door leaf with an outside force. The hand release shall be an automatic reset type so that the brake will be operable during subsequent electrical operation of the door. Brakes shall be capable of stopping the door leaf when running at full speed within 125 mm after the brake is applied. The electric

brake shall be mounted higher than 1.2 metres above the hangar floor. A permanent placard shall be installed indicating instruction for brake release to operate door by tractor pull. A back-up wheel or track braking system shall be designed and installed to engage in the event of an equipment failure of the drive mechanism. The back-up brake system shall also have a manual release.

.17 Anchored Group Controller Unit: Lead door leaf shall have control station at leading edge 1.2 metres above the floor and approximately 300 mm from the edge, to avoid interference with the weatherstripping, but still permit hand access when door leaves are stacked in the open position. Control stations shall be heavy-duty, with constant switch hold down pressure, mushroom type pushbuttons, requiring operator to walk group of door leaves open or closed while depressing the button. Each control station shall include push buttons clearly marked “OPEN” and “CLOSE”. Provide a spring loaded cover over the switches to prevent accidental activation of the doors. Controls shall be weather tight with convenient hand access when doors are stacked fully open. Interior push buttons shall be mushroom head type, mounted in heavy duty, water tight, oil-tight enclosures conforming to NEMA ICS 6, Type 4. A permanent placard shall be installed near the hangar door control location indicating complete operating instructions for the hangar doors. Provide electrical interlocks to protect equipment and personnel during emergency operation by towing.

.18 Operator Disconnect Switch: Provide a three-pole disconnect switch for the drive motor not more than 1.2 metres above the hangar floor behind an access panel.

.19 Limit Switches: Provide limit switches to prevent over-travel, bumping and building damage. Safety edges shall not be used as limit switches.

.1 Limit Arm Type Limit Switches: Provide heavy-duty limit switches for anchored group doors to stop the travel of each group in the fully open and fully closed positions. The heavy-duty limit switches shall be positive acting snap action, lever arm type with actuating cams designed with sufficient over-travel to permit the group to come to a complete stop without over-traveling the limit switches. Mount on the leaves and the actuating cams mounted either on the top guides or on adjacent door leaves.

.20 Warning Devices: provide one flashing amber light and one clearly audible signal on the powered door leaf of hangar door system. The warning devices shall automatically signal movement of the powered door leaf five (5) seconds before the door moves and shall flash and sound continuously while door is being operated. Warning devices shall consist of a rotating amber beacon light and a bell with a decibel level of not less than 100db at 3 metres or an equivalent decibel-rated horn, loud enough to be heard in the hangar and on the apron. Audible warning device shall have a sound different from that of the fire alarm system.

.21 Emergency Operation: Hangar doors shall be constructed and equipped so that they can be operated by on-site emergency power or manually by tractor pulls. Manual operation of hangar doors shall be designed to avoid damage to door leaves and electrical system.

.22 Electrical Work: The door manufacturer shall provide the proper electrical equipment and controls built in accordance with the latest NEMA standards. Equipment, control circuits, and safety edge circuits shall conform to NFPA 70. Where located 450 mm or less above the floor, they shall be explosion-proof as defined in NFPA 70, Article 513. Manual or automatic control devices necessary for motor operation of the doors shall be

provided, including push button stations, limit switches, combination fused disconnect switches and magnetic reversing starters, control circuit transformers, relays, timing devices, warning devices, and trolley ducts with collectors or trolleys.

.23 Power and Grounding: Power shall be provided by junction boxes on both ends of the door leaves. Electrical for doors are 600 volts, three phase, six wire, 20 amperes, 60 hertz. Power shall be delivered to the rolling leaves by a trolley device carried along by each door leaf in the door canopy. The trolley duct electrical characteristics shall be 600 volts, three phase, four pole, 60 amperes, with the fourth pole (rail) being for grounding purposes. Continuity of electrical grounding from leaf to leaf shall be accomplished by using grounding pole (rail) in each trolley duct. Electrical work and equipment shall be grounded and bonded in conformance with UL 467.

.24 Trolley Duct Electrification System:

.1 Provide runs of trolley duct, used as a feeder system to the hangar doors, as required for the door system, including warning and safety devices. Ducts shall have solid copper conductors in protective steel or polyvinyl chloride housing. Locate ducts as shown on door manufacturer's shop drawings. Provide adequate clearances in the top guide system for the travel.

.2 Each run shall consist of the required number of sections of straight track, a section of dropout track, feed boxes, end caps, couplings, hangers and all accessories to make the system complete and workable.

.3 Furnish one self-supporting collector for each individually motor-operated door, complete with spring-loaded brush contacts. Provide trolley pulling brackets and corrosion-protected chains attached from each side of the pulling bracket to each side of the support bracket for self-bracket for self-supporting collectors.

.25 Safety Edge:

.1 Provide safety edges on each leading and trailing edge of leaf from 25 mm above the floor to the top of the door leaf. For leaves 305 mm thick or less, provide a single run of safety edge. For leaves over 305 mm thick, provide a double run of safety edges spaced to provide the maximum degree of safety in stopping the leaves. Safety edges installation shall not interfere with proper functioning of pick up brackets.

.2 Design: Provide safety edges to provide a minimum of 89 mm of over-travel after actuation until solid resistance is met and door motion comes to a complete stop. Safety edges shall be pneumatic type. A minimum of one air pressure switch shall be provided for each 6.1 metres of vertical edge. The electrical service to the pressure switch shall not be more than 110 volts.

.3 Actuation of a safety edge shall stop movement of the door leaf and lock out the motor control in the direction of travel until reset, but shall permit the door to be reversed away from the obstruction which tripped the safety edge. Safety edges shall be live only when doors are in motion. Safety edges shall be reset by moving doors away from the obstruction. The lower portion of the safety edges to a height of approximately 1.5 metres shall be independently removable for convenience in servicing or repair. The remainder of the safety edge may be in one piece up to a maximum of 6.1 metres.

.4 Provide a keyed bypass to the door controls to render the safety edges in a temporary "repair" mode. The door drive shall be restored from its "fail safe" mode by activation of the keyed bypass.

.26 Interlock Limit Switches:

.1 Provide each personnel door with a non-contact electromagnetic interlock switch to prevent motor operation of the hangar door group when the personnel door is open. Interlock control wiring between door leaves shall be done via a control wiring trolley busway. Provide an identified indicator light at door leaf control station indicating when the personnel door is in the open position.

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 Doors and accessories shall be erected in accordance with reviewed shop drawings and shall include the installation of top guides, bottom rails with structural supports, connection and setting door frames, installation of all seals, bumpers and hardware, installation of all necessary wiring, conduit fittings, junction boxes, limit switches, devices, illuminated exist signs, push buttons, control panels, warning lights, audible alarms, control trolley busway, power busway, disconnect switches and electrical cables, and metal panel systems.

.2 The door manufacturer shall provide an authorized representative to supervise erection of doors. The representative shall be experienced in the erection of hangar doors of this type and shall be present during start-up of door operation and during checkout.

.3 Bottom rails with structural supports and anchors shall be set in positions, leveled and aligned by the hangar door manufacturer.

.4 Install all electrical equipment, outlets, conduit, and wiring within 610 mm of walls and a minimum on 1220 mm above finished floor.

3.3 SHOP PAINTING

.1 Before shipment all steel members and hardware shall be painted with one (1) sprayed on coat of rust-inhibitive primer. All steel shall be thoroughly cleaned prior to painting to remove all oil, rust and other foreign material. Machined surfaces and neoprene weathering shall not be painted.

3.4 FIELD QUALITY CONTROL

.1 Have manufacturer of products supplied under this Section review Work involved in handling, installation/application, protection and cleaning of its products, and submit written reports in acceptable format to verify compliance of Work with Contract.

3.5 TESTING

.1 Acceptance Test:

.1 Contractor shall perform complete operating tests for all door leaves. Perform no less than three complete opening and closing cycles, all safety controls, emergency manual operational system, and such other tests as specified in the Manufacturer's approved door test procedure plan. Notify the Departmental Representative a minimum of seven (7) days prior to the beginning of door tests.

.2 Any defects disclosed by the tests shall be corrected; final adjustments of the doors and operating equipment shall be turned over to the Departmental Representative in accordance with Section 01 33 00 – Closeout Submittals. Tests of previously defective items repaired or replaced by the Contractor shall be accomplished at no additional cost to the owner.

3.6 DEMONSTRATION

.1 After completion and acceptance of the door installation, the hangar door manufacturer shall provide the services of a competent factory service engineer for a period of 2 – four hour sessions, to instruct all shifts of the Departmental Representative and Owner's operating and maintenance personnel in the proper operation, lubrication, maintenance and servicing of the doors and operating systems.

3.7 CLEANING

.1 Perform cleaning after installation to remove construction and accumulated environmental dirt.

.2 Clean aluminum, metal and other components with damp rag and approved non-abrasive cleaner in accordance with manufacturer's instructions.

.3 Remove traces of primer, caulking; 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 Aluminum Association (AA)

.1 AA DAF 45-03(R2009), Designation System for Aluminum Finishes.

.2 ASTM International

.1 ASTM A123/A123M-12, Standard Specification for Zinc (Hot-Dip galvanized) Coatings on Iron and Steel Products.

.3 CSA Group

.1 AAMA/WDMA/CSA 101/I.S.2/A440-11, NAFS - North American Fenestration Standard for Windows, Doors, and Skylights.

.2 CAN/CSA-A440.2/A440.3-09, Fenestration energy performance/User guide to CSA A440.2, Fenestration energy performance.

.4 Master Painters Institute (MPI)

.1 Architectural Painting Specification Manual - current edition.

.1 MPI #79, Primer, Alkyd, Anti-Corrosive for Metal.

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 windows and include product characteristics, performance criteria, physical size, finish and limitations.

.3 Shop Drawings:

.1 Indicate materials and details in full size scale for head, jamb and sill, profiles of components, interior and exterior trim, elevations of unit, anchorage details, location of isolation coating, description of related components, fasteners, and caulking. Indicate location of manufacturer's nameplates.

.4 Samples:

.1 Submit for review and acceptance of each unit.

.2 Samples will be returned for inclusion into work.

.3 Submit one representative model of each type window.

.4 Include frame, sash, sill, glazing and weatherproofing method, insect screens, surface finish and hardware. Show location of manufacturer's nameplates.

.5 Test and Evaluation Reports:

.1 Submit test reports from approved independent testing laboratories, certifying compliance with specifications.

.2 All test reports that reference the NAFS must include, on the first page, a summary of the results including, at minimum:

.1 The product manufacturer.

.2 The type of product.

.3 The model number/series number.

.4 The primary product designation.

.5 The secondary product designation.

.1 Positive design pressure.

.2 Negative design pressure.

.3 Water penetration resistance test pressure.

.4 Canadian air infiltration and exfiltration levels.

.6 The test completion date.

.3 The report will also contain the following information:

.1 Test dates.

.2 Report preparation dates.

.3 Test information retention period.

.4 Location of testing facilities.

.5 Full description of test samples, including:

.1 Anodized finish, and weathering characteristics.

.2 Condensation resistance.

.3 Forced entry resistance.

.6 Complete description of amendments, as applicable.

.7 Conclusion.

.8 Drawings signed by the testing laboratory, if provided.

.6 Sustainable Design Submittals:

.1 Construction Waste Management:

.1 Submit project Waste Reduction Workplan highlighting recycling and salvage requirements.

1.3 CLOSEOUT SUBMITTALS

.1 Submit in accordance with Section 01 78 00 - Closeout Submittals.

.2 Operation and Maintenance Data: submit operation and maintenance data for windows for incorporation into manual.

1.4 QUALITY ASSURANCE

.1 Certifications: product certificates signed by manufacturer certifying materials comply with specified performance characteristics and criteria and physical requirements.

1.5 DELIVERY, STORAGE AND HANDLING

.1 Deliver, store and handle materials in accordance with Section 01 61 00 - Common Product Requirements and with manufacturer's written instructions.

.2 Delivery and Acceptance Requirements: deliver materials to site in original factory packaging, labelled with manufacturer's name and address.

.3 Storage and Handling Requirements:

.1 Store materials off ground, in dry location and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.

.2 Store and protect windows from nicks, scratches, and blemishes.

.3 Replace defective or damaged materials with new.

.4 Develop Waste Reduction Workplan related to Work of this.

Part 2 Products

2.1 MATERIALS

.1 Materials: to AAMA/WDMA/CSA 101/I.S.2/A440 supplemented as follows:

.2 All windows by same manufacturer.

.3 Sash: aluminum, thermally broken.

.4 Main frame: aluminum, thermally broken.

.5 Glass: double glazed sealed units, in accordance with Section 08 80 50 - Glazing.

.6 Exterior metal sills and aluminum facings: extruded aluminum, brake formed aluminum sheet metal of type and size to suit job conditions; minimum 3 mm thick, complete with joint covers, jamb drip deflectors, chairs, anchors, and anchoring devices.

.7 Isolation coating: alkali resistant bituminous paint.

.8 Sealants:

.1 VOC limit 250 g/L maximum.

2.2 WINDOW TYPE AND CLASSIFICATION

.1 Window specifications are based on Kawneer 5500 Isoweb

.2 Product type:

.1 FW- Fixed window, with double, insulating glass.

.3 Classification rating: to AAMA/WDMA/CSA 101/I.S.2/A440.

.1 Primary designation:

.1 Performance classes: CW.

.2 Performance categories: 30.

.2 Secondary designation:

.1 Positive design pressure: 1440 Pa.

.2 Negative design pressure: 2160 Pa.

.3 Water penetration resistance test pressure: 220 Pa.

.4 Canadian air infiltration and exfiltration levels: A3.

.3 Surface condensation control: compliant with standard CAN/CSA-A440.2/A440.3.

.4 Forced Entry: F1.

.5 Ancillary properties (Energy rating).

.1 Overall coefficient of heat transfer (U-factor) 0.049 W/(m^2.K).

.2 Temperature index (I) 55.

2.3 FABRICATION

.1 Fabricate in accordance with AAMA/WDMA/CSA 101/I.S.2/A440 supplemented as follows:

.2 Fabricate units square and true with maximum tolerance of plus or minus 1.5 mm for units with a diagonal measurement of 1800 mm or less and plus or minus 3 mm for units with a diagonal measurement over 1800 mm.

.3 Face dimensions detailed are maximum permissible sizes.

.4 Brace frames to maintain squareness and rigidity during shipment and installation.

.5 Finish steel clips and reinforcement with 380 g/m^2 zinc coating to ASTM A123/A123M.

2.4 ALUMINUM FINISHES

.1 Finish exposed surfaces of aluminum components in accordance with Aluminum Association Designation System for Aluminum Finishes.

.1 Clear anodic finish: designation AAM10C22A41, #14 Clear Anodized Aluminum.

2.5 ISOLATION COATING

.1 Isolate aluminum from following components, by means of isolation coating:

.1 Dissimilar metals except stainless steel, zinc, or white bronze of small area.

.2 Concrete, mortar and masonry.

.3 Wood.

2.6 GLAZING

.1 Glaze windows in accordance with AAMA/WDMA/CSA 101/I.S.2/A440.

2.7 AIR BARRIER AND VAPOUR RETARDER

.1 Equip window frames with factory installed air barrier and vapour retarder material for sealing to building air barrier and vapour retarder as follows:

.1 Material: identical to, or compatible with, building air barrier and vapour retarder materials to provide required air tightness and vapour diffusion control throughout exterior envelope assembly.

.2 Material width: adequate to provide required air tightness and vapour diffusion control to building air barrier and vapour retarder from interior.

Part 3 Execution

3.1 EXAMINATION

.1 Verification of Conditions: verify conditions of substrates previously installed under other Sections or Contracts are acceptable for product installation in accordance with manufacturer's written instructions.

.1 Visually inspect substrate in presence of Departmental Representative.

.2 Inform Departmental Representative of unacceptable conditions immediately upon discovery.

.3 Proceed with installation only after unacceptable conditions have been remedied and after receipt of written approval to proceed from Departmental Representative.

3.2 INSTALLATION

.1 Window installation:

.1 Install in accordance with AAMA/WDMA/CSA 101/I.S.2/A440.

.2 Attached to structure to permit sufficient adjustment to accommodate existing building conditions and other irregularities.

.3 Arrange components to prevent abrupt variation in colour.

.2 Sill installation:

.1 Install metal sills with uniform wash to exterior, level in length, straight in alignment with plumb upstands and faces. Use one piece lengths at each location.

.2 Secure sills in place with concealed anchoring devices located at ends and mid-point; spaced no more than 600]mm on centre in between.

.3 Caulking:

.1 Seal joints between windows and window sills with sealant. Bed sill expansion joint cover plates and drip deflectors in bedding compound. Caulk between sill upstand and window-frame. Caulk butt joints in continuous sills.

.2 Apply sealant in accordance with Section 07 92 00 - Joint Sealants. Conceal sealant within window units except where exposed use is permitted by Departmental Representative.

.4 Low expansion foam:

.1 Ensure compatibility between form and adjacent materials.

.2 Fill gap between window frame and adjacent rough opening with low expansion foam. Do not overfill cavity.

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 reuse and 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 PROTECTION

.1 Protect installed products and components from damage during construction.

.2 Repair damage to adjacent materials caused by window installation.

END OF SECTION

Part 1 General

1.1 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-69.20-M90/ANSI/BHMA A156.4-1986, Door Controls (Closers).

.3 CAN/CGSB-69.22-M90/ANSI/BHMA A156.6-1986, Architectural Door Trim.

.4 CAN/CGSB-69.29-93/ANSI/BHMA A156.13-1987, Mortise Locks and Latches.

.5 CAN/CGSB-69.32-M90/ANSI/BHMA A156.16-1981, Auxiliary Hardware.

1.2 ACTION AND INFORMATIONAL 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.

1.3 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.

1.4 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 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.

1.5 WASTE DISPOSAL AND MANAGEMENT

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

1.6 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 Use one manufacturer's products only for similar items.

2.2 DOOR HARDWARE

.1 Locks and latches:

.1 Mortise locks and latches: to CAN/CGSB-69.29, series 1000 mortise lock, grade 1, designed for function as stated in Hardware Schedule.

.2 Lever handles: Corbin Russwin ‘LWR’ design.

.3 Escutcheons: Cast.

.4 Normal strikes: box type, lip projection not beyond jamb.

.5 Cylinders: Corbin Russwin 6 pin, random bitted, L4 cylinder for construction purposes; Keying by Owner.

.6 Finish: 626 satin chrome.

.7 Acceptable manufacturer: Corbin Russwin

.8 List of locksets:

.1 ANSI F15: Corbin Russwin Model ML2029-LWR-626.

.2 Butts and hinges:

.1 Butts and hinges: to CAN/CGSB-69.18.

.2 Manufacturers: Stanley, Hager, Monthard, McKinney or approved alternate.

.3 List of hinges: FBB 168 114 x 114 NRP.

.3 Door Closers and Accessories:

.1 Door controls (closers): to CAN/CGSB-69.20, Grade One, heavy duty, adjustable hydraulic back check, separate regulation of closing speed and latching speed, rack and pinion action. Size in accordance with CAN/CGSB-69.20, Table A1, finished to 626.

.2 Manufacturers: LCN, Sargent, Norton, Rixson or approved alternate.

.3 List of closers: LCN 4040 with delayed action function.

.4 Architectural door trim: to CAN/CGSB-69.22, listed in Hardware Schedule, and as listed below.

.1 Door protection plates: kick plate type, 1.6 mm thick stainless steel, 300 mm high by 25 mm less than door width, finished to satin steel.

.5 Auxiliary hardware: to CAN/CGSB-69.32, listed in Hardware Schedule and as listed below.

.1 Door check chain: heavy duty compression springs, heavy duty welded steel chain, vinyl cover, 650 mm long, 26D finish.

.6 Thresholds: 125 mm wide x full width of door opening, stainless steel, mill finish, serrated surface, with thermal break of rigid PVC.

.7 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, door seal of extruded aluminum frame and closed cell neoprene weather seal, surface mounted, closed ends, adjustable, clear anodized finish.

2.3 FASTENINGS

.1 Use only fasteners provided by manufacturer. Failure to comply may void warranties and applicable licensed labels.

.2 Supply screws, bolts, expansion shields and other fastening devices required for satisfactory installation and operation of hardware.

.3 Exposed fastening devices to match finish of hardware.

.4 Use fasteners compatible with material through which they pass.

2.4 KEYING

.1 Door locks to be keyed by Owner.

.2 Provide blank keys in duplicate for every lock in this Contract.

.3 Provide construction cores.

.4 Provide all permanent cores and keys to 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.

.4 Remove construction cores when directed by Departmental Representative.

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 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.

3.5 SCHEDULE

.1 Door 101A:

.1 1 lockset
.2 1½ pair hinges, NRP.
.3 1 closer.
.4 1 kick plate (interior side).
.5 1 check chain.
.6 1 threshold.
.7 1 set weatherstripping c/w door bottom seal.

.2 Door 101B and Door 101C:

.1 1 threshold.

END OF SECTION

Part 1 General

1.1 REFERENCES

.1 American National Standards Institute (ANSI).

.1 ANSI/ASTM E330-02(2010), 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), Specification for Lock-Strip Gaskets.

.2 ASTM D2240-05(2010), Test Method for Rubber Property - Durometer Hardness.

.3 Canadian General Standards Board (CGSB).

.1 CAN/CGSB-12.3-M91, Flat, Clear Float Glass.

.2 CAN/CGSB-12.8-97, Insulating Glass Units.

.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 Performance Requirements:

.1 Provide continuity of building enclosure vapour and air barrier using glass and glazing materials.

.2 Size glass to withstand wind loads, dead loads and positive and negative live loads as measured in accordance with ANSI/ASTM E330.

.3 Limit glass deflection to 1/200 with full recovery of glazing materials.

1.3 ACTION AND INFORMATIONAL SUBMITTALS

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

.2 Product Data:

.1 Submit manufacturer's instructions, printed product literature and data sheets for glass, sealants, glazing accessories and include product characteristics, performance criteria, physical size, finish and limitations.

.3 Shop Drawings:

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

.4 Samples:

.1 Submit for review and acceptance of each unit.

.2 Samples will be returned for inclusion into work.

.5 Certificates: submit product certificates signed by manufacturer certifying materials comply with specified performance characteristics and criteria and physical requirements.

.6 Test Reports: certified test reports showing compliance with specified performance characteristics and physical properties.

.1 Submit testing of glass under provisions of Section 01 45 00 - Quality Control.

1.4 CLOSEOUT SUBMITTALS

.1 Submit in accordance with Section 01 78 00 - Closeout Submittals.

.2 Operation and Maintenance Data: submit operation and maintenance data for glazing for incorporation into manual.

1.5 QUALITY ASSURANCE

.1 Certificates: product certificates signed by manufacturer certifying materials comply with specified performance characteristics and criteria and physical requirements.

.2 Mock-ups:

.1 Construct mock-ups in accordance with Section 01 45 00 - Quality Control.

.2 Construct mock-up to including glass, glazing, and perimeter air barrier and vapour retarder seal.

.3 Mock-up will be used:

.1 To judge workmanship, substrate preparation, operation of equipment and material application.

.4 Locate where directed.

.5 Allow 24 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.

1.6 DELIVERY, STORAGE AND HANDLING

.1 Deliver, store and handle materials in accordance with Section 01 61 00 - Common Product Requirements and with manufacturer's written instructions.

.2 Delivery and Acceptance Requirements: deliver materials to site in original factory packaging, labelled with manufacturer's name and address.

.3 Storage and Handling Requirements:

.1 Store materials off ground, in dry location and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.

.2 Store and protect glazing and frames from nicks, scratches, and blemishes.

.3 Protect prefinished aluminum surfaces with wrapping.

.4 Replace defective or damaged materials with new.

.4 Develop Waste Reduction Workplan related to Work of this.

1.7 AMBIENT CONDITIONS

.1 Ambient 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.

Part 2 Products

2.1 MATERIALS

.1 Design Criteria:

.1 Ensure continuity of building enclosure vapour and air barrier using glass and glazing materials as follow:

.1 Utilize inner light of multiple light sealed units for continuity of air and vapour seal.

.2 Size glass to withstand wind loads, dead loads and positive and negative live loads to ASTM E330.

.3 Limit glass deflection to 1/200 with full recovery of glazing materials.

.2 Flat Glass:

.1 Float glass: to CAN/CGSB-12.3, thickness as indicated.

.3 Insulating Glass Units:

.1 Insulating glass units: to CAN/CGSB-12.8, double unit, 25 mm overall thickness.

.1 Glass: to CAN/CGSB-12.3.

.2 Glass thickness: 6 mm each light.

.3 Exterior Lite:

.1 Heat strengthened.

.2 Colour: clear.

.4 Inter-cavity space thickness: 12.7 mm with low conductivity spacers.

.5 Interior Lites:

.1 Colour: clear.

.6 Glass coating: Low E coating, surface number 2.

.1 Manufacturers:

.1 AGC “Comfort TI-AC-40.”

.2 PPG “Solarban 60.”

.3 Approved alternate.

.7 Inert gas fill: argon.

.8 Spacer: warm edge “Superspacer.”

2.2 ACCESSORIES

.1 Sealant: in accordance with 07 92 00 - Joint Sealants.

.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: as recommended by aluminum window manufacturer.

.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 Verification of Conditions: verify conditions of substrates previously installed under other Sections or Contracts are acceptable for glazing installation in accordance with manufacturer's written instructions.

.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 Visually inspect substrate in presence of Departmental Representative.

.4 Inform Departmental Representative of unacceptable conditions immediately upon discovery.

.5 Proceed with installation only after unacceptable conditions have been remedied and after receipt of written approval to proceed from Departmental Representative.

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 GANA Glazing Manual, and GANA Laminated Glazing Reference 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 CLEANING

.1 Progress Cleaning: clean in accordance with Section 01 74 11 - Cleaning.

.1 Leave Work area clean at end of each day.

.1 Remove traces of primer, caulking.

.2 Remove glazing materials from finish surfaces.

.3 Remove labels.

.4 Clean glass [and mirrors] using approved non-abrasive cleaner in accordance with manufacturer's instructions.

.2 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment in accordance with Section 01 74 11 - Cleaning.

.2 Waste Management: separate waste materials for reuse and 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.

3.6 PROTECTION OF FINISHED WORK

.1 Protect installed products and components from damage during construction.

.2 After installation, mark each light with an "X" by using removable plastic tape or paste.

.1 Do not mark heat absorbing or reflective glass units.

.3 Repair damage to adjacent materials caused by glazing installation.

3.7 SCHEDULE

.1 Refer to drawings.

END OF SECTION

Part 1 General

1.1 SUMMARY

.1 Provide an abrasion, impact and chemical-resistant, high-performance, resin-based, monolithic floor surfacing designed to produce a seamless floor, complete with a slip-resistant surface.

1.2 REFERENCES

.1 American Society for Testing Materials International (ASTM)

.1 ASTM C811-98(2008), Standard Practice for Surface Preparation of Concrete for Application of Chemical-Resistant Resin Monolithic Surfacings.

.2 ASTM C1028-07e1, Standard Test Method for Determining the Static Coefficient of Friction of Ceramic Tile and Other Like Surfaces by the Horizontal Dynamometer Pull-Meter Method.

.3 ASTM D638-14, Standard Test Method for Tensile Properties of Plastics.

.4 ASTM D2240-05(2010), Standard Test Method for Robber Property - Durometer Hardness.

.5 ASTM D2794-93(2010), Standard Test Method for Resistance of Organic Coatings to the Effects of Rapid Deformation (Impact)

.6 ASTM D4060-10, Standard Test Method for Abrasion Resistance of Organic Coatings by the Taber Abraser.

.7 ASTM D4541-09e1, Standard Test Method for Pull-Off Strength of Coatings Using Portable Adhesion Testers.

.2 Canadian General Standards Board (CGSB)

.1 CGSB 81-GP-4M, Flooring, Seamless, Decorative Epoxy, Troweled Finish.

.2 CGSB 81-GP-5M, Flooring, Seamless, Epoxy, Broadcast Quartz.

.3 CGSB 81-GP-10M, Application of Seamless Flooring.

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

.1 Material Safety Data Sheets (MSDS).

1.3 ACTION AND INFORMATIONAL 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 600 x 600 mm sample of flooring as representative of specified colour, texture, and finish.

.2 Retain reviewed samples on-site to demonstrate acceptable standard of quality for appropriate on-site surface.

.4 Closeout Submittals:

.1 Provide maintenance data for resinous flooring for incorporation into manual specified in Section 01 78 00 - Closeout Submittals.

.1 Product name, type, and use.

.2 Manufacturer's product number.

.3 Colour numbers.

1.4 DELIVERY, STORAGE AND HANDLING

.1 Deliver, store and handle materials in accordance with Section 01 61 00 - Common Product Requirements.

.2 Store materials in original undamaged condition with manufacturer's labels and seals intact. Prevent damage to materials during handling and storage.

.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.

1.5 ENVIRONMENTAL REQUIREMENTS

.1 Maintain minimum air temperature and structural base temperature at flooring installation area above 20 degrees C for 48 hours before, during and for 48 hours after installation.

.2 Concrete must be free of hydrostatic, capillary or moisture vapor pressure. Moisture content of concrete not to exceed 1.8kg/93m^3 (4lbs/1,000ft^2) per 24 hours when tested by the quantitative calcium chloride test method.

.3 Do not apply materials unless surface to receive coating is clean and dry.

1.6 QUALITY ASSURANCE

.1 Manufacturer:

.1 Minimum five (5) years documented experience installation of fluid-applied floors.

.2 Installer shall be an authorized representative of the flooring manufacturer.

.3 Installer shall be skilled and experienced in the application of this product based on type and size required for this project.

Part 2 Products

2.1 MATERIALS

.1 In conformance with CGSB 81-GP-4M, CGSB 81-GP-5M, and CGSB 81-GP-10M.

.2 System based on HP Spartacote, Sparta-Guard SL Self-Leveling Solid Color Aviation Hanger Resinous Flooring System

.3 Primer (One Coat)

.1 100% solids, self-levelling epoxy concrete primer.

.2 Thickness: 20 mils

.3 Acceptable products

.1 Spartacote HP Surface Build SL Self Leveling Epoxy

.2 Approved alternate

.4 Body Coats (Two Coats)

.1 100% solids, Self Leveling Epoxy.

.2 Thickness: 40 mils (20 + 20)

.3 Silica sand as required to achieve thickness.

.4 Approved products

.1 Spartacote HP Surface Build SL Self Leveling Epoxy

.2 Approved alternate

.5 Mid-Coat (One Coat)

.1 72% Solids, Polyaspartic Aliphatic Polyurea, pigmented, non-yellowing.

.2 Thickness: 6 mils

.3 Acceptable products

.1 Sparta-Flex Pigmented

.2 Approved alternate

.6 Top Coat (Two Coats)

.1 72% solids chemical resistant, two-component, polyester aliphatic polyurea, clear epoxy non-yellowing, non-flammable.

.2 Thickness: 20 mils (10 + 10)

.3 Acceptable products

.1 Sparta-Flex Clear

.2 Approved alternate

.4 Slip Resistant Aggregates

.1 Uniformly graded (20 – 40 mesh) pulverized resin

.2 Acceptable products

.1 Sparta-Grip

.2 Approved alternate.

.7 Heavy Duty Wear Coat (Two Coats)

.1 Thickness: 8 (4 + 4)

.2 Acceptable products

.1 Diamond-Topp

.2 Approved alternate.

.8 Crack and joint filler: two-component, 100% solids, self leveling polyurea.

.1 Acceptable products

.1 Spartacote Joint-Flex

.2 Approved alternate

.9 Resin: Polyaspartic Aliphatic Polyurea

.10 Formulation: ultra-high solids

.11 Overall system thickness: 100 mils.

.12 Colour: as selected by Departmental Representative from manufacturer’s full range.

.13 Acceptable Products:

.1 Sparta-Guard SL (Aviation Hanger) by HP Spartacote.

.2 Approved alternate.

2.2 PERFORMANCE CRITERIA

.1 Resinous flooring system

.1 Coefficient to friction: dry: 0.83, wet: 0.98 to ASTM C1028

.2 Tensile strength: 4,500 psi to ASTM D638.

.3 Impact Direct/Reverse: 160/160 to ASTM D2794

.4 Adhesion: 400 psi to ASTM D4541.

.5 Abrasion Resistance: 22-28 maximum weigh loss to ASTM D4060

.6 Hardness: Shore D: 80 to ASTM D2240.

2.3 MIXES

.1 Comply with manufacturer’s written instruction for mixing procedures

.2 Carefully measure and mix the components together.

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 INSPECTION

.1 Ensure concrete floors are dry, by using test methods recommended by flooring manufacturer.

3.3 SUB-FLOOR TREATMENT

.1 De-grease, chemically clean, and roughen existing concrete substrate to a profile as per manufacturer’s instructions. Further preparation to prepare existing floor to ensure complete bonding shall be performed only as directed by manufacturer for application of new material over concrete floor.

3.4 FLOORING APPLICATION

.1 Workers shall be fully trained and experienced.

.2 Prepare surface of substrate in accordance with flooring material manufacturer’s written instructions.

.3 Patch cracks & other openings in substrate using epoxy filler.

.4 Grind down uneven joints, rough areas, projections and foreign matter from surfaces to receive flooring.

.5 Mask adjacent surfaces and apply seamless flooring and base in accordance with manufacturer’s directions.

.6 Broadcast or trowel apply flooring, as per manufacturer’s written instructions, thicknesses noted, tightly compacted and free from surface holes and depressions.

.7 Application consists of one prime coat, two body coats, one mid coat, two top coats and slip resistant aggregate, and two heavy duty wear coats. Apply slip-resistant aggregate as per manufacturer’s written instructions.

.8 Allow aggregate, grout and glaze coats to dry to touch between coats. Do not apply more than 2 coats per day.

.9 At completion of work clean up and remove all surplus materials and debris.

.10 Mix non-slip grit into top coat at rate consistent with approved sample.

3.5 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.

3.6 CLEANING

.1 Proceed in accordance with Section 01 74 11 - Cleaning.

.2 Remove excess flooring from base, wall, and adjacent surfaces without damage.

.3 Clean floor and base surface to flooring manufacturer's instructions.

3.7 PROTECTION

.1 Protect new floors from time of final set until final inspection.

.2 Prohibit traffic on floor for 48 hours after installation.

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 The Master Painters Institute (MPI)

.1 Architectural Painting Specification Manual - current edition.

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 paint and coating products and include product characteristics, performance criteria, physical size, finish and limitations.

.2 Submit 2 copies of WHMIS MSDS.

.3 Samples:

.1 Submit for review and acceptance of each unit.

.2 Submit duplicate 200 x 300 mm sample panels of each paint and special finish with specified paint or coating in colours, gloss/sheen and textures required to MPI Painting Specification Manual standards.

.4 Certificates: submit product certificates signed by manufacturer certifying materials comply with specified performance characteristics and criteria and physical requirements.

.5 Sustainable Design Submittals:

.1 Construction Waste Management:

.1 Submit project Waste Reduction Workplan highlighting recycling and salvage requirements.

1.3 DELIVERY, STORAGE AND HANDLING

.1 Deliver, store and handle materials in accordance with Section 01 61 00 - Common Product Requirements and with manufacturer's written instructions.

.2 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 Provide and maintain dry, temperature controlled, secure storage.

.2 Store painting materials and supplies away from heat generating devices.

.3 Store materials and equipment in well ventilated area within temperature as recommended by manufacturer.

.4 Fire Safety Requirements:

.1 Supply 1 - 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.

.5 Develop Waste Reduction Workplan related to Work of this.

1.4 SITE CONDITIONS

.1 Heating, Ventilation and Lighting:

.1 Ventilate enclosed spaces in accordance with Section 01 51 00 - Temporary Utilities.

.2 Provide temporary ventilating and heating equipment.

.3 Provide minimum lighting level of 323 Lux on surfaces to be painted.

.2 Temperature, Humidity and Substrate Moisture Content Levels:

.1 Apply paint finishes when ambient air and substrate temperatures at location of installation can be satisfactorily maintained during application and drying process, within MPI and paint manufacturer's prescribed limits.

.2 Test concrete, masonry and plaster surfaces for alkalinity as required.

.3 Apply paint to adequately prepared surfaces, when moisture content is below paint manufacturer's prescribed limits.

.3 Additional application requirements:

.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 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 Supply paint materials for paint systems from single manufacturer.

.2 Conform to latest MPI requirements for painting work including preparation and priming.

.3 Materials in accordance with MPI - Architectural Painting Specification Manual "Approved Product" listing.

.1 Use MPI listed materials having E2 or E3 rating where indoor air quality requirements exist.

.2 Primer: VOC limit 100 g/L maximum.

.3 Paint: VOC limit 100 g/L maximum.

.4 Colours:

.1 Base colour schedule on selection of 2 base colours and 1 accent colours.

.2 Exterior portion of personnel door frame and door colour to match colour of hangar door exterior cladding.

.3 Interior portion of personnel door frame and door colour to match colour of hangar door interior liner panel.

.5 Mixing and tinting:

.1 Perform colour tinting operations prior to delivery of paint to site, in accordance with manufacturer's written recommendations. Obtain written approval from Departmental Representative for tinting of painting materials.

.2 Use and add thinner in accordance with paint manufacturer's recommendations.

.1 Do not use kerosene or similar organic solvents to thin water-based paints.

.3 Thin paint for spraying in accordance with paint manufacturer's written recommendations.

.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.

.6 Gloss/sheen ratings:

.1 Paint gloss is defined as sheen rating of applied paint, in accordance with following values:

Gloss Level-Category	Gloss @ 60 degrees	Sheen @ 85 degrees
Gloss Level 1 - Matte Finish	Max. 5	Max. 10
Gloss Level 2 - Velvet	Max.10	10 to 35
Gloss Level 3 - Eggshell	10 to 25	10 to 35
Gloss Level 4 - Satin	20 to 35	min. 35
Gloss Level 5 - Semi-Gloss	35 to 70	
Gloss Level 6 - Gloss	70 to 85	
Gloss Level 7 - High Gloss	More than 85	

.2 Gloss level ratings of painted surfaces as indicated.

.7 Exterior painting:

.1 Concrete Horizontal Surfaces.

.1 EXT 3.2F - Alkyd zone/traffic marking finish for directional lines.

.2 Galvanized Metal: not chromate passivated (exterior door and frame).

.1 EXT 5.3B – Alkyd, G5, premium finish

.8 Interior painting:

.1 Concrete horizontal surfaces: floors:

.1 INT 3.2C - Epoxy finish (for parking lines).

.2 INT 3.2F - Concrete floor sealer (confirm requirements for specified floor finishes)

.2 Galvanized Metal: high contact/high traffic areas (interior doors and frames) and pipes.

.1 INT 5.3N - Institutional low odour/low VOC, G5, premium finish.

Part 3 Execution

3.1 GENERAL

.1 Compliance: comply with manufacturer's written recommendations or specifications, including product technical bulletins, handling, storage and installation instructions, and data sheets.

.2 Perform preparation and operations for interior painting in accordance with MPI - Architectural Painting Specifications Manual except where specified otherwise.

3.2 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.

3.3 PREPARATION

.1 Protection of in-place conditions:

.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.

.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.

.4 Clean and prepare surfaces in accordance with MPI - Architectural Painting Specification Manual specific requirements and coating manufacturer's recommendations.

.5 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.

.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.

.8 Touch up of shop primers with primer as specified.

3.4 APPLICATION

.1 Paint only after prepared surfaces have been accepted by Departmental Representative.

.2 Use method of application approved by Departmental Representative.

.1 Conform to manufacturer's application recommendations.

.3 Apply coats of paint in continuous film of uniform thickness.

.1 Repaint thin spots or bare areas before next coat of paint is applied.

.4 Allow surfaces to dry and properly cure after cleaning and between subsequent coats for minimum time period as recommended by manufacturer.

.5 Sand and dust between coats to remove visible defects.

.6 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.

.7 Finish top, bottom, edges and cutouts of doors after fitting as specified for door surfaces.

.8 Mechanical/Electrical Equipment:

.1 Paint conduits, piping, hangers, ductwork and other mechanical and electrical equipment exposed in finished areas, to match adjacent surfaces, except as indicated.

.2 Do not paint over nameplates.

.3 Keep sprinkler heads free of paint.

.4 Paint natural gas piping yellow.

.5 Paint both sides and edges of backboards for telephone and electrical equipment before installation.

.1 Leave equipment in original finish except for touch-up as required, and paint conduits, mounting accessories and other unfinished items.

3.5 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 reuse and 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.

.4 Place paint and primer defined as hazardous or toxic waste, including tubes and containers, in containers or areas designated for hazardous waste.

END OF SECTION

Part 1 General

1.1 PRODUCT DATA

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

1.2 SAMPLES

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

.2 Submit for approval: complete assembly of each type of insulation, coating, and adhesive proposed. Mount sample on 12 mm plywood board. Affix typewritten label beneath sample indicating service.

1.3 QUALIFICATIONS

.1 Installer to be 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.

1.4 DELIVERY, STORAGE AND HANDLING

.1 Deliver materials to site in original factory packaging, labelled with manufacturer's name, address.

.2 Protect from weather and construction traffic.

.3 Protect against damage from any source.

.4 Store at temperatures and conditions recommended by manufacturer.

1.5 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 for recycling in accordance with Waste Management Plan.

.3 Divert unused metal materials from landfill to metal recycling facility approved by Consultant.

.4 Divert unused adhesive materials from landfill to official hazardous material collections site approved by Consultant.

.5 Do not dispose of unused adhesive 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 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: includes glass fibre, rock wool, slag wool.

.2 Thermal conductivity ("k" factor) not to exceed specified values at 24°C mean temperature when tested in accordance with ASTM C335.

.3 TIAC Code A-1: Rigid moulded mineral fibre without factory applied vapour retarder jacket.

.1 Mineral fibre: ASTM C547.

.2 Maximum "k" factor: ASTM C547.

.4 TIAC Code A-3: Rigid moulded mineral fibre with factory applied vapour retarder jacket.

.1 Mineral fibre: ASTM C547.

.2 Jacket: to CGSB 1-GP-52Ma.

.3 Maximum "k" factor: ASTM C547.

.5 TIAC Code C-1: Rigid mineral fibre board, unfaced.

.1 Mineral fibre: ASTM C612.

.2 Maximum "k" factor: ASTM C612.

.6 TIAC Code C-4: Rigid mineral fibre board faced with factory applied vapour retarder jacket.

.1 Mineral fibre: ASTM C612.

.2 Jacket: to CGSB51-GP-52Ma.

.3 Maximum "k" factor: ASTM C612.

.7 TIAC Code C-2: Mineral fibre blanket unfaced or faced with factory applied vapour retarder jacket (as scheduled in PART 3 of this section).

.1 Mineral fibre: ASTM C553.

.2 Jacket: to CGSB 51-GP-52Ma.

.3 Maximum "k" factor: ASTM C553.

2.3 CEMENT

.1 Thermal insulating and finish

.1 To: ASTM C449/C449M.

.2 Hydraulic setting or Air drying on mineral wool, to ASTM C449.

2.4 JACKETS

.1 Aluminium:

.1 To ASTM B209.

.2 Thickness: 0.50 mm sheet.

.3 Finish: Stucco finish.

.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.

2.5 INSULATION SECUREMENTS

.1 Tape: Self-adhesive, aluminium, reinforced, 50 mm wide minimum.

.2 Contact adhesive: Quick setting.

.3 Tie wire: 1.5 mm diameter stainless steel.

.4 Bands: Stainless steel, 19 mm wide, 0.5 mm thick.

.5 Fasteners: 2 mm diameter pins with 35 mm diameter square clips. Length of pin to suit thickness of insulation.

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.

Part 3 Execution

3.1 PRE- INSTALLATION REQUIREMENTS

.1 Pressure testing of equipment and adjacent piping systems complete, witnessed and certified.

.2 Surfaces clean, dry, free from foreign material.

3.2 INSTALLATION

.1 Install in accordance with TIAC National Standards

.1 Hot equipment: To TIAC code 1503-H.

.2 Cold equipment: to TIAC code 1503-C.

.2 Elastomeric Insulation: to remain dry. Overlaps to manufacturer's instructions. Joints tight and sealed properly.

.3 Provide vapour retarder as recommended by manufacturer.

.4 Apply materials in accordance with insulation and equipment manufacturer's instructions and this specification.

.5 Use two layers with staggered joints when required nominal wall thickness exceeds 75 mm.

.6 Maintain uninterrupted continuity and integrity of vapour retarder jacket and finishes.

.1 Hangers, supports outside vapour retarder jacket.

.7 Supports, Hangers:

.1 Apply high compressive strength insulation, suitable for service, at oversized saddles and shoes where insulation saddles have not been provided.

3.3 REMOVABLE, PRE-FABRICATED, INSULATION AND ENCLOSURES

.1 Application: At expansion joints, valves, primary flow measuring elements flanges and unions at equipment.

.2 Installation to permit movement of expansion joint and to permit periodic removal and replacement without damage to adjacent insulation.

3.4 EQUIPMENT INSULATION SCHEDULES

.1 Includes valves, valve bonnets, strainers, flanges and fittings unless otherwise specified.

.2 Hot Equipment:

.1 TIAC code A-1 or C-1 with mechanical fastenings or wire or bands and 13 mm cement reinforced with one layer of reinforcing mesh.

.2 TIAC code C-2 unfaced with wire or bands and 13 mm cement precede by one layer of reinforcing mesh.

.3 Thicknesses:

Domestic hot water storage tanks	25mm
Heat exchangers	50mm
Steam condensate receivers	50mm
Deaerator-feedwater heaters	50mm

.3 Cold equipment:

.1 TIAC A-3 or C-4 with mechanical fastenings or wire or bands and 13 mm cement reinforced with one layer of reinforcing mesh.

.2 TIAC C-2 faced with vapour retardant jacket and with wire or bands and 13 mm cement preceded by one layer of reinforcing mesh.

.3 TIAC A-6 or C-4 with mechanical fastenings or wire or bands.

.4 Thicknesses: Chillers (except factory insulated) 50 mm.

.4 Finishes:

.1 Equipment in mechanical rooms: TIAC code CEF/1 with canvass jacket.

.2 Equipment elsewhere: TIAC code CEF/2 with canvass jacket.

END OF SECTION

Part 1 General

1.1 RELATED SECTIONS

.1 Section 01 33 00 - Submittal Procedures].

.2 Section 01 74 19 - Construction/Demolition Waste Management And Disposal].

.3 Section 07 92 10 - Joint Sealing].

1.2 REFERENCES

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

.1 ASHRAE Standard 90.1-[99], Energy Efficient Design of New Buildings Except Low-Rise Residential Buildings (Including Addenda B, C, D, E, F, G, I and M) (includes supplements).

.2 American Society for Testing and Materials (ASTM)

.1 ASTM B209M-[01], Specification for Aluminum and Aluminum Alloy Sheet and Plate [Metric].

.2 ASTM C335-[95], Test Method for Steady State Heat Transfer Properties of Horizontal Pipe Insulation.

.3 ASTM C411-[97], 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 C795-[92(1998)e1], Standard Specification for Thermal Insulation for Use in Contact with Austenitic Stainless Steel.

.6 ASTM C921-[89(1996)], 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 Manufacturer's Trade Associations

.1 Thermal Insulation Association of Canada (TIAC): National Insulation Standards (Revised 1999).

.5 Underwriters' Laboratories of Canada (ULC)

.1 CAN/ULC-S102-[M88(R2000)], 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

□

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 defined herein.

.2 TIAC ss:

.1 CRF: Code Rectangular Finish.

.2 CPF: Code Piping Finish.

1.4 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 pipe, fittings, valves and jointing recommendations.

1.5 SAMPLES

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

.2 Submit for approval: complete assembly of each type of insulation system, insulation, coating, and adhesive proposed. Mount sample on 12 mm plywood board. Affix typewritten label beneath sample indicating service.

1.6 MANUFACTURERS' INSTRUCTIONS

.1 Submit manufacturers' installation instructions in accordance with Section 01 33 00 - Submittal Procedures.

.2 Installation instructions to include procedures to be used, installation standards to be achieved.

1.7 QUALIFICATIONS

.1 Installer to be 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.

1.8 DELIVERY, STORAGE AND HANDLING

.1 Deliver materials to site in original factory packaging, labelled with manufacturer's name, address.

.2 Protect from weather, construction traffic.

.3 Protect against damage from any source.

.4 Store at temperatures and conditions required by manufacturer.

□

1.9 WASTE MANAGEMENT AND DISPOSAL

.1 Separate and recycle waste materials in accordance with Section 01 74 19 - Construction/Demolition Waste Management And Disposal.

.2 Divert unused metal and wiring materials from landfill to metal recycling facility approved by Consultant.

.3 Dispose of unused paint material at official hazardous material collections site approved by Consultant.

.4 Do not dispose of unused paint material into sewer system, into streams, lakes, onto ground or in any other location where it will pose health or environmental hazard.

.5 Remove from site and dispose of packaging materials at appropriate recycling facilities.

.6 Dispose of corrugated cardboard, polystyrene, and plastic packaging material in appropriate on-site bin for recycling in accordance with site waste management program.

Part 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, rock wool, slag wool.

.2 Thermal conductivity ("k" factor) not to exceed specified values at 24 °C mean temperature when tested in accordance with ASTM C335.

.3 TIAC Code A-1: Rigid moulded mineral fibre without factory applied vapour retarder jacket.

.1 Mineral fibre: to CAN/ULC-S702.

.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.

.2 Jacket: to CGSB 51-GP-52Ma.

.3 Maximum "k" factor: to CAN/ULC-S702.

.5 TIAC Code C-2: Mineral fibre blanket faced [with] [without] factory applied vapour retarder jacket (as scheduled in PART 3 of this section).

□

.1 Mineral fibre: to CAN/ULC-S702.

.2 Jacket: to CGSB 51-GP-52Ma.

.3 Maximum "k" factor: to CAN/ULC-S702.

2.3 INSULATION SECUREMENT

.1 Tape: Self-adhesive, aluminum.

.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.

2.4 CEMENT

.1 Thermal insulating and finishing cement:

.1 Air drying on mineral wool, to ASTM C449/C449M.

2.5 VAPOUR RETARDER LAP ADHESIVE

.1 Water based, fire retardant type, compatible with insulation.

2.6 INDOOR VAPOUR RETARDER FINISH

.1 Vinyl emulsion type acrylic, compatible with insulation.

2.7 OUTDOOR VAPOUR RETARDER FINISH

.1 Vinyl emulsion type acrylic, compatible with insulation.

.2 Reinforcing fabric: Fibrous glass, untreated 305 g/m^2.

2.8 JACKETS

.1 Polyvinyl Chloride (PVC):

.1 One-piece moulded type [and sheet] to CAN/CGSB-51.53 with pre-formed shapes as required.

.2 Colours: to match adjacent finish paint.

.3 Minimum service temperatures: -20°C.

.4 Maximum service temperature: 65°C.

.5 Moisture vapour transmission: 0.02 perm.

.6 Thickness: to be determined on site/

.7 Fastenings:

.1 Use solvent weld adhesive compatible with insulation to seal laps and joints.

□

.2 Tacks.

.3 Pressure sensitive vinyl tape of matching colour.

.2 ABS Plastic:

.1 One-piece moulded type with pre-formed shapes as required.

.2 Colours: to match adjacent finish paint.

.3 Minimum service temperatures: -40°C.

.4 Maximum service temperature: 82°C.

.5 Moisture vapour transmission: 0.012 perm.

.6 Thickness: [0.75] mm.

.7 Fastenings:

.1 Solvent weld adhesive compatible with insulation to seal laps and joints.

.2 Tacks.

.3 Pressure sensitive vinyl tape of matching colour.

.8 Locations:

.1 For outdoor use ONLY.

.3 Canvas:

.1 220 and 120 gm/m^2 cotton, plain weave, treated with dilute fire retardant lagging adhesive to ASTM C921.

.2 Lagging adhesive: Compatible with insulation.

.4 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.

2.9 WEATHERPROOF CAULKING FORJACKETS INSTALLED OUTDOORS

.1 Caulking to: Section 07 92 10 - Joint Sealing.

Part 3 Execution

3.1 PRE- INSTALLATION REQUIREMENT

.1 Pressure testing of piping systems and adjacent equipment to be complete, witnessed and certified.

.2 Surfaces to be 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 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 Hangers, supports to be 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.

3.3 REMOVABLE, PRE-FABRICATED, INSULATION AND ENCLOSURES

.1 Application: At expansion joints, valves, primary flow measuring elements flanges and unions at equipment.

.2 Design: To permit movement of expansion joint and to permit periodic removal and replacement without damage to adjacent insulation.

.3 Insulation:

.1 Insulation, fastenings and finishes: same as system.

.2 Jacket: high temperature fabric.

3.4 INSTALLATION OF ELASTOMERIC INSULATION

.1 Insulation to remain dry at all times. Overlaps to manufacturers instructions. Ensure tight joints.

.2 Provide vapour retarder as recommended by manufacturer.

3.5 PIPING INSULATION SCHEDULES

.1 Includes valves, valve bonnets, strainers, flanges and fittings unless otherwise specified.

.2 TIAC Code: [A-1].

.1 Securements: Tape at 300 mm oc.

.2 Seals: lap seal adhesive, lagging adhesive.

.3 Installation: TIAC Code [1501-H].

.3 TIAC Code: [A-3].

.1 Securements: Tape at 300 mm oc.

.2 Seals: VR lap seal adhesive, VR lagging adhesive.

.3 Installation: TIAC Code: [1501-C].

□

.4 Thickness of insulation to be 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 °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	8 & over
Glycol Heating	60 - 94	[A-1]	25	38	38	38	38	38
Glycol Heating	up to 59	[A-1]	25	25	25	25	38	38

.5 Finishes:

.1 Exposed indoors: PVC jacket.

.2 Use vapour retarder jacket on TIAC code A-3 insulation compatible with insulation.

.3 Finish attachments: bands, at 150 mm oc. Seals: closed.

.4 Installation: To appropriate TIAC code CRF/1 through CPF/5.

END OF SECTION

□

Part 1 General

1.1 RELATED SECTIONS

.1 Section [01 33 00 - Submittal Procedures].

.2 Section [01 74 19 - Construction/Demolition Waste Management And Disposal].

.3 Section [01 78 00 - Closeout Submittals].

.4 Section [01 91 00 - Commissioning].

1.2 SHOP DRAWINGS AND PRODUCT DATA

.1 Submit shop drawings and product data in accordance with Section [01 33 00 - Submittal Procedures].

.2 Drawings to indicate:

.1 Equipment, including connections, fittings, control assemblies and ancillaries. Identify whether factory or field assembled.

.2 Wiring and schematic diagrams.

.3 Dimensions and recommended installation.

.4 Pump performance and efficiency curves.

1.3 CLOSEOUT SUBMITTALS

.1 Provide maintenance data for incorporation into manual specified in Section [01 78 00 - Closeout Submittals].

.2 Data to include:

.1 Manufacturers name, type, model year, capacity and serial number.

.2 Details of operation, servicing and maintenance.

.3 Recommended spare parts list with names and addresses.

1.4 WASTE MANAGEMENT AND DISPOSAL

.1 Separate and recycle waste materials in accordance with Section 01 74 19 - Construction/Demolition Waste Management And Disposal.

.2 Collect and separate plastic, paper packaging and corrugated cardboard in accordance with Waste Management Plan.

.3 Fold up metal banding, flatten and place in designated area for recycling.

Part 2 Products

2.1 SUMP PUMP SUBMERSIBLE

.1 Capacity: as indicated on mechanical drawings.

.2 Construction: as indicated on mechanical drawings.

.3 Motor: as indicated on mechanical drawings.

.4 Control: as indicated on mechanical drawings.

.5 Acceptable material: as indicated on mechanical drawings.

Part 3 Execution

3.1 INSTALLATION

.1 Make piping and electrical connections to pump and motor assembly and controls as indicated.

.2 Ensure pump and motor assembly do not support piping.

.3 Align vertical pit mounted pump assembly after mounting and securing cover plate.

.4 Place [150] mm sand under sump pit tank.

3.2 FIELD QUALITY CONTROL

.1 Check power supply.

.2 Check starter protective devices.

.3 Start-up, check for proper and safe operation.

.4 Check settings and operation of hand-off-auto selector switch, operating, safety and limit controls, audible and visual alarms, over-temperature and other protective devices.

.5 Adjust flow from water-cooled bearings.

.6 Adjust impeller shaft stuffing boxes, packing glands.

3.3 START-UP

.1 General:

.1 In accordance with Section [01 91 00 - Commissioning]: General Requirements, supplemented as specified herein.

.2 Procedures:

.1 Check power supply.

.2 Check starter O/L heater sizes.

.3 Start pumps, check impeller rotation.

.4 Check for safe and proper operation.

.5 Check settings, operation of operating, limit, safety controls, over-temperature, audible/visual alarms, other protective devices.

.6 Test operation of HOA switch.

.7 Test operation of alternator.

.8 Adjust leakage through water-cooled bearings.

.9 Adjust shaft stuffing boxes.

.10 Adjust leakage flow rate from pump shaft stuffing boxes to manufacturer's recommendations.

.11 Check base for free-floating, no obstructions under base.

.12 Run-in pumps for 12 continuous hours.

.13 Check installation, operation of mechanical seals, packing gland type seals. Adjust as necessary.

.14 Adjust alignment of piping and conduit to ensure full flexibility at all times.

.15 Eliminate causes of cavitation, flashing, air entrainment.

.16 Measure pressure drop across strainer when clean and with flow rates as finally set.

.17 Replace seals if pump used to degrease system or if pump used for temporary heat.

.18 Verify lubricating oil levels.

3.4 PV - [SANITARY] [AND] [STORM WATER] PUMPS

.1 Application tolerances:

.1 Flow: Plus 10%; Minus 0%.

.2 Pressure: Plus 10%; Minus 5%.

.2 Timing:

.1 NA

.3 PV Procedures:

.1 Fill sump at rate slower than capacity of pump #1.

.2 Record levels at which pump #1 starts and stops. Determine flow rate by observing time taken to down water level.

.3 Fill sump at rate faster than capacity of pump #1 but slower than capacities of pumps #1 and #2 operating in parallel.

.4 Record levels at which pumps start and stop - water level rising and water level falling.

.5 Verify operation of alternator.

.6 Adjust water level controls as necessary.

.7 Fill sump at rate faster than capacities of pumps #1 and #2 operating in parallel.

.8 Record levels at pump starts and stops - water level rising and falling.

.9 Check operation of alternator.

.10 Adjust level controls as necessary.

.11 Check level at which high water level alarm starts and stops. Adjust as necessary.

.4 Check removability of pumps for servicing without interfering with installation or operation of other equipment.

.5 Verify non-clog capability and maximum size of solids, using procedures recommended by manufacturer.

3.5 REPORTS

.1 In accordance with Section 01 91 00 - Commissioning: Reports, supplemented as specified herein.

.2 Include

.1 PV results on approved PV Report Forms.

.2 Product Information report forms.

.3 Pump performance curves (family of curves) with final point of actual performance marked thereon.

3.6 TRAINING

.1 In accordance with Section [01 91 00 - Commissioning]: Training of O&M Personnel, supplemented as specified herein.

END OF SECTION

Part 1 General

1.1 SECTION INCLUDES

.1 Materials and installation for copper domestic water service used in the following:

.1 Hard drawn copper domestic hot and cold water services inside building.

1.2 SUBMITTALS

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

.2 Submit product data for following: valves.

.3 Submit WHMIS MSDS - Material Safety Data Sheets.

.4 Provide maintenance data for incorporation into manual.

1.3 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 for recycling in accordance with Waste Management Plan.

.3 Place excess or unused insulation and insulation accessory materials in designated containers.

.4 Divert unused metal materials from landfill to metal recycling facility approved by Consultant.

.5 Dispose of unused adhesive material at official hazardous material collections site approved by Consultant.

Part 2 Products

2.1 PIPING

.1 Domestic hot, cold and recirculation systems, within building.

.1 Above ground: copper tube, hard drawn, type K L M: to ASTM B88M.

.2 Buried or embedded: copper tube, soft annealed, type K L: to ASTM B88M, in long lengths and with no buried joints.

2.2 FITTINGS

.1 Bronze pipe flanges and flanged fittings, Class 150 and 300: to ANSI/ASME B16.24.

.2 Cast bronze threaded fittings, Class 125 and 250: 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, latex-free 1.6 mm thick: to AWWA C111.

.2 Bolts, nuts, hex head and washers: to ASTM A307, heavy series.

.3 Solder: 95/5 tin copper alloy .

.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 .

.3 NPS 2-1/2 and over, flanged:

.1 Non-rising stem: to MSS-SP-70, Class 125, 860 kPa, flat flange faces, cast-iron body, bronze trim, bolted bonnet specified Section 23 05 23 - Valves - Cast Iron: Gate, Globe, Check.

2.5 GLOBE VALVES

.1 NPS2 and under, soldered:

.1 To MSS-SP-80, Class 125, 860 kPa, bronze body, renewable composition disc, screwed over bonnet as specified Section 23 05 22 - Valves - Bronze .

.2 NPS 2 and under, screwed:

.1 To MSS-SP-80, Class 150, 1 MPa, bronze body, screwed over bonnet, renewable composition disc as specified Section 23 05 22 - Valves - Bronze .

2.6 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, re-grindable 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, re-grindable seat as specified Section 23 05 22 - Valves - Bronze .

.3 NPS 2-1/2 and over, flanged:

.1 To MSS-SP-71, Class 125, 860 kPa, cast iron body, flat flange faces, regrind renewable seat, bronze disc, bolted cap specified Section 23 05 23 - Valves - Cast Iron: Gate, Globe, Check .

2.7 BALL VALVES

.1 NPS 2 and under, screwed:

.1 Class 150.

.2 Bronze body, chrome plated brass stainless steel ball, PTFE adjustable packing, brass gland and PTFE 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 stainless steel ball, PTFE adjustable packing, brass gland and PTFE BunaN seat, steel lever handle, with NPT to copper adaptors as specified Section 23 05 22 - Valves - Bronze .

Part 3 Execution

3.1 INSTALLATION

.1 Assemble piping using fittings manufactured to ANSI standards.

3.2 PRESSURE TESTS

.1 Conform to requirements of Section 23 05 00 - Common Work Results - Mechanical .

.2 Test pressure: greater of 1 times maximum system operating pressure or 860 kPa.

3.3 FLUSHING AND CLEANING

.1 Flush entire system for 8 h. Ensure outlets flushed for 2 h. Let stand for 24 h, then draw one sample off longest run. Submit to testing laboratory to verify that system is clean copper to Provincial potable water guidelines. Let system flush for additional 2 h, then draw off another sample for testing.

3.4 PRE-START-UP INSPECTIONS

.1 Systems to be complete, prior to flushing, testing and start-up.

.2 Verify that system can be completely drained.

.3 Ensure that pressure booster systems are operating properly.

.4 Ensure that air chambers, expansion compensators are installed properly.

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 Check control, limit, safety devices for normal and safe operation.

.4 Rectify start-up deficiencies.

3.6 PERFORMANCE VERIFICATION

.1 Procedures:

.1 Verify compliance with safety and health requirements.

END OF SECTION

Part 1 General

1.1 SUBMITTALS

.1 Submit shop drawings and product data in accordance with Section 01 33 00 - Submittal Procedures.

.2 For product data, indicate dimensions, construction details and materials for items specified herein.

1.2 CLOSEOUT SUBMITTALS

.1 Provide maintenance data for incorporation into manual.

.2 Data to include:

.1 Description of plumbing specialties and accessories, giving manufacturers name, type, model, year and capacity.

.2 Details of operation, servicing and maintenance.

.3 Recommended spare parts list.

1.3 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 for recycling in accordance with Waste Management Plan.

.3 Divert unused metal materials from landfill to metal recycling facility approved by Consultant.

.4 Dispose of unused adhesive material at official hazardous material collections site approved by Consultant.

Part 2 Products

2.1 PRESSURE REGULATORS

.1 Up to NPS1-1/2 bronze bodies, screwed: to ASTM B62.

.2 NPS2 and over, semi-steel bodies, Class 125, flanged: to ASTM A126, Class B.

.3 Semi-steel spring chambers with bronze trim.

2.2 WATER METERS

.1 Displacement type to AWWA C700.

2.3 STRAINERS

.1 860 kPa, Y type with 20 mesh, monel, bronze or stainless steel removable screen.

.2 NPS2 and under, bronze body, screwed ends, with brass cap.

.3 NPS22 and over, cast iron body, flanged ends, with bolted cap.

Part 3 Execution

3.1 INSTALLATION

.1 Install in accordance with Canadian Plumbing Code provincial codes, and local authority having jurisdiction or .

.2 Install in accordance with manufacturer's instructions and as specified.

3.2 STRAINERS

.1 Install with sufficient room to remove basket.

3.3 WATER METERS

.1 Install water meter provided by local water authority.

.2 Install water meter as indicated.

3.4 START-UP

.1 Timing: Start-up only after:

.1 Pressure tests have been completed.

.2 Certificate of static completion has been issued.

.2 Provide continuous supervision during start-up.

3.5 TESTING AND ADJUSTING

.1 Application tolerances:

.1 Pressure at fixtures: +/- 70 kPa.

.2 Flow rate at fixtures: +/- 20%.

.2 Pressure regulators, PRV assemblies:

.1 Adjust settings to suit locations, flow rates, pressure conditions.

.3 Strainers:

.1 Clean out repeatedly until clear.

.2 Verify accessibility of cleanout plug and basket.

.3 Verify that cleanout plug does not leak.

END OF SECTION

Part 1 General

1.1 RELATED SECTIONS

.1 Section 01 33 00 - Submittal Procedures.

.2 Section 01 74 19 - Construction/Demolition Waste Management And Disposal.

.3 Section 01 78 00 - Closeout Submittals.

.4 Section 23 05 93 - Testing, Adjusting and Balancing for HVAC.

1.2 EQUIPMENT LIST

.1 Complete list of equipment and materials to be used on this project and forming part of tender documents by adding manufacturer's name, model number and details of materials, and submit for approval.

.2 Submit for approval within 10 days after award of contract.

1.3 TRIAL USAGE

.1 Owner may use equipment and systems for test purposes prior to acceptance. Supply labour, material, and instruments required for testing.

1.4 PROTECTION OF OPENINGS

.1 Protect equipment and systems openings from dirt, dust, and other foreign materials with materials appropriate to system.

1.5 SPARE PARTS

.1 Furnish spare parts in accordance with Section 01 78 00 - Closeout Submittals as follows:

.1 One set of packing for each pump.

.2 One casing joint gasket for each size pump.

.3 One filter cartridge or set of filter media for each filter or filter bank in addition to final operating set.

1.6 SPECIAL TOOLS

.1 Provide one set of special tools required to service equipment as recommended by manufacturers and in accordance with Section 01 78 00 - Closeout Submittals.

.2 Furnish one commercial quality grease gun, grease and adapters to suit different types of grease and grease fittings.

1.7 DEMONSTRATION AND OPERATING AND MAINTENANCE INSTRUCTIONS

.1 Separate and recycle waste materials in accordance with Section 01 74 19 - Construction/Demolition Waste Management And Disposal.

.2 Divert unused metal and wiring materials from landfill to metal recycling facility approved by Consultant.

.3 Dispose of unused paint material at official hazardous material collections site approved by Consultant.

.4 Do not dispose of unused paint material into sewer system, into streams, lakes, onto ground or in any other location where it will pose health or environmental hazard.

.5 Remove from site and dispose of packaging materials at appropriate recycling facilities.

.6 Dispose of corrugated cardboard, polystyrene, and plastic packaging material in appropriate on-site bin for recycling in accordance with site waste management program.

1.8 CLOSEOUT SUBMITTALS

.1 Provide operation and maintenance data for incorporation into manual specified in Section 01 78 00 - Closeout Submittals.

.2 Operation and maintenance manual to be approved by, and final copies deposited with, Owner before final inspection.

.3 Operation data to include:

.1 Control schematics for each system including environmental controls.

.2 Description of each system and its controls.

.3 Description of operation of each system at various loads together with reset schedules and seasonal variances.

.4 Operation instruction for each system and each component.

.5 Description of actions to be taken in event of equipment failure.

.6 Valves schedule and flow diagram.

.7 Colour coding chart.

.4 Maintenance data shall include:

.1 Servicing, maintenance, operation and trouble-shooting instructions for each item of equipment.

.2 Data to include schedules of tasks, frequency, tools required and task time.

.5 Performance data to include:

.1 Equipment manufacturer's performance data sheets with point of operation as left after commissioning is complete.

.2 Equipment performance verification test results.

.3 Special performance data as specified elsewhere.

.4 Testing, adjusting and balancing reports as specified in Section 23 05 93 - Testing, Adjusting and Balancing for HVAC.

.6 Approvals:

.1 Submit [2] copies of draft Operation and Maintenance Manual to Consultant for approval. Submission of individual data will not be accepted unless so directed by Consultant.

.2 Make changes as required and re-submit as directed by Consultant.

.7 Additional data:

.1 Prepare and insert into operation and maintenance manual when need for same becomes apparent during demonstrations and instructions specified above.

1.9 SHOP DRAWINGS AND PRODUCT DATA

.1 Submit shop drawings and product data in accordance with Section 01 33 00 - Submittal Procedures.

.2 Shop drawings and product data shall show:

.1 Mounting arrangements.

.2 Operating and maintenance clearances. eg. access door swing spaces.

.3 Shop drawings and product data shall be accompanied by:

.1 Detailed drawings of bases, supports, and anchor bolts.

.2 Acoustical sound power data, where applicable.

.3 Points of operation on performance curves.

.4 Manufacturer to certify as to current model production.

.5 Certification of compliance to applicable codes.

.4 In addition to transmittal letter referred to in Section 01 33 00 - Submittal Procedures: use MCAC "Shop Drawing Submittal Title Sheet". Identify section and paragraph number.

1.10 CLEANING

.1 Clean interior and exterior of all systems including strainers. Vacuum interior of ductwork and air handling units.

1.11 AS-BUILT DRAWINGS

.1 Site records:

.1 Consultant will provide [1] set of reproducible mechanical drawings. Provide sets of white prints as required for each phase of the work. Mark there on all changes as work progresses and as changes occur. This shall include changes to existing mechanical systems, control systems and low voltage control wiring.

.2 On a daily basis, transfer information to reproducibles, revising reproducibles to show all work as actually installed.

.3 Use different colour waterproof ink for each service.

.4 Make available for reference purposes and inspection at all times.

.2 As-built drawings:

.1 Prior to start of Testing, Adjusting and Balancing (TAB), 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 [Engineer] [Consultant] for approval and make corrections as directed.

.4 TAB to be performed using as-built drawings.

.5 Submit completed reproducible as-built drawings with Operating and Maintenance Manuals.

.3 Submit copies of as-built drawings for inclusion in final TAB report.

1.12 WASTE MANAGEMENT AND DISPOSAL

.1 Separate and recycle waste materials in accordance with Section 01 74 19 - Construction/Demolition Waste Management And Disposal.

.2 Divert unused metal and wiring materials from landfill to metal recycling facility approved by Consultant.

.3 Dispose of unused paint material at official hazardous material collections site approved by Consultant.

.4 Do not dispose of unused paint material into sewer system, into streams, lakes, onto ground or in any other location where it will pose health or environmental hazard.

.5 Remove from site and dispose of packaging materials at appropriate recycling facilities.

.6 Dispose of corrugated cardboard, polystyrene, and plastic packaging material in appropriate on-site bin for recycling in accordance with site waste management program.

Part 2 Products

2.1 NOT USED

.1 Not Used.

Part 3 Execution

3.1 NOT USED

.1 Not Used.

END OF SECTION

Part 1 General

1.1 RELATED SECTIONS

.1 Section 01 74 19 - Construction/Demolition Waste Management And Disposal.

.2 Section 01 74 11 - Cleaning.

.3 Section 23 08 02 - Cleaning and Start-up of Mechanical Piping Systems.

1.2 REFERENCES

.1 Canadian General Standards Board (CGSB)

.1 CAN/CGSB-1.181-[99], Ready-Mixed Organic Zinc-Rich Coating.

1.3 WASTE MANAGEMENT AND DISPOSAL

.1 Separate and recycle waste materials in accordance with Section 01 74 19 - Construction/Demolition Waste Management And Disposal.

.2 Divert unused metal and wiring materials from landfill to metal recycling facility approved by Consultant.

.3 Dispose of unused paint material at official hazardous material collections site approved by Consultant.

.4 Do not dispose of unused paint material into sewer system, into streams, lakes, onto ground or in any other location where it will pose health or environmental hazard.

.5 Remove from site and dispose of packaging materials at appropriate recycling facilities.

.6 Dispose of corrugated cardboard, polystyrene, and plastic packaging material in appropriate on-site bin for recycling in accordance with site waste management program.

Part 2 Products

2.1 NOT USED

.1 Not Used.

Part 3 Execution

3.1 CONNECTIONS TO EQUIPMENT

.1 In accordance with manufacturer's instructions unless otherwise indicated.

.2 Use valves and either unions or flanges 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 at low points in piping systems, at equipment and at section isolating valves.

.3 Pipe each drain valve discharge separately to above floor drain. 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.

.2 Install isolating valve at each automatic air valve.

.3 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 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.

.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 Group piping wherever possible [and as indicated].

.11 Ream pipes, remove scale and other foreign material before assembly.

.12 Use eccentric reducers at pipe size changes to ensure positive drainage and venting.

.13 Provide for thermal expansion as indicated.

.14 Valves:

.1 Install in accessible locations.

.2 Remove interior parts before soldering.

.3 Install with stems above horizontal position unless otherwise indicated.

.4 Valves accessible for maintenance without removing adjacent piping.

.5 Install globe valves in bypass around control valves.

.6 Use ball valves at branch take-offs for isolating purposes except where otherwise specified.

.7 Install ball valves for glycol service.

.8 Use chain operators on valves NPS 2-1/2 and larger where installed more than 2400 mm above floor in Mechanical Rooms.

.15 Check Valves:

.1 Install silent check valves on discharge of pumps and in vertical pipes with downward flow and elsewhere as indicated.

.2 Install swing check valves in horizontal lines on discharge of pumps and elsewhere as indicated.

3.7 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.

3.8 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.

3.9 FLUSHING OUT OF PIPING SYSTEMS

.1 In accordance with Section 23 08 02 - Cleaning and Start-up of Mechanical Piping Systems.

.2 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 Division 15.

.3 Preparatory to acceptance, clean and refurbish equipment and leave in operating condition, including replacement of filters in piping systems.

3.10 PRESSURE TESTING OF EQUIPMENT AND PIPEWORK

.1 Advise Consultant prior to performance of pressure tests.

.2 Pipework: Test as specified in relevant sections of Division 15.

.3 Maintain specified test pressure without loss for 4 hours minimum unless specified for longer period of time in relevant sections of Division 15.

.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 Consultant.

.6 Pay costs for repairs or replacement, retesting, and making good. Consultant to determine whether repair or replacement is appropriate.

.7 Insulate or conceal work only after approval and certification of tests by Consultant.

3.11 EXISTING SYSTEMS

.1 Connect into existing piping systems at times approved by Consultant.

.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

Part 1 General

1.1 SECTIONS INCLUDES

.1 Electrical work to conform to Division 16 including the following:

.1 Starters, motor protection and manual control devices are specified and indicated in Division 16 except where otherwise indicated or specified. Wiring to packaged mechanical equipment is indicated on electrical drawings.

.2 Supplier and installer responsibility is on electrical drawings and related mechanical responsibility is indicated on Mechanical Equipment Schedule on mechanical drawings.

.3 Control wiring and conduit is specified in Division 16 except for conduit, wiring and connections below 50 V which are related to control systems specified in Division 15. Refer to Division 16 for quality of materials and workmanship.

1.2 SHOP DRAWINGS

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

1.3 CLOSEOUT SUBMITTALS

.1 Provide maintenance data for motors, drives and guards for incorporation into manual specified in Section 01 33 00 - Submittal Procedures.

Part 2 Products

2.1 GENERAL

.1 Motors to be high efficiency.

2.2 MOTORS

.1 Provide motors for mechanical equipment as specified.

.2 If delivery of specified motor will delay delivery or installation of equipment, install motor approved by Consultant for temporary use. Final acceptance of equipment will not occur until specified motor is installed.

.3 Motors under 1/2 HP : speed as indicated, continuous duty, built-in overload protection, resilient mount, single phase, 120 V, unless otherwise specified or indicated.

.4 Motors 1/2 HP and larger: EEMAC Class B, squirrel cage induction, speed as indicated, continuous duty, drip proof, ball bearing, maximum temperature rise 40°C, 3 phase, 575 V, unless otherwise specified or indicated.

2.3 TEMPORARY MOTORS

.1 If delivery of specified motor will delay completion or commissioning work, install motor approved by Consultant for temporary use. Work will only be accepted when specified motor is installed.

2.4 DRIVE GUARDS

.1 Provide guards for unprotected drives.

.2 Provide means to permit lubrication and use of test instruments with guards in place.

.3 Guard for flexible coupling:

.1 "U" shaped, minimum 1.6 mm thick galvanized mild steel.

.2 Securely fasten in place.

.3 Removable for servicing.

Part 3 Execution

3.1 INSTALLATION

.1 Fasten securely in place.

.2 Make removable for servicing, easily returned into, and positively in position.

END OF SECTION

Part 1 General

1.1 SECTION INCLUDES

.1 Materials and installation for thermometers and pressure gauges in piping systems.

1.2 SUBMITTALS

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

.2 Submit shop drawings and product data.

.3 Submit manufacturer's product data for following items:

.1 Pressure gauges.

1.3 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 for recycling in accordance with Waste Management Plan.

.3 Divert unused metal materials from landfill to metal recycling facility approved by Consultant.

.4 Dispose of unused adhesive material at official hazardous material collections site approved by Consultant.

Part 2 Products

2.1 GENERAL

.1 Design point to be at mid point of scale or range.

2.2 PRESSURE GAUGES

.1 112 mm, dial type: to ASME B40.100 Grade 2A, stainless steel bourdon tube having 0.5% accuracy full scale unless otherwise specified.

.2 Provide:

.1 Snubber for pulsating operation.

.2 Bronze stop cock.

Part 3 Execution

3.1 GENERAL

.1 Install so they can be easily read from floor or platform. If this cannot be accomplished, install remote reading units.

.2 Install between equipment and first fitting or valve.

3.2 PRESSURE GAUGES

.1 Install in following locations:

.1 Suction and discharge of pumps.

.2 Upstream and downstream of PRV's.

.3 Upstream and downstream of control valves.

.4 Elsewhere as shown on the drawings.

.2 Use extensions where pressure gauges are installed through insulation.

END OF SECTION

Part 1 General

1.1 SUMMARY

.1 Section Includes:

.1 Bronze - valves.

1.2 SUBMITTALS

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

.2 Product Data: submit WHMIS MSDS - Material Safety Data Sheets.

.3 Closeout Submittals:

.1 Submit maintenance data for incorporation into manual.

1.3 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 for recycling in accordance with Waste Management Plan.

.3 Divert unused metal materials from landfill to metal recycling facility approved by Consultant.

.4 Dispose of unused adhesive material at official hazardous material collections site approved by Consultant.

Part 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 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 Hand wheel: non-ferrous.

.7 Hand wheel 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: Hand wheel.

.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: Hand wheel.

.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: Hand wheel.

.5 NPS 2 and under, rising stem, solid wedge disc, Class 125:

.1 Body: with long disc guides, screwed bonnet.

.2 Operator: Hand wheel.

.6 NPS 2 and under, rising stem, solid wedge disc, Class 150:

.1 Body: with long disc guides, screwed union bonnet.

.2 Operator: Hand wheel.

.4 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 Hand wheel: non-ferrous.

.7 Hand wheel 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 PTFEdisc composition to suit service conditions, regrindable bronze seat, loosely secured to bronze stem to ASTM B505.

.3 Operator: Hand wheel.

.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: Hand wheel.

.5 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.

.6 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 in down flow applications.

.6 Seat: regrindable.

.7 Ball Valves:

.1 NPS 2 and under:

.1 Body and cap: cast high tensile bronze to ASTM B62.

.2 Pressure rating: Class125, 860 kPa steam.

.3 Connections: Screwed ends to ANSI B1.20.1 and with hexagonal shoulders .

.4 Stem: tamperproof ball drive.

.5 Stem packing nut: external to body.

.6 Ball and seat: replaceable stainless steel hard chrome solid ball and Teflon seats.

.7 Stem seal: TFE with external packing nut.

.8 Operator: removable lever handle.

Part 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 at each piece of equipment arranged to allow servicing, maintenance, and equipment removal.

END OF SECTION

Part 1 General

1.1 SUMMARY

.1 Section Includes:

.1 Valves, gate, globe, and check.

1.2 REFERENCES

.1 American National Standards Institute (ANSI)/American Society of Mechanical Engineers (ASME).

.1 ANSI/ASME B16.1, Cast Iron Pipe Flanges and Flanged Fittings.

.2 American Society for Testing and Materials International (ASTM).

.1 ASTM A49, Specification for Heat-Treated Carbon Steel Joint Bars.

.2 ASTM A126, Specification for Gray Iron Castings for Valves, Flanges, and Pipe Fittings.

.3 ASTM B61, Specification for Steam or Valve Bronze Castings.

.4 ASTM B62, Specification for Composition Bronze or Ounce Metal Castings.

.5 ASTM B85, Specification for Aluminium-Alloy Die Castings.

.6 ASTM B209, Specification for Aluminium and Aluminium-Alloy Sheet and Plate.

.3 Manufacturers Standardization Society of the Valve and Fittings Industry, Inc. (MSS).

.1 MSS SP-70, Cast Iron Gate Valves, Flanged and Threaded Ends.

.2 MSS SP-71, Grey Iron Swing Check Valves, Flanged and Threaded Ends.

.3 MSS SP-82, Valve Pressure Testing Methods.

.4 MSS SP-85, Cast Iron Globe and Angle Valves, Flanged and Threaded Ends.

1.3 SUBMITTALS

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

Part 2 Products

2.1 MATERIAL

.1 Valves:

.1 Except for specialty valves, to be of single manufacturer.

.2 Standard specifications:

.1 Gate valves: MSS SP-70.

.2 Globe valves: MSS SP-85.

.3 Check valves: MSS SP-71.

.3 Requirements common to valves, unless specified otherwise:

.1 Body, bonnet: cast iron to ASTM B209 Class B.

.2 Connections: flanged ends plain face with 2 mm raised face with serrated finish to ANSI B16.1.

.3 Inspection and pressure testing: to MSS SP-82.

.4 Bonnet gasket: non-asbestos.

.5 Stem: to have precision-machined Acme or 60 degrees V threads, top screwed for handwheel nut.

.6 Stuffing box: non-galling two-piece ball-jointed packing gland, gland bolts and nuts.

.7 Gland packing: non-asbestos.

.8 Handwheel: Die-cast aluminium alloy to ASTM B85 or malleable iron to ASTM A49. Nut of bronze to ASTM B62.

.9 Identification tag: with catalogue number, size, other pertinent data.

.4 All products to have CRN registration numbers.

2.2 GATE VALVES

.1 NPS 2 1/2 - 8, non rising stem, inside screw, bronze trim, solid wedge disc:

.1 Body and multiple-bolted bonnet: with full length disc guides designed to ensure correct re-assembly. Class 125.

.2 Disc: solid offset taper wedge, bronze to ASTM B62.

.3 Seat rings: renewable bronze to ASTM B62, screwed into body.

.4 Stem: bronze to ASTM B62.

.5 Seat: Integral with body.

.6 Stem: wrought steel.

.7 Operator: Handwheel

2.3 GLOBE VALVES

.1 NPS 2 1/2 - 10, OSY:

.1 Body: with multiple-bolted bonnet.

.2 WP: 860 kPa steam, 1.4 MPa CWP.

.3 Bonnet-yoke gasket: non-asbestos.

.4 Disc: bronze to ASTM B62, fully guided from bottom, securely yet freely connected to stem for swivel action and accurate engagement with disc.

.5 Seat ring: renewable, regrindable, screwed into body.

.6 Stem: bronze to ASTM B62.

.7 Operator: Handwheel

2.4 VALVE OPERATORS

.1 Install valve operators as follows:

.1 Handwheel: on valves except as specified.

.2 Handwheel with chain operators: on valves installed more than 2400 mm above floor in boiler rooms and mechanical equipment rooms.

2.5 CHECK VALVES

.1 Swing check valves, Class 125:

.1 Body and bolted cover: with tapped and plugged opening on each side for hinge pin. Flanged ends: plain faced with smooth finish.

.1 Up to NPS 16: cast iron to ASTM A126 Class B.

.2 Ratings:

.1 NPS 2 1/2 - 12: 860 kPa steam; 1.4 MPa CWP.

.3 Seat rings: renewable bronze to ASTM B62 screwed into body.

.4 Hinge pin, bushings: renewable bronze to ASTM B62.

.5 Seat: cast iron, integral with body.

.6 Hinge pin: exelloy; bushings: malleable iron.

.7 Identification tag: fastened to cover.

.8 Hinge: galvanized malleable iron.

2.6 SILENT CHECK VALVES

.1 Construction:

.1 Body: malleable iron with integral seat.

.2 Pressure rating: class 125, WP = 860 kPa.

.3 Connections: grooved ends.

.4 Disc: stainless steel renewable rotating disc.

.5 Seat: renewable, EPDM.

.6 Spring required in vertical downflow applications: Stainless steel spring, heavy duty.

Part 3 Execution

3.1 INSTALLATION

.1 Install rising stem valves in upright position with stem above horizontal.

END OF SECTION

Part 1 General

1.1 SUMMARY

.1 Section Includes:

.1 Butterfly Valves.

1.2 REFERENCES

.1 American National Standards Institute (ANSI)/American Society of Mechanical Engineers (ASME).

.1 ANSI/ASME B1.20.1, Pipe Threads, General Purpose (Inch).
.2 ANSI/ASME B16.1, Cast Iron Pipe Flanges and Flanged Fittings.
.3 ANSI/ASME B16.5, Pipe Flanges and Flanged Fittings.
.4 ANSI/ASME B16.11, Forged Fittings, Socket-Welding and Threaded.
.5 ANSI/ASME B16.25, Buttwelding Ends.
.6 ANSI/ASME B16.34, Valves - Flanged, Threaded and Welding Ends.

.2 American National Standards Institute (ANSI)/American Petroleum Institute (API).

.1 ANSI/API 609, Lug- and Water-Type Butterfly Valves.

.3 American Society for Testing and Materials International, (ASTM).

.1 ASTM A126, Specification for Gray Iron Castings for Valves, Flanges, and Pipe Fittings.
.2 ASTM B62, Specification for Composition Bronze or Ounce Metal Castings.
.3 ASTM B209M, Specification for Aluminium and Aluminium-Alloy Sheet and Plate.

.4 Manufacturers Standardization Society of the Valve and Fittings Industry, Inc. (MSS).

.1 MSS SP-67, Butterfly Valves.

1.3 SUBMITTALS

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

Part 2 Products

2.1 BUTTERFLY VALVES - RESILIENT SEAT - 200 PSIG

.1 Except to specialty valves, to be of single manufacturer.

.2 To be suitable for dead-end service.

.3 CRN registration number required for products.

.4 Sizes: Lug type: NPS 2 to 30.

.5 Pressure rating for tight shut-off at temperatures up to maximum for seat material.

.1 NPS 2 - 12: 200 psig.

.2 NPS 14 - 48: 200 psig.

.6 Minimum seat temperature ratings to135 degrees C.

.7 Application: on-off operation.

.8 Full lug body (threaded).

.9 Operators:

.1 NPS 2 - 6: Handles capable of locking in any of ten (10) positions - 0 degrees to 90 degrees. Handle and release trigger - ductile iron. Return spring and hinge pin: carbon steel. Latch plate and mounting hardware: cadmium plated carbon steel. Standard coating: black lacquer.

.2 NPS 8 - 30: Manual enclosed gear operator.

.10 Designed to comply with MSS SP-67 and API 609.

.11 Compatible with ANSI Class 125/Class 150 flanges.

.12 Construction:

.1 Body ductile iron.

.2 Disc: aluminium bronze.

.3 Seat: EPDM.

.4 Shaft: stainless steel.

.5 Taper pin: stainless steel.

.6 Key: carbon steel.

.7 O-Ring: Buna-N.

.8 Bushings: Luberized bronze.

2.2 MOUNTING FLANGES

.1 Class 125 cast iron to ANSI B16.1 or Class 150 steel to B16.5 pipe flanges.

Part 3 Execution

3.1 PREPARATION

.1 Valve and mating flange preparation.

.1 Inspect adjacent pipeline, remove rust, scale, welding slag, other foreign material.

.2 Ensure that valve seats and pipe flange faces are free of dirt or surface irregularities which may disrupt flange seating and cause external leakage.

.3 Install butterfly valves with disc in almost closed position.

.4 Inspect valve disc seating surfaces and waterway and eliminate dirt or foreign material.

3.2 INSTALLATION OF VALVES

.1 Install in accordance with manufacturer's instructions.

.2 Do not use gaskets between pipe flanges and valves unless instructed otherwise by valve manufacturer.

.3 Verify suitability of valve for application by inspection of identification tag.

.4 Mount actuator on to valve prior to installation.

.5 Handle valve with care so as to prevent damage to disc and seat faces.

.6 Valves in horizontal pipe lines should be installed with stem in horizontal position to minimize liner and seal wear.

.7 Ensure that valves are centered between bolts before bolts are tightened and then opened and closed to ensure unobstructed disc movement. If interference occurs due, for example to pipe wall thickness, taper bore adjacent piping to remove interference.

END OF SECTION

Part 1 General

1.1 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 all conditions of operation, allow free expansion and contraction, prevent excessive stresses from being introduced into pipe work or connected equipment.

.5 Provide for vertical adjustments after erection and during commissioning. Amount of adjustment to be in accordance with MSS SP58.

1.2 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 for recycling in accordance with Waste Management Plan.

.3 Divert unused metal materials from landfill to metal recycling facility approved by Consultant.

.4 Dispose of unused adhesive material at official hazardous material collections site approved by Consultant.

Part 2 Products

2.1 GENERAL

.1 Fabricate hangers, supports and sway braces in accordance with ANSI B31.1 and MSS SP58.

.2 Use components for intended design purpose only. Do not use for rigging or erection purposes.

2.2 PIPE HANGERS

.1 Finishes:

.1 Ensure steel hangers in contact with copper piping are copper plated or epoxy coated.

.2 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.

.3 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 pipe work is anticipated.

.3 Do not use 22 mm or 28 mm rod.

.4 Pipe attachments: material to MSS SP58.

.1 Attachments for steel piping: carbon steel.

.2 Attachments for copper piping: copper plated black steel.

.3 Use insulation shields for hot pipe work.

.4 Oversize pipe hangers and supports.

.5 Adjustable clevis: material to MSS SP69 , clevis bolt with nipple spacer and vertical adjustment nuts above and below clevis.

.6 Yoke style pipe roll: carbon steel yoke, rod and nuts with cast iron roll, to MSS SP69.

.7 U-bolts: carbon steel to MSS SP69 with 2 nuts at each end to ASTM A563.

.1 Finishes for steel pipe work: black.

.2 Finishes for copper, glass, brass or aluminium pipe work: black with formed portion plastic coated.

2.3 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.

2.4 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.

2.5 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 to be complete with factory calibrated travel stops

.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.

Part 3 Execution

3.1 INSTALLATION

.1 Install in accordance with:

.1 manufacturer's instructions and recommendations.

.2 Vibration Control Devices:

.1 Install on piping systems at pumps and elsewhere as indicated.

.3 Clamps on riser piping:

.1 Support independent of connected horizontal pipe work using riser clamps and riser clamp lugs welded to riser.

.2 Bolt-tightening torques to be 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 pipe work 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.

3.2 HANGER SPACING

.1 Copper piping: up to NPS 1/2: every 1.5 m.

.2 Flexible joint roll groove pipe: in accordance with table below, but not less than one hanger at joints.

.3 Within 300 mm of each elbow.

Maximum Pipe Size: NPS	Maximum Spacing Steel	Maximum Spacing Copper
up to 1-1/4	2.1 m	1.8 m

Maximum Pipe Size: NPS	Maximum Spacing Steel	Maximum Spacing Copper
1-1/2	2.7 m	2.4 m
2	3.0 m	2.7 m
2-1/2	3.6 m	3.0 m
3	3.6 m	3.0 m
3-1/2	3.9 m	3.3 m
4	4.2 m	3.6 m
5	4.8 m	
6	5.1 m	
8	5.7 m	
10	6.6 m	
12	6.9 m	

.4 Pipe work greater than NPS 12: to MSS SP69.

3.3 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.

3.4 HORIZONTAL MOVEMENT

.1 Angularity of rod hanger resulting from horizontal movement of pipe work 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.

3.5 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.

END OF SECTION

Part 1 General

1.1 SHOP DRAWINGS

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

.2 Provide separate shop drawings for each isolated system complete with performance and product data.

Part 2 Products

2.1 GENERAL

.1 Size and shape of bases type and performance of vibration isolation to be as indicated.

2.2 ELASTOMERIC PADS

.1 Type EP1 - neoprene waffle or ribbed; 9mm minimum thick; 50 durometer; maximum loading 350 kPa.

.2 Type EP2 - rubber waffle or ribbed; 9 mm minimum thick; 30 durometer natural rubber; maximum loading 415 kPa.

.3 Type EP3 - neoprene-steel-neoprene; 9 mm minimum thick neoprene bonded to 1.71 mm steel plate; 50 durometer neoprene, waffle or ribbed; holes sleeved with isolation washers; maximum loading 350 kPa.

.4 Type EP4 - rubber-steel-rubber; 9 mm minimum thick rubber bonded to 1.71 mm steel plate; 30 durometer natural rubber, waffle or ribbed; holes sleeved with isolation washers; maximum loading 415 kPa.

2.3 ELASTOMERIC MOUNTS

.1 Type M1 - colour coded; neoprene in shear; maximum durometer of 60; threaded insert and two bolt-down holes; ribbed top and bottom surfaces.

2.4 SPRINGS

.1 Design stable springs so that ratio of lateral to axial stiffness is equal to or greater than 1.2 times the ratio of static deflection to working height. Select for 50% travel beyond rated load. Units to be complete with levelling devices.

.2 Ratio of height when loaded to diameter of spring to be between 0.8 to 1.0.

.3 Cadmium plate for outdoor installations.

.4 Colour code springs.

2.5 SPRING MOUNT

.1 Zinc or cadmium plated hardware; housings coated with rust resistant paint.

.2 Type M2 - stable open spring: support on bonded 6 mm minimum thick ribbed neoprene or rubber friction and acoustic pad.

.3 Type M3 - stable open spring: 6 mm minimum thick ribbed neoprene or rubber friction and acoustic pad, bonded under isolator and on isolator top plate; levelling bolt for rigidly mounting to equipment.

.4 Type M4 - restrained stable open spring: supported on bonded 6 mm minimum thick ribbed neoprene or rubber friction and acoustic pad; built-in resilient limit stops, removable spacer plates.

.5 Type M5 - enclosed spring mounts with snubbers for isolation up to 950 kg maximum.

2.6 HANGERS

.1 Colour coded springs, rust resistant, painted box type hangers. Arrange to permit hanger box or rod to move through a 30° arc without metal to metal contact.

.2 Type H1 - neoprene - in-shear, moulded with rod isolation bushing which passes through hanger box.

.3 Type H2 - stable spring, elastomeric washer, cup with moulded isolation bushing which passes through hanger box.

.4 Type H3 - stable spring, elastomeric element, cup with moulded isolation bushing which passes through hanger box.

.5 Type H4 - stable spring, elastomeric element with precompression washer and nut with deflection indicator.

2.7 STRUCTURAL BASES

.1 Type B1 - Prefabricated steel base: integrally welded on sizes up to 2400 mm on smallest dimension, split for field welding on sizes over 2400 mm on smallest dimension and reinforced for alignment of drive and driven equipment; without supplementary hold down devices; complete with isolation element attached to base brackets arranged to minimize height; pre-drilled holes to receive equipment anchor bolts; and complete with adjustable built-in motor slide rail where indicated.

.2 Type B2 - Steel rail base: structural steel, positioned for alignment of drive and driven equipment; without supplementary hold down devices; complete with isolation element attached to base brackets arranged to minimize height; and pre-drilled holes to receive equipment anchor bolts.

.3 Bases to clear housekeeping pads by 25 mm minimum.

2.8 INERTIA BASE

.1 Type B3 - Full depth perimeter structural or formed channels, frames: welded in place reinforcing rods running in both directions; spring mounted, carried by gussetted height-saving brackets welded to frame; and clear housekeeping pads by 50 mm minimum.

.2 Pump bases: "T" shaped, where applicable, to provide support for elbows.

Part 3 Execution

3.1 INSTALLATION

.1 Install vibration isolation equipment in accordance with manufacturers instructions and adjust mountings to level equipment.

.2 Ensure piping, ducting and electrical connections to isolated equipment do not reduce system flexibility and that piping, conduit and ducting passage through walls and floors do not transmit vibrations.

.3 Unless indicated otherwise, support piping connected to isolated equipment with spring mounts or spring hangers with 25 mm minimum static deflection as follows:

.1 Up to NPS4: first 3 points of support. NPS5 to NPS8: first 4 points of support. NPS10 and Over: first 6 points of support.

.2 First point of support shall have a static deflection of twice deflection of isolated equipment, but not more than 50 mm.

.4 Where isolation is bolted to floor use vibration isolation rubber washers.

.5 Block and shim level bases so that ductwork and piping connections can be made to a rigid system at the operating level, before isolator adjustment is made. Ensure that there is no physical contact between isolated equipment and building structure.

3.2 APPLICATION

.1 Install the following types of vibration isolation on equipment:

.1 Base Mounted Pumps Type B3

3.3 SITE VISIT

.1 Manufacturer to visit site and provide written certification that installation is in accordance with manufacturer's instructions and submit report to Consultant.

.2 Provide Consultant with notice 24 h in advance of visit.

.3 Make adjustments and corrections in accordance with written report.

END OF SECTION

Part 1 General

1.1 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 for recycling in accordance with Waste Management Plan.

.3 Divert unused metal materials from landfill to metal recycling facility approved by Consultant.

.4 Dispose of unused adhesive material at official hazardous material collections site approved by Consultant.

Part 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 to be 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 aluminium, 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.

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.

.3 Before starting work, obtain written approval of identification system from Consultant.

2.4 PIPING SYSTEMS GOVERNED BY CODES

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, to 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 All other pipes: Pressure sensitive plastic-coated cloth vinyl with protective over coating, waterproof contact adhesive undercoating, suitable for ambient of 100%RH and continuous operating temperature of 150°C and intermittent temperature of 200°C.

.7 Colours and Legends:

.1 Where not listed, obtain direction from Engineer Consultant.

.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
** Add design temperature		
++ Add design temperature and pressure		
Raw water	Green	RAW WATER
Compressed air (<700kPa)	Green	COMP. AIR ___ kPa
Compressed air (>700kPa)	Yellow	COMP. AIR ___ kPa
Condenser water supply	Green	COND. WTR. SUPPLY
Condenser water return	Green	COND. WTR. RETURN
Raw water	Green	RAW WATER
City water	Green	CITY WATER
Chilled water supply	Green	CH. WTR. SUPPLY
Chilled water return	Green	CH. WTR. RETURN

2.6 IDENTIFICATION DUCTWORK SYSTEMS

.1 50 mm high stencilled letters and directional arrows 150 mm long x 50 mm high.

.2 Colours: Black, 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 to be in English.

Part 3 Execution

3.1 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 in any way.

3.2 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, dampers, etc. Where this is not possible, place identification as close as possible, preferably on upstream side.

.9 Identification to be easily and accurately readable from usual operating areas and from access points.

.1 Position of identification to be 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.

3.3 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 Consultant. Provide one copy (reduced in size if required) in each operating and maintenance manual.

.3 Number valves in each system consecutively.

END OF SECTION

Part 1 General

1.1 GENERAL

.1 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 Names of personnel it is proposed to perform TAB to be submitted to and approved by Consultant within 30 days of award of contract.

.2 Provide documentation confirming qualifications, successful experience.

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 so as 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 be 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 so as 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.

.2 Review specified standards and report to Consultant in writing all 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 unless specified otherwise.

1.8 OPERATION OF SYSTEMS DURING TAB

.1 Operate systems for length of time required for TAB and as required by Consultant for verification of TAB reports.

1.9 START OF TAB

.1 Start TAB when work is essentially completed.

.2 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 Fire, smoke, volume control dampers installed and open.
  - .4 Access doors, installed, closed.
  - .5 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.

1.10 APPLICATION TOLERANCES

.1 Do TAB to following tolerances of design values:

- .1 HVAC systems: plus 5 %, minus 5 %.
- .2 Hydronic systems: plus or minus 10 %.

1.11 ACCURACY TOLERANCES

.1 Measured values to be accurate to within plus or minus 2 % of actual values.

1.12 INSTRUMENTS

.1 Calibrate in accordance with requirements of most stringent of referenced standard for either applicable system or HVAC system.

.2 Calibrate within 3 months of TAB.

1.13 TAB REPORT

.1 TAB report to show results in SI units and to include:

- .1 Project record drawings.
- .2 System schematics.

.2 Submit 6 copies of TAB Report to Consultant for verification and approval.

1.14 VERIFICATION

.1 Reported results subject to verification by Consultant.

.2 Bear costs to repeat TAB as required to satisfaction of Consultant.

1.15 SETTINGS

.1 After TAB is completed to satisfaction of Consultant, replace drive guards, close access doors, lock devices in set positions, ensure sensors are at required settings.

.2 Permanently mark settings to allow restoration at any time during life of facility. Markings not to be eradicated or covered in any way.

1.16 COMPLETION OF TAB

.1 TAB to be considered complete when final TAB Report received and approved by Consultant.

1.17 AIR SYSTEMS

.1 Do TAB of :

.1 Mechanical Room Fan Unit.

.2 Measurements: to include, but not limited to, following as appropriate for systems, equipment, components, controls: air velocity, static pressure, flow rate, pressure drop (or loss), temperatures (dry bulb, wet bulb, dew point), duct cross-sectional area, RPM, electrical power, voltage, noise, vibration.

1.18 HYDRONIC SYSTEMS

.1 Definitions: for purposes of this section, to include raw water pumping system.

.2 Do TAB of :

.1 New pumps.

.3 Measurements: to include, but not limited to, following as appropriate for systems, equipment, components, controls: Flow rate, static pressure, pressure drop (or loss), temperature, specific gravity, density, RPM, electrical power, voltage, noise, vibration.

Part 2 Products

2.1 NOT USED

.1 Not used.

Part 3 Execution

3.1 NOT USED

.1 Not used.

END OF SECTION

Approved: 2003-12-31

Part 1 General

1.1 RELATED SECTIONS

.1 Section 01 33 00 - Submittal Procedures.

.2 Section 01 74 19 - Construction/Demolition Waste Management And Disposal.

.3 Section 23 05 29 - Hangers and Supports for HVAC Piping and Equipment.

1.2 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-02, Specification for Aluminum and Aluminum Alloy Sheet and Plate (Metric).

.2 ASTM C335-95, Test Method for Steady State Heat Transfer Properties of Horizontal Pipe Insulation.

.3 ASTM C411-97, 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 C547-00, Specification for Mineral Fiber Pipe Insulation.

.6 ASTM C553-00, Specification for Mineral Fiber Blanket Thermal Insulation for Commercial and Industrial Applications.

.7 ASTM C612-00a, Specification for Mineral Fiber Block and Board Thermal Insulation.

.8 ASTM C795-92, Specification for Thermal Insulation for Use with Austenitic Stainless Steel.

.9 ASTM C921-92(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-89, 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-M88(R2000), Surface Burning Characteristics of Building Materials and Assemblies.

.2 CAN/ULC-S701-01, Thermal Insulation Polyotrene, Boards and Pipe Covering.

1.3 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.

1.4 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.

1.5 SAMPLES

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

.2 Submit for approval: complete assembly of each type of insulation system, insulation, coating, and adhesive proposed. Mount sample on 12 mm plywood board. Affix typewritten label beneath sample indicating service.

1.6 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.

1.7 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, member of TIAC.

1.8 DELIVERY, STORAGE AND HANDLING

.1 Deliver materials to site in original factory packaging, labelled with manufacturer's name, address.

.2 Protect from weather and construction traffic.

.3 Protect against damage from any source.

.4 Store at temperatures and conditions recommended by manufacturer.

1.9 WASTE MANAGEMENT AND DISPOSAL

.1 Separate and recycle waste materials in accordance with Section 01 74 19 - 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 packaging material in appropriate off site recycling in accordance with Waste Management Plan.

.4 Divert unused metal materials from landfill to metal recycling facility approved by Consultant.

.5 Divert unused adhesive material from landfill to official hazardous material collections site approved by Consultant.

.6 Do not dispose of unused adhesive 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 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°C mean temperature when tested in accordance with ASTM C335.

.3 TIAC Code C-1: Rigid mineral fibre board to ASTM C612, with 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 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.

.3 Maximum "k" factor: to ASTM C553.

2.3 JACKETS

.1 Canvas:

.1 220 gm/m^2 cotton, plain weave, treated with dilute fire retardant lagging adhesive to ASTM C921.

.2 Lagging adhesive: Compatible with insulation.

.3 Aluminum:

.1 To ASTM B209 with and without moisture barrier as scheduled in PART 3 of this section.

.2 Thickness: 0.50 mm sheet.

.3 Finish: Stucco embossed.

.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 0.50 mm sheet.

.7 Finish: Stucco embossed.

.8 Jacket banding and mechanical seals: 12 19 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 ULC Listed Canvas Jacket:

.1 220 gm/m^2 cotton, plain weave, treated with dilute fire retardant lagging adhesive to ASTM C921.

.5 Outdoor Vapour Retarder Mastic:

.1 Vinyl emulsion type acrylic, compatible with insulation.

.2 Reinforcing fabric: Fibrous glass, untreated 305 g/m^2.

.6 Tape: self-adhesive, aluminum, reinforced, 50 mm wide minimum.

.7 Contact adhesive: quick-setting

.8 Canvas adhesive: washable.

.9 Tie wire: 1.5 mm stainless steel.

.10 Banding: 12 mm wide, 0.5 mm thick stainless steel.

.11 Facing: 25 mm galvanized steel hexagonal wire mesh stitched on one face of insulation.

.12 Fasteners: 2 mm diameter pins with 35 mm diameter clips, length to suit thickness of insulation.

Part 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 manufacturers 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.

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 temperatire supply air ducts	[C-2]	[yes]	[50]
Rectangular warm air ducts	[C-1]	[no]	[25]
Round warm air ducts	[C-1]	[no]	[25]
Supply, return and exhaust ducts exposed in space being served			[none]
Outside air ducts to mixing plenum	[C-1]	[yes]	[25]
Mixing plenums	[C-1]	[yes]	[25]
Exhaust duct between dampers and louvres	[C-1]	[no]	[25]
Rectangular ducts outside	[C-1]	[special]	[50]
Round ducts outside	[C-1]	[special]	[50]

	TIAC Code	Vapour Retarder	Thickness (mm)
Acoustically lined ducts	[none]		

.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

Part 1 General

1.1 REFERENCES

.1 ASTM E202, Standard Test Methods for Analysis of Ethylene Glycols and Propylene Glycols.

1.2 CLEANING AND START-UP OF MECHANICAL PIPING SYSTEMS

.1 In accordance with Section 23 08 02 - Cleaning and Start-up of Mechanical Piping Systems.

1.3 HYDRONIC SYSTEMS - PERFORMANCE VERIFICATION (PV)

.1 Timing:

.1 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.

.2 Verify performance of hydronic system circulating pumps as specified in relevant technical sections, recording system pressures, temperatures, fluctuations by simulating maximum design conditions and varying.

.1 Pump operation.

.2 Boiler and/or chiller operation.

.3 Pressure bypass open/closed.

.4 Control pressure failure.

.5 Maximum heating demand.

.6 Maximum cooling demand.

.7 Boiler and/or chiller failure.

.8 Cooling tower (and/or industrial fluid cooler) fan failure.

.9 Outdoor reset. Re-check heat exchanger output supply temperature at 100% and 50% reset, maximum water temperature.

1.4 HYDRONIC SYSTEM CAPACITY TEST

.1 Timing: After:

.1 TAB has been completed

.2 Verification of operating, limit, safety controls.

.3 Verification of primary and secondary pump flow rates.

.4 Verification of accuracy of temperature and pressure sensors and gauges.

.2 Calculate system capacity at test conditions.

.3 Using manufacturer's published data and calculated capacity at test conditions, extrapolate system capacity at design conditions.

.4 When capacity test is completed, return controls and equipment status to normal operating conditions.

.5 Submit sample of system water to approved testing agency to determine if chemical treatment is correct. Include cost.

.6 Chilled water system capacity test:

.1 Perform capacity test when ambient temperature is within 10% of design conditions. Simulate design conditions by:

.1 Adding heat from building heating system or

.2 Raising space temperature by turning off cooling and air systems for sufficient period of time before starting testing and pre-heating building to summer design space temperature (occupied) or above. Set OAD and RAD for minimum outside air if OAT is near outside design temperature or to maximum recirculation if RAT is greater that OAT. RAT to be at least 23^0C.

.2 Test procedures:

.1 Open fully cooling coil control valves.

.2 Set thermostats on associated AHU's for maximum cooling.

.3 Set AHU's for design maximum air flow rates.

.4 Set load or demand limiters on chillers to 100%

.5 After system has stabilized, record chilled water, condenser water, etc., flow rates and supply and return temperatures simultaneously.

Part 2 Products

2.1 NOT USED

.1 Not Used.

Part 3 Execution

3.1 NOT USED

.1 Not Used.

END OF SECTION

Part 1 General

1.1 RELATED SECTIONS

.1 Section 01 74 19 - Construction/Demolition Waste Management And Disposal.

.2 Section 23 25 00 - HVAC Water Treatment Systems.

.3 Section 23 05 93 - Testing Adjusting and Balancing for HVAC.

1.2 REFERENCES

.1 American Society for Testing and Materials

.1 ASTM E202-[00], Test Methods for Analysis of Ethylene Glycols and Propylene Glycols.

1.3 WASTE MANAGEMENT AND DISPOSAL

.1 Separate and recycle waste materials in accordance with Section 01 74 19 - Construction/Demolition Waste Management And Disposal.

.2 Divert unused metal and wiring materials from landfill to metal recycling facility approved by Consultant.

.3 Dispose of unused paint material at official hazardous material collections site approved by Consultant.

.4 Do not dispose of unused paint material into sewer system, into streams, lakes, onto ground or in any other location where it will pose health or environmental hazard.

.5 Remove from site and dispose of packaging materials at appropriate recycling facilities.

.6 Dispose of corrugated cardboard, polystyrene, and plastic packaging material in appropriate on-site bin for recycling in accordance with site waste management program.

Part 2 Products

2.1 CLEANING SOLUTIONS

.1 Tri-sodium phosphate: 0.40 kg per 100 L water in system.

.2 Sodium carbonate: 0.40 kg per 100 L water in system.

.3 Low-foaming detergent: 0.01 kg per 100 L water in system.

Part 3 Execution

3.1 CLEANING HYDRONIC AND STEAM SYSTEMS

.1 Timing

.1 Systems to be operational, hydrostatically tested and with safety devices functional, before cleaning is carried out.

.2 Cleaning Agency:

.1 Retain qualified water treatment specialist to perform system cleaning.

.3 Install instrumentation such as flow meters, orifice plates, pitot tubes, flow metering valves only after cleaning is certified as complete by water treatment specialist.

.4 Cleaning procedures:

.1 Provide detailed report outlining proposed cleaning procedures at least 4 weeks prior to proposed starting date. Report to include:

.1 Cleaning procedures, flow rates, elapsed time.

.2 Chemicals and concentrations to be used.

.3 Inhibitors and concentrations.

.4 Specific requirements for completion of work.

.5 Special precautions for protecting piping system materials and components.

.6 Complete analysis of water to be used to ensure water will not damage systems or equipment.

.5 Conditions at time of cleaning of systems

.1 Systems to be free from construction debris, dirt and other foreign material.

.2 Control valves to be operational, fully open to ensure that terminal units can be cleaned properly.

.3 Strainers to be clean prior to initial fill.

.4 Install temporary filters on pumps not equipped with permanent filters.

.5 Install pressure gauges on strainers to detect plugging.

.6 Report on Completion of Cleaning

.1 When cleaning is completed, submit report, complete with certificate of compliance with specifications of cleaning component supplier.

.7 Hydronic Systems:

.1 Fill system with water, ensure air is vented from system.

.2 Fill expansion tanks 1/3 to 1/2 full, charge system with compressed air to at least 35 kPa (does not apply to diaphragm type expansion tanks).

.3 Use water metre to record volume of water in system to +/- 0.5%.

.4 Add chemicals under direct supervision of chemical treatment supplier.

.5 Closed loop systems: circulate system cleaner at 60°C for at least 36 h. Drain as quickly as possible. Refill with water and inhibitors. Test concentrations and adjust to recommended levels.

.6 Flush velocity in system mains and branches so as to ensure removal of debris. System pumps may be used for circulating cleaning solution provided that velocities are adequate.

.7 Add chemical solution to system.

.8 Establish circulation, raise temperature slowly to [maximum design] [82°C minimum]. Circulate for 12 h, ensuring flow in all circuits. Remove heat, continue to circulate until temperature is below 38°C. Drain as quickly as possible. Refill with clean water. Circulate for 6 h at design temperature. Drain and repeat procedures specified above. Flush through low point drains in system. Refill with clean water adding to sodium sulphite (test for residual sulphite).

.8 Glycol Systems:

.1 In addition to procedures specified above perform procedures specified herein.

.2 Test to prove concentration will prevent freezing to minus 40°C Test inhibitor strength and include in procedural report. Refer to ASTM E202.

3.2 START-UP OF HYDRONIC SYSTEMS

.1 After cleaning is completed and system is filled:

.1 Establish circulation and expansion tank level, set pressure controls.

.2 Ensure air is removed.

.3 Check pumps to be free from air, debris, possibility of cavitation when system is at design temperature.

.4 Dismantle system pumps used for cleaning, inspect, replace worn parts, install new gaskets and new set of seals.

.5 Clean out strainers repeatedly until system is clean.

.6 Commission water treatment systems as specified in Section 23 25 00 - HVAC Water Treatment Systems.

.7 Check water level in expansion tank with cold water with circulating pumps OFF and again with pumps ON.

.8 Repeat with water at design temperature.

.9 Check pressurization to ensure proper operation and to prevent water hammer, flashing, cavitation. Eliminate water hammer and other noises.

.10 Bring system up to design temperature and pressure slowly.

.11 Perform TAB as specified in Section 23 05 93 - Testing, Adjusting and Balancing for HVAC.

.12 Adjust pipe supports, hangers, springs as necessary.

.13 Monitor pipe movement, performance of expansion joints, loops, guides, anchors.

.14 If sliding type expansion joints bind or if bellows type expansion joints flex incorrectly, shut down system, re-align, repeat start-up procedures.

.15 Re-tighten bolts, etc. using torque wrench, to compensate for heat-caused relaxation. Repeat several times during commissioning.

.16 Check operation of drain valves.

.17 Adjust valve stem packings as systems settle down.

.18 Fully open all balancing valves (except those that are factory-set).

.19 Check operation of over-temperature protection devices on circulating pumps.

.20 Adjust alignment of piping at pumps to ensure flexibility, adequacy of pipe movement, absence of noise or vibration transmission.

END OF SECTION

Part 1 General

1.1 SUMMARY

.1 Section Includes:

.1 The installation of drainage waste and vent piping.

.2 Sustainable requirements for construction and verification.

.3 Related Sections:

.1 Section [01 74 19 - Construction/Demolition Waste Management And Disposal].
.2 Section [01 47 15 - Sustainable Requirements: Construction].
.3 Section [01 47 17 - Sustainable Requirements: Contractor's Verification].
.4 Section [01 35 30 - Health and Safety Requirements].
.5 Section [23 22 13 - Steam and Condensate Heating Piping].

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.

1.3 QUALITY ASSURANCE

.1 Health and Safety:

.1 Do construction occupational health and safety in accordance with Section 01 35 30 - Health and Safety Requirements.

1.4 DELIVERY STORAGE AND DISPOSAL

.1 Waste Management and Disposal:

.1 Separate and recycle waste materials in accordance with Section 01 74 19 - Construction/Demolition Waste Management And Disposal.
.2 Collect and separate for disposal packaging material for recycling in accordance with Waste Management Plan.

Part 2 Products

2.1 MATERIAL

.1 Sustainable Requirements:

.1 Materials and resources in accordance with Section 01 47 15 Sustainable Requirements: Construction.

2.2 COPPER TUBE AND FITTINGS

.1 Above ground sanitary DWV to: ASTM B306.

.1 Fittings.

.1 Cast brass: to CAN/CSA-B125.

.2 Wrought copper: to CAN/CSA-B125.

.2 Solder: lead free, tin-95:5,

2.3 CAST IRON PIPING AND FITTINGS

.1 Buried sanitary minimum NPS 3, to: CAN/CSA-B70.

.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: 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.

Part 3 Execution

3.1 INSTALLATION

.1 In accordance with Section 23 05 01 - Installation of Pipework.

.2 Install in accordance with Canadian 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.

.5 Affix applicable label (storm, sanitary, vent, pump discharge etc.) c/w directional arrows every floor or 4.5 m (whichever is less).

3.4 VERIFICATION

.1 Verification requirements in accordance with Section 01 47 17 - Sustainable Requirements: Contractor's Verification, include:

- .1 Materials and resources.
- .2 Storage and collection of recyclables.
- .3 Construction waste management.
- .4 Resource reuse.
- .5 Local/regional materials.
- .6 Low-emitting materials.

END OF SECTION

Part 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.

.3 Related Sections:

.1 Section [01 74 19 - Construction/Demolition Waste Management And Disposal].
.2 Section [01 47 15 - Sustainable Requirements: Construction].
.3 Section [01 47 17 - Sustainable Requirements: Contractor's Verification].
.4 Section [01 35 30 - Health and Safety Requirements].
.5 Section [23 05 01 - Installation of Pipework].

1.2 REFERENCES

.1 American Society for Testing and Materials International, (ASTM).

.1 ASTM D2235-[01], Specification for Solvent Cement for Acrylonitrille-Butadiene-Styrene (ABS) Plastic Pipe and Fittings.
.2 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.

1.3 DELIVERY STORAGE AND DISPOSAL

.1 Waste Management and Disposal:

.1 Separate and recycle waste materials in accordance with Section 01 74 19 - Construction/Demolition Waste Management And Disposal
.2 Collect and separate for disposal packaging material for recycling in accordance with Waste Management Plan.

Part 2 Products

2.1 MATERIAL

.1 Sustainable Requirements:

.1 Materials and resources in accordance with Section 01 47 15 Sustainable Requirements: Construction.

2.2 PIPING AND FITTINGS

.1 For buried and above ground DWV piping to:

.1 CSA-B181.1.

.2 CSA-B181.2.

.3 CSA-B182.1.

2.3 JOINTS

.1 Solvent weld for PVC: to ASTM D2564.

.2 Solvent weld for ABS: to ASTM D2235.

Part 3 Execution

3.1 INSTALLATION

.1 In accordance with Section 23 05 01 - Installation of Pipework.

.2 Install in accordance with Canadian 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.

.5 Affix applicable label (storm, sanitary, vent, pump discharge etc.) c/w directional arrows every floor or 4.5 m (whichever is less).

3.4 VERIFICATION

.1 Verification requirements in accordance with Section 01 47 17 - Sustainable Requirements: Contractor's Verification, include:

.1 Materials and resources.

.2 Storage and collection of recyclables.

.3 Construction waste management.

.4 Resource reuse.

.5 Local/regional materials.

.6 Low-emitting materials.

END OF SECTION

Part 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 [___].

.3 Related Sections:

.1 Section 01 33 00 - Submittal Procedures.
.2 Section 01 74 19 - Construction/Demolition Waste Management And Disposal.
.3 Section 02 61 33 - Hazardous Materials.
.4 Section 01 47 15 - Sustainable Requirements: Construction.
.5 Section 01 47 17 - Sustainable Requirements: Contractor's Verification.
.6 Section 01 35 30 - Health and Safety Requirements.
.7 Section 01 78 00 - Closeout Submittals.

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.

1.4 QUALITY ASSURANCE

.1 Health and Safety:

.1 Do construction occupational health and safety in accordance with Section 01 35 30 - Health and Safety Requirements.

1.5 DELIVERY STORAGE AND DISPOSAL

.1 Waste Management and Disposal:

.1 Separate waste materials for reuse and recycling in accordance with Section 01 74 19 - Construction/Demolition Waste Management And Disposal.

.2 Collect and separate for disposal paper, plastic, polystyrene, and corrugated cardboard packaging material in appropriate on-site bins for recycling in accordance with Waste Management Plan.

Part 2 Products

2.1 MATERIAL

.1 Sustainable Requirements:

.1 Materials and resources in accordance with Section 01 47 15 Sustainable Requirements: Construction.

2.2 DIAPHRAGM TYPE EXPANSION TANK

.1 Horizontal or Vertical galvanized steel pressurized diaphragm type expansion tank.

.2 Capacity: As specified.

.3 Size: As specified.

.4 Diaphragm sealed in EPDM suitable for 115 degrees C operating temperature.

.5 Working pressure: 860 kPa with ASME stamp and certification.

.6 Air precharged to 84 kPa (initial fill pressure of system).

.7 Saddles for horizontal installation or Base mount for vertical installation.

.8 Supports: provide supports with hold down bolts and installation.

2.3 AUTOMATIC AIR VENT

.1 Standard float vent: brass body and NPS connection and rated at 310 kPa working pressure.

2.4 AIR SEPARATOR - IN-LINE

.1 Working pressure: 860 kPa.

.2 Size: as indicated.

Part 3 Execution

3.1 GENERAL

.1 Install as indicated and to manufacturer's recommendations.

.2 Run drain lines to terminate above nearest drain.

.3 Maintain proper clearance to permit service and maintenance.

.4 Should deviations beyond allowable clearances arise, request and follow Consultant'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 except at radiation and as indicated.

3.3 AIR VENTS

.1 Install at high points of systems.

.2 Install gate valve on automatic air vent inlet. Run discharge to nearest drain.

3.4 EXPANSION TANKS

.1 Adjust expansion tank pressure to suit design criteria.

Part 4 VERIFICATION

.1 Verification requirements in accordance with Section 01 47 17 - Sustainable Requirements: Contractor's Verification, include:

.1 Materials and resources.

.2 Storage and collection of recyclables.

.3 Construction waste management.

.4 Resource reuse.

.5 Local/regional materials.

.6 Low-emitting materials.

4.2 PRESSURE SAFETY RELIEF VALVES

.1 Run discharge pipe to terminate above nearest drain.

4.3 SUCTION DIFFUSERS

.1 Install on inlet to pumps having suction size greater than 50mm.

END OF SECTION

Part 1 General

1.1 SUMMARY

.1 Section Includes.

.1 Materials and installation for steel piping, valves and fittings for hydronic systems.

.2 American Society of Mechanical Engineers (ASME).

.1 ASME B16.1, Cast Iron Pipe Flanges and Flanged Fittings.

.2 ASME B16.3, Malleable Iron Threaded Fittings.

.3 ASME B16.5, Pipe Flanges and Flanged Fittings.

.4 ASME B16.9, Factory-Made Wrought Buttwelding Fittings.

.5 ASME B18.2.1, Square and Hex Bolts and Screws (Inch Series).

.6 ASME B18.2.2, Square and Hex Nuts (Inch Series).

.3 American Society for Testing and Materials International, (ASTM).

.1 ASTM A47/A47M, Standard Specification for Ferritic Malleable Iron Castings.

.2 ASTM A53/A53M, Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc Coated Welded and Seamless.

.3 ASTM A536, Standard Specification for Ductile Iron Castings.

.4 ASTM B61, Standard Specification for Steam or Valve Bronze Castings.

.5 ASTM B62, Standard Specification for Composition Bronze or Ounce Metal Castings.

.6 ASTM E202, Standard Test Method for Analysis of Ethylene Glycols and Propylene Glycols.

.4 American Water Works Association (AWWA).

.1 AWWA C111, Rubber-Gasket Joints for Ductile-Iron Pressure Pipe and Fittings.

.5 Canadian Standards Association (CSA International).

.1 CSA B242, Groove and Shoulder Type Mechanical Pipe Couplings.

.2 CAN/CSA W48, Filler Metals and Allied Materials for Metal Arc Welding (Developed in cooperation with the Canadian Welding Bureau).

.6 Manufacturer's Standardization of the Valve and Fittings Industry (MSS).

.1 MSS-SP-67, Butterfly Valves.

.2 MSS-SP-70, Cast Iron Gate Valves, Flanged and Threaded Ends.

.3 MSS-SP-71, Cast Iron Swing Check Valves Flanged and Threaded Ends.

.4 MSS-SP-80, Bronze Gate, Globe, Angle and Check Valves.

.5 MSS-SP-85, Cast Iron Globe and Angle Valves, Flanged and Threaded Ends.

1.2 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.

Part 2 Products

2.1 PIPE

.1 Steel pipe: to ASTM A53/A53M, Grade B.

2.2 PIPE JOINTS

.1 NPS2 and under: screwed fittings with PTFE tape or lead-free pipe dope.

.2 NPS2-1/2 and over:

.1 welding fittings and flanges to CAN/CSA W48 ; or,

.2 Roll grooved: standard coupling to CSA B242.

.3 Flanges: plain face.

.4 Orifice flanges: slip-on raised face, 2100 kPa.

.5 Flange gaskets: to AWWA C111.

.6 Pipe thread: taper.

.7 Bolts and nuts: to ASME B18.2.1 and ASME B18.2.2.

.8 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.

2.4 VALVES

.1 Connections:

.1 NPS2 and smaller: screwed ends.

.2 NPS2.1/2 and larger: Flanged or grooved 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 NPS21/2 and over:

.1 Mechanical Rooms: rising stem, split wedge disc, bronze trim, as specified Section 23 05 23 - Valves - Cast Iron: Gate, Globe, Check.

.3 Butterfly valves: to MSS-SP-67 Application: Isolating cells or section of multiple component equipment (i.e. multi-section coils, multi-cell cooling towers):

.1 NPS21/2 and over: Grooved ends: as specified Section 23 05 17 - Pipe Welding.

.4 Globe valves: to MSS-SP-80 Application: Throttling, flow control, emergency bypass:

.1 NPS2 and under:

.1 Mechanical Rooms: with PTFE disc, as specified Section 23 05 22 - Valves - Bronze.

.2 NPS21/2 and over:

.1 With composition disc, bronze trim, as specified Section 23 05 23 - Valves - Cast Iron: Gate, Globe, Check.

.5 Drain valves: Gate, Class 125 , non-rising stem, solid wedge disc, as specified Section 23 05 22 - Valves - Bronze.

.6 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.

.2 NPS21/2 and over:

.1 Flanged or Grooved ends: as specified Section 23 05 23 - Valves - Cast Iron: Gate, Globe, Check.

.7 Silent check valves:

.1 NPS2 and under:

.1 As specified Section 23 05 22 - Valves - Bronze.

.2 NPS21/2 and over:

.1 Flanged or Grooved ends: as specified Section 23 05 23 - Valves - Cast Iron: Gate, Globe, Check.

.8 Ball valves:

.1 NPS2 and under: as specified Section 23 05 22 - Valves - Bronze.

Part 3 Execution

3.1 PIPING INSTALLATION

.1 Install pipework in accordance with Section 23 05 01 - Installation of Pipe Work.

3.2 CIRCUIT 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 00 - Common Work Results - Mechanical.

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

Part 1 General

1.1 SECTION INCLUDES

.1 Materials, equipment selection, installation and start up for hydronic system pumps.

1.2 RELATED SECTIONS

.1 Section 01 33 00 - Submittal Procedures.

.2 Section 01 74 19 - Construction/Demolition Waste Management And Disposal.

.3 Section 01 47 15 - Sustainable Requirements: Construction.

.4 Section 01 47 17 - Sustainable Requirements: Contractor's Verification.

.5 Section 01 47 19 - Sustainable Requirements: Operation.

.6 Section 01 35 30 - Health and Safety Requirements.

.7 Section 01 78 00 - Closeout Submittals.

1.3 REFERENCES

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

.1 Standard 90.1-2001 Energy Standard for Buildings Except Low-Rise Residential Buildings.

.2 Electrical Equipment Manufacturers Advisory Council (EEMAC).

.3 Canadian Standards Association (CSA International).

.1 CAN/CSA-B214-[01], Installation Code for Hydronic Heating Systems.

.4 National Electrical Manufacturers Association (NEMA).

.1 NEMA MG 1-[2003], Motors and Generators.

1.4 SUBMITTALS

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

.2 Submit shop drawings and product data in accordance with Section 01 33 00 - Submittal Procedures.

.3 Submit manufacturer's detailed composite wiring diagrams for control systems showing factory installed wiring and equipment on packaged equipment or required for controlling devices or ancillaries, accessories and controllers.

.4 Submit product data of pump curves for review showing point of operation.

.5 Indicate piping, valves and fittings shipped loose by packaged equipment supplier, showing their final location in field assembly.

.6 Provide maintenance data for incorporation into manual specified in Section 01 78 00 - Closeout Submittals.

1.5 HEALTH AND SAFETY

.1 Do construction occupational health and safety in accordance with Section 01 35 30 - Health and Safety Requirements.

1.6 WASTE MANAGEMENT AND DISPOSAL

.1 Separate and recycle waste materials in accordance with Section 01 74 19 - Construction/Demolition Waste Management And Disposal.

.2 Divert unused metal and wiring materials from landfill to metal recycling facility approved by Consultant.

.3 Dispose of unused paint material at official hazardous material collections site approved by Consultant.

.4 Do not dispose of unused paint material into sewer system, into streams, lakes, onto ground or in any other location where it will pose health or environmental hazard.

.5 Remove from site and dispose of packaging materials at appropriate recycling facilities.

.6 Dispose of corrugated cardboard, polystyrene, and plastic packaging material in appropriate on-site bin for recycling in accordance with site waste management program.

1.7 EXTRA MATERIALS

.1 Provide maintenance materials in accordance with Section 01 78 00 - Closeout Submittals.

Part 2 Products

2.1 SUSTAINABLE REQUIREMENTS

.1 Materials and resources in accordance with Section 01 47 15 - Sustainable Requirements: Construction.

2.2 EQUIPMENT

.1 Do component selection and sizing to: CAN/CSA-B214.

2.3 IN-LINE CIRCULATORS

.1 Volute: cast iron radially split, with screwed or flanged design suction and discharge connections.

.2 Impeller: Alloy Steal.

.3 Shaft: alloy steel with bronze sleeve bearing, integral thrust collar.

.4 Seal assembly: mechanical for service to 135 degrees C.

.5 Coupling: rigid self-aligning.

.6 Motor: to NEMA MG 1 non overloading, capacity as specified.

.7 Capacity: as indicated.

.8 Design pressure: 860 kPa.

Part 3 Execution

3.1 INSTALLATION

.1 Do Work in accordance with CAN/CSA-B214.

.2 In line circulators: install as indicated by flow arrows. Support at inlet and outlet flanges or unions. Install with bearing lubrication points accessible.

.3 Base mounted type: supply templates for anchor bolt placement. Furnish anchor bolts with sleeves. Place level, shim unit and grout. Align coupling in accordance with manufacturer's recommended tolerance. Check oil level and lubricate. After run-in, tighten glands.

.4 Ensure that pump body does not support piping or equipment. Provide stanchions or hangers for this purpose. Refer to manufacturer's installation instructions for details.

.5 Pipe drain tapping to floor drain.

.6 Install volute venting pet cock in accessible location.

.7 Check rotation prior to start-up.

.8 Install pressure gauge test cocks.

3.2 START-UP

.1 General

.1 In accordance with Section: General Requirements; supplemented as specified herein.

.2 In accordance with manufacturer's recommendations.

.2 Procedures:

.1 Before starting pump, check that cooling water system over-temperature and other protective devices are installed and operative.

.2 After starting pump, check for proper, safe operation.

.3 Check installation, operation of mechanical seals, packing gland type seals. Adjust as necessary.

.4 Check base for free-floating, no obstructions under base.

.5 Run-in pumps for 12 continuous hours.

.6 Verify operation of over-temperature and other protective devices under low- and no-flow condition.

.7 Eliminate air from scroll casing.

.8 Adjust water flow rate through water-cooled bearings.

.9 Adjust flow rate from pump shaft stuffing boxes to manufacturer's recommendation.

.10 Adjust alignment of piping and conduit to ensure true flexibility at all times.

.11 Eliminate cavitation, flashing and air entrainment.

.12 Adjust pump shaft seals, stuffing boxes, glands.

.13 Measure pressure drop across strainer when clean and with flow rates as finally set.

.14 Replace seals if pump used to degrease system or if pump used for temporary heat.

.15 Verify lubricating oil levels.

3.3 PERFORMANCE VERIFICATION (PV)

.1 General

.1 In accordance with Section 01 47 17 - Sustainable Requirement: Contractor's Verification, include:

.1 Materials and resources.

.2 Low-emitting materials.

.2 In accordance with manufacturer's recommendations.

.2 Exclusions:

.1 This paragraph does not apply to small in-line circulators.

.3 Assumptions: these PV procedures assume that:

.1 Manufacturer's performance curves are accurate.

.2 Valves on pump suction and discharge provide tight shut-off.

.4 Net Positive Suction Head (NPSH):

.1 Application: measure NPSH for pumps which operate on open systems and with water at elevated temperatures.

.2 Measure using procedures prescribed in the Standard.

.3 Where procedures do not exist, discontinue PV, report to Consultant and await instructions.

.5 Mark points of design and actual performance at design conditions as finally set upon completion of TAB.

3.4 OPERATION REQUIREMENTS

.1 Operational requirements in accordance with Section 01 47 19 - Sustainable Requirements: Operations, include:

.1 Repair and maintenance materials and instructions.

END OF SECTION

Part 1 General

1.1 RELATED SECTIONS

.1 Section 01 33 00 - Submittal Procedures.

.2 Section 01 74 19 - Construction/Demolition Waste Management And Disposal.

1.2 REFERENCES

.1 American Society of Mechanical Engineers (ASME)

.1 ASME Boiler and Pressure Vessel Code, Section VII-[2001].

1.3 SHOP DRAWINGS

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

1.4 CLOSEOUT SUBMITTALS

.1 Submit operation and maintenance data for incorporation into manual specified in Section 01 78 00 - Closeout Submittals.

.2 Include following:

.1 Log sheets as recommended by Consultant.

1.5 WASTE MANAGEMENT AND DISPOSAL

.1 Separate and recycle waste materials in accordance with Section 01 74 19 - Construction/Demolition Waste Management And Disposal.

.2 Divert unused metal and wiring materials from landfill to metal recycling facility approved by Consultant.

.3 Dispose of unused paint material at official hazardous material collections site approved by Consultant.

.4 Do not dispose of unused paint material into sewer system, into streams, lakes, onto ground or in any other location where it will pose health or environmental hazard.

.5 Remove from site and dispose of packaging materials at appropriate recycling facilities.

.6 Dispose of corrugated cardboard, polystyrene, and plastic packaging material in appropriate on-site bin for recycling in accordance with site waste management program.

Part 2 Products

2.1 MANUFACTURER

.1 Equipment, chemicals, service by one supplier.

2.2 POT FEEDER

.1 Welded steel, pressure rating 861 kPa. Temperature rating: 90°C.

2.3 CHEMICAL FEED PIPING

.1 Resistant to chemicals employed. Pressure rating: 861 kPa.

2.4 CHEMICAL FEED PUMPS

.1 Top-mounted electronic metering diaphragm type: flow range 0-100%, adjustable, plus or minus 1.0% accuracy (repetitive), on-off operation, with pressure relief valve, check valve, foot valve, injection fitting.

.2 Piston type: flow range 0-100%, adjustable, plus or minus 1.0% accuracy (repetitive), on-off operation, with stainless steel piston, pressure relief valve, double ball and check valves.

2.5 SHIPPING/ FEEDING CHEMICAL CONTAINERS

.1 High density moulded polyethylene, with liquid level graduations, cover.

2.6 WATER TREATMENT FOR HYDRONIC SYSTEMS

.1 Glycol system: Pot feeder, 19L, operating pressure 861 kPa.

.2 Micron filter for each pot feeder:

.1 Capacity 2% of pump recirculating rate at operating pressure.

.2 Six (6) sets of filter cartridges for each type, size of micron filter.

2.7 CHEMICALS

.1 Provide [1] years supply of 67%water and 33% ethylene glycol c/w inhibitor heating solution.

.2 Obtain chemicals from manufacturer with existing valid contract with Owner.

2.8 TEST EQUIPMENT

.1 Provide one set of test equipment for each system to verify performance.

.2 Complete with carrying case, reagents for chemicals, all specialized or supplementary equipment.

Part 3 Execution

3.1 INSTALLATION

.1 Install HVAC water treatment systems in accordance with ASME Boiler Code Section VII, and requirements and standards of authorities having jurisdiction, except where specified otherwise.

.2 Ensure adequate clearances to permit performance of servicing and maintenance of equipment.

3.2 CHEMICAL FEED PIPING

.1 Install crosses at all changes in direction. Install plugs in unused connections.

3.3 CLEANING OF MECHANICAL SYSTEM

.1 Provide copy of recommended cleaning procedures and chemicals for approval by Consultant.

.2 Thoroughly flush mechanical systems and equipment with approved cleaning chemicals designed to remove deposition from construction such as pipe dope, oils, loose mill scale and other extraneous materials. Chemicals to inhibit corrosion of various system materials and be safe to handle and use.

.3 During circulation of cleaning solution, periodically examine and clean filters and screens and monitor changes in pressure drop across equipment.

.4 Drain and flush system[s] until alkalinity of rinse water is equal to make-up water. Refill with clean water treated to prevent scale and corrosion during system operation.

.5 Disposal of cleaning solutions to be approved by authority having jurisdiction.

3.4 WATER TREATMENT SERVICES

.1 Provide water treatment monitoring and consulting services for period of [one year] after system start-up. Service to include:

- .1 Initial water analysis and treatment recommendations.
- .2 System start-up assistance.
- .3 Operating staff training.
- .4 Visit plant every 30 days during period of operation and as required until system stabilizes, and advise on treatment system performance.
- .5 Provide necessary recording charts and log sheets for operation.
- .6 Provide necessary laboratory and technical assistance.
- .7 Instructions and advice to operating staff to be clear, concise and in writing.

3.5 START-UP

.1 Start up water treatment systems in accordance with manufacturer's instructions.

END OF SECTION

Approved: 2001-12-04

Part 1 General

1.1 RELATED SECTIONS

.1 Section 01 33 00 - Submittal Procedures.

.2 Section 01 74 19 - Construction/Demolition Waste Management And Disposal.

.3 Section 23 05 94 - Pressure Testing of Ducted Air Systems.

1.2 REFERENCES

.1 American Society for Testing and Materials (ASTM)

.1 ASTM A480/A480M-[01], Specification for General Requirements for Flat-Rolled Stainless and Heat-Resisting Steel Plate, Sheet and Strip.

.2 ASTM A635/A635M-[00], Specification for Steel, Sheet and Strip, Heavy-Thickness Coils, Carbon, Hot Rolled.

.3 ASTM A653/A653M-[00], Specification for Steel Sheet, Zinc Coated (Galvanized) or Zinc-Iron Alloy Coated (Galvannealed) by the Hot-Dip Process.

.2 National Fire Protection Agency (NFPA)

.1 NFPA 90A-[99], Installation of Air Conditioning and Ventilating Systems.

.2 NFPA 90B-[99], Installation of Warm Air Heating and Air Conditioning Systems.

.3 NFPA 91-[1995], Standard for Exhaust System for Air Conveying of Vapours, Gases, Mists, and Noncombustible Particle Solids.

.4 NFPA 96-[98], Standard for Ventilation Control and Fire Protection of Commercial Cooking Operations.

.3 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 Duct Leakage Test Manual, [1985], Technical Research Update-92.

1.3 SHOP DRAWINGS AND PRODUCT DATA

.1 Submit shop drawings and product data in accordance with Section 01 33 00 - Submittal Procedures.

.2 Indicate following:

.1 Sealants.

.2 Tape.

.3 Proprietary Joints.

1.4 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.

1.5 WASTE MANAGEMENT AND DISPOSAL

.1 Separate and recycle waste materials in accordance with Section 01 74 19 - Construction/Demolition Waste Management And Disposal.

.2 Collect and separate plastic, paper packaging and corrugated cardboard in accordance with Waste Management Plan

.3 Fold up metal banding, flatten and place in designated area for recycling.

Part 2 Products

2.1 SEAL CLASSIFICATION

.1 Classification as follows:

Maximum Pressure Pa	SMACNA Seal Class
500	[C]
250	[C]
125	[C]
125	[Unsealed]

.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.

.4 Unsealed seams and joints.

2.2 SEALANT

.1 Sealant: oil resistant, polymer type flame resistant duct sealant. Temperature range of minus 30^0C to plus 93^0C.

2.3 TAPE

.1 Tape: polyvinyl treated, open weave fiberglass tape, 50 mm wide.

2.4 DUCT LEAKAGE

.1 In accordance with SMACNA HVAC Duct Leakage Test Manual.

2.5 FITTINGS

.1 Fabrication: to SMACNA.

.2 Radiused elbows:

.1 Rectangular: standard radius.

.2 Round: five piece. Centreline radius: 1.5 times diameter.

.3 Mitred elbows, rectangular:

.1 To 400 mm: with double thickness turning vanes.

.2 Over 400 mm: with double thickness 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 45^0 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: 20^0 maximum included angle.

.2 Converging: 30^0 maximum included angle.

.6 Offsets:

.1 as indicated.

.7 Obstruction deflectors: maintain full cross-sectional area. Maximum included angles: as for transitions.

2.6 FIRESTOPPING

.1 Retaining angles around duct, on both sides of fire separation.

.2 Firestopping material and installation must not distort duct.

2.7 GALVANIZED STEEL

.1 Lock forming quality: to ASTM A653, Z90 zinc coating.

.2 Thickness, fabrication and reinforcement: to SMACNA.

.3 Joints: to SMACNA proprietary manufactured duct joint. Proprietary manufactured flanged duct joint to be considered to be a class A seal.

2.8 HANGERS AND SUPPORTS

.1 Strap hangers: of same material as duct [but next sheet metal thickness heavier than duct]. Maximum size duct supported by strap hanger: [500] mm.

.2 Hanger configuration: to SMACNA.

.3 Hangers: galvanized steel angle with galvanized steel rods to SMACNA

.4 Upper hanger attachments:

.1 For concrete: manufactured concrete inserts.

.2 For steel joist: manufactured joist clamp.

.3 For steel beams: manufactured beam clamps:

Part 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. Insulate strap hangers 100 mm beyond insulated duct.

.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.

3.2 HANGERS

.1 Strap hangers: install in accordance with SMACNA.

.2 Angle hangers: complete with locking nuts and washers.

.3 Hanger spacing: in accordance with SMACNA.

3.3 WATERTIGHT DUCT

.1 Provide watertight duct for:

.1 Dishwasher exhaust.

.2 Fresh air intake.

.3 As indicated.

.2 Form bottom of horizontal duct without longitudinal seams. Solder or weld joints of bottom and side sheets. Seal other joints with duct sealer.

.3 Slope horizontal branch ductwork down towards fume hoods served. Slope header ducts down toward risers.

.4 Fit base of riser with 150 mm deep drain sump and 32 mm drain connected, with deep seal trap and valve and discharging to open funnel drain.

3.4 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.

3.5 LEAKAGE TESTS

.1 Refer to Section 23 05 94 - Pressure Testing of Ducted Air Systems.

.2 In accordance with SMACNA HVAC Duct Leakage Test Manual.

.3 Do leakage tests in sections.

.4 Make trial leakage tests as instructed to demonstrate workmanship.

.5 Install no additional ductwork until trial test has been passed.

.6 Test section minimum of 30 m long with not less than [three] branch takeoffs and two 90^0 elbows.

.7 Complete test before insulation or concealment.

END OF SECTION

Part 1 General

1.1 RELATED SECTIONS

.1 Section [01 33 00 - Submittal Procedures].

.2 Section [01 74 19 - Construction/Demolition Waste Management And Disposal].

1.2 REFERENCES

.1 Sheet Metal and Air Conditioning Contractors' National Association (SMACNA)

.1 SMACNA - HVAC Duct Construction Standards - Metal and Flexible, [95].

1.3 PRODUCT DATA

.1 Submit product data in accordance with Section [01 33 00 - Submittal Procedures].

.2 Indicate the following:

.1 Flexible connections.
.2 Duct access doors.
.3 Turning vanes.
.4 Instrument test ports.

1.4 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 WASTE MANAGEMENT AND DISPOSAL

.1 Separate and recycle waste materials in accordance with Section [01 74 19 - Construction/Demolition Waste Management And Disposal].

.2 Collect and separate plastic, paper packaging and corrugated cardboard in accordance with Waste Management Plan

.3 Fold up metal banding, flatten and place in designated area for recycling.

Part 2 Products

2.1 GENERAL

.1 Manufacture in accordance with SMACNA - HVAC Duct Construction Standards.

2.2 FLEXIBLE CONNECTIONS

.1 Frame: galvanized sheet metal frame with fabric clenched by means of double locked seams.

.2 Material:

.1 Fire resistant, self-extinguishing, neoprene coated glass fabric, temperature rated at minus 40^0C to plus 90^0C, density of 1.3 kg/m^2.

2.3 ACCESS DOORS IN DUCTS

.1 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.

.2 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.

.3 Gaskets: neoprene.

.4 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.

2.4 TURNING VANES

.1 Factory or shop fabricated double thickness with trailing edge, and to recommendations of SMACNA and as indicated.

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.

Part 3 Execution

3.1 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 servicing entry.

.2 300 x 300 mm for viewing.

.3 As indicated.

.2 Locations:

.1 Fire and smoke dampers.

.2 Control dampers.

.3 Devices requiring maintenance.

.4 Required by code.

.5 Reheat coils.

.6 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 Consultant.

.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.

END OF SECTION

Part 1 General

1.1 REFERENCES

.1 Sheet Metal and Air Conditioning National Association (SMACNA)

.1 SMACNA HVAC Duct Construction Standards, Metal and Flexible- 1985.

1.2 PRODUCT DATA

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

1.3 WASTE MANAGEMENT AND DISPOSAL

.1 Separate and recycle waste materials in accordance with Section [01 74 19 - Construction/Demolition Waste Management And Disposal] , and with the Waste Reduction Workplan.

.2 Place materials defined as hazardous or toxic waste in designated containers.

.3 Ensure emptied containers are sealed and stored safely for disposal away from children.

Part 2 Products

2.1 GENERAL

.1 Manufacture to SMACNA standards.

2.2 SPLITTER DAMPERS

.1 Of same material as duct but one sheet metal thickness heavier, with appropriate stiffening.

.2 [Single] [Double] thickness construction.

.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.

2.3 SINGLE BLADE DAMPERS

.1 Of same material as duct, but one sheet metal thickness heavier. V-groove stiffened.

.2 Size and configuration to recommendations of SMACNA,

.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: pin in bronze bushings.

.5 Linkage: shaft extension with locking quadrant.

.6 Channel frame of same material as adjacent duct, complete with angle stop.

Part 3 Execution

3.1 INSTALLATION

.1 Install where indicated.

.2 Install in accordance with recommendations of SMACNA and in accordance with manufacturer's instructions.

.3 For supply, return and exhaust systems, locate balancing dampers in each branch duct.

.4 Runouts to registers and diffusers: install single blade damper located as close as possible to main ducts.

.5 All dampers to be vibration free.

.6 Ensure damper operators are observable and accessible.

END OF SECTION

Part 1 General

1.1 RELATED SECTIONS

.1 Section [23 33 00 - Air Duct Accessories].

.2 Section [23 09 43 - Pneumatic Control System for HVAC].

1.2 REFERENCES

.1 American Society for Testing and Materials (ASTM)

.1 ASTM A 653M- [95] , Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by Hot-Dip Process.

1.3 PRODUCT DATA

.1 Submit product data in accordance with Section [01 33 00 - Submittal Procedures].

.2 Indicate the following:

.1 Performance data.

1.4 CLOSEOUT SUBMITTALS

.1 Provide maintenance data for incorporation into manual specified in Section [01 78 00 - Closeout Submittals].

1.5 CERTIFICATION OF RATINGS

.1 Catalogue or published ratings shall be those obtained from tests carried out by manufacturer or those ordered by him from independent testing agency.

1.6 WASTE MANAGEMENT AND DISPOSAL

.1 Separate and recycle waste materials in accordance with Section [01 74 19 - Construction/Demolition Waste Management And Disposal], and with the Waste Reduction Workplan.

.2 Place materials defined as hazardous or toxic waste in designated containers.

.3 Ensure emptied containers are sealed and stored safely for disposal away from children.

Part 2 Products

2.1 MULTI-LEAF DAMPERS

.1 Opposed and/or Parallel blade type as indicated.

.2 Extruded aluminum , interlocking blades, complete with extruded vinyl seals, spring stainless steel side seals, extruded aluminum frame.

.3 Pressure fit self-lubricated bronze bearings.

.4 Linkage: plated steel tie rods, brass pivots and plated steel brackets, complete with plated steel control rod.

.5 Operator: to Section [23 09 43 - Pneumatic Control System for HVAC] .

.6 Performance:

.1 Leakage: in closed position to be less than 2% of rated air flow at 32 Pa differential across damper.

.2 Pressure drop: at full open position to be less than 16 Pa differential across damper at 0.047 m/s.

.7 Insulated aluminum dampers:

.1 Frames: insulated with extruded polystyrene foam with R factor of 5.0.

.2 Blades: constructed from aluminum extrusions with internal hollows insulated with polyurethane or polystyrene foam, R factor of 5.0.

2.2 DISC TYPE DAMPERS

.1 Frame: insulated brake formed, welded, 1.6 mm thick, galvanized steel to ASTM A 653M.

.2 Disc: insulated spin formed, 1.6 mm thick, galvanized steel to ASTM A 653M.

.3 Gasket: extruded neoprene, field replaceable, with 10 year warranty.

.4 Bearings: roller self lubricated and sealed.

.5 Operator: compatible with damper, linear stroke operator, [spring loaded] actuator, zinc-aluminum foundry alloy casting cam follower.

.6 Performance:

.1 Leakage: in closed position to be less than 0.001% of rated air flow at 32 kPa pressure differential across damper.

.2 Pressure drop: at full open position to be less than 16 kPa differential across damper at .047 m/s.

2.3 BACK DRAFT DAMPERS

.1 Automatic gravity operated , multi leaf, aluminum construction with nylon bearings, spring assisted.

2.4 RELIEF DAMPERS

.1 Automatic multi-leaf aluminum dampers with ball bearing centre pivoted and counter-weights set to open at 32 Pa static pressure,

Part 3 Execution

3.1 INSTALLATION

.1 Install where indicated.

.2 Install in accordance with recommendations of SMACNA and manufacturer's instructions.

.3 Seal multiple damper modules with silicon sealant.

.4 Install access door adjacent to each damper. See Section 23 33 00 - Air Duct Accessories .

.5 Ensure dampers are observable and accessible.

END OF SECTION

Part 1 General

1.1 RELATED SECTIONS

.1 Section [01 33 00 - Submittal Procedures].

.2 Section [01 74 19 - Construction/Demolition Waste Management And Disposal].

1.2 REFERENCES

.1 American Society for Testing and Materials (ASTM)

.1 ASTM C177-[97], Test Method for Steady-State Heat Flux Measurements and Thermal Transmission Properties by Means of the Guarded-Hot-Plate Apparatus.

.2 Canadian General Standards Board (CGSB)

.1 CGSB 51-GP-10M-[76], Thermal Insulation, Mineral Fibre, Block or Board, for Ducting, Machinery and Boilers.

.2 CGSB 51-GP-11M-[76], Thermal Insulation, Mineral Fibre, Blanket, for Piping, Ducting, Machinery and Boilers.

.3 National Fire Protection Association (NFPA)

.1 NFPA 90A-[99], Installation of Air Conditioning and Ventilating Systems.

.2 NFPA 90B-[99], Installation of Warm Air Heating and Air Conditioning Systems.

.4 Sheet Metal and Air Conditioning Contractor=s National Association (SMACNA)

.1 SMACNA HVAC Duct Construction Standards, Metal and Flexible-[95 (Addendum No.1, Nov. 97)].

.5 Underwriter=s Laboratories of Canada (ULC)

.1 CAN/ULC-S102-[88(R2000)], Surface Burning Characteristics of Building Materials and Assemblies.

1.3 PRODUCT DATA

.1 Submit product data in accordance with Section [01 33 00 - Submittal Procedures].

1.4 WASTE MANAGEMENT AND DISPOSAL

.1 Separate and recycle waste materials in accordance with Section [01 74 19 - Construction/Demolition Waste Management And Disposal].

.2 Collect and separate plastic, paper packaging and corrugated cardboard in accordance with Waste Management Plan

Part 2 Products

2.1 DUCT LINER

.1 General:

.1 Fibrous glass duct liner: air stream side faced with mat facing.

.2 Flame spread rating shall not exceed 25. Smoke development rating shall not exceed 50 when tested in accordance with CAN/ULC-S102.

.2 Rigid:

.1 Use on flat surfaces.

.2 25 mm thick, to CGSB 51-GP-10M, fibrous glass rigid board duct liner.

.3 Density: 36 kg/m^{3}minimum.

.4 Thermal resistance to be minimum 0.76 m^2.EC/W for 25 mm thickness when tested in accordance with ASTM C177, at 24EC mean temperature.

.3 Flexible:

.1 Use on round or oval surfaces.

.2 [25] mm thick, to CGSB-51-GP-11M, fibrous glass blanket duct liner.

.3 Density: [24] kg/m^3 minimum.

.4 Thermal resistance to be minimum 0.37 m^2.EC/W for 12 mm thickness, when tested in accordance with ASTM C177, at 24EC mean temperature.

2.2 ADHESIVE

.1 Meet requirements of NFPA 90A and NFPA 90B.

.2 Flame spread rating shall not exceed 25. Smoke development rating shall not exceed 50. Temperature range minus 29EC to plus 93EC.

2.3 FASTENERS

.1 Weld pins 2.0 mm diameter, length to suit thickness of insulation. Metal retaining clips, [32] mm square.

2.4 JOINT TAPE

.1 Poly-Vinyl treated open weave fiberglass membrane 50 mm wide.

2.5 SEALER

.1 Meet requirements of NFPA 90A and NFPA90B.

.2 Flame spread rating shall not exceed 25. Smoke development rating shall not exceed 50. Temperature range minus 68EC to plus 93EC.

Part 3 Execution

3.1 GENERAL

.1 Do work in accordance with recommendations of SMACNA duct liner standards as indicated in SMACNA HVAC Duct Construction Standards, Metal and Flexible, except as specified otherwise.

.2 Line inside of ducts where indicated.

.3 Duct dimensions, as indicated, are clear inside duct lining.

3.2 DUCT LINER

.1 Install in accordance with manufacturer's recommendations, and as follows:

.1 Fasten to interior sheet metal surface with 100% coverage of adhesive.

.2 In addition to adhesive, install weld pins not less than 2 rows per surface and not more than 425 mm on centres.

3.3 JOINTS

.1 Seal butt joints, exposed edges, weld pin and clip penetrations and damaged areas of liner with joint tape and sealer. Install joint tape in accordance with manufacturer's written recommendations, and as follows:

.1 Bed tape in sealer.

.2 Apply [two] coats of sealer over tape.

.2 Replace damaged areas of liner at discretion of Consultant.

.3 Protect leading and trailing edges of duct sections with sheet metal nosing having 15 mm overlap and fastened to duct.

END OF SECTION

Part 1 General

1.1 RELATED SECTIONS

.1 Section [23 05 13 - Common Motor Requirements for HVAC Equipment].

.2 Section [23 05 48 - Vibration and Seismic Controls for HVAC Piping and Equipment].

.3 Section [23 33 00 - Air Duct Accessories].

1.2 REFERENCES

.1 AMCA 99-[1986], Standards Handbook.

.2 ANSI/AMCA 210-[1985], Laboratory Methods of Testing Fans for Rating.

.3 AMCA 300-[1985 Revised 1987], Reverberant Room Method for Sound Testing of Fans.

.4 AMCA 301-[1990], Methods for Calculating Fan Sound Ratings from Laboratory Test Data.

.5 ANSI/ASHRAE 51- [1985], Laboratory Methods of Testing Fans for Rating.

.6 CGSB 1-GP-181M-[77], Coating, Zinc Rich, Organic, Ready Mixed.

1.3 SHOP DRAWINGS AND PRODUCT DATA

.1 Submit shop drawings and product data in accordance with Section [01 33 00 - Submittal Procedures].

.2 Provide :

.1 Fan performance curves showing point of operation, BHP and efficiency.

.2 Sound rating data at point of operation.

.3 Indicate:

.1 Motors, sheaves, bearings, shaft details.

.2 Minimum performance achievable with variable speed controllers.

1.4 CLOSEOUT SUBMITTALS

.1 Provide operation and 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].

.1 Spare parts to include:

.1 Matched sets of belts.

.2 Furnish list of individual manufacturer's recommended spare parts for equipment such as bearings and seals, and addresses of suppliers, together with list of specialized tools necessary for adjusting, repairing or replacing, for placement into operating manual.

1.6 MANUFACTURED ITEMS

.1 Catalogued or published ratings shall be those obtained from tests carried out by manufacturer or those ordered by him from independent testing agency signifying adherence to codes and standards in force.

Part 2 Products

2.1 FANS GENERAL

.1 Capacity: flow rate, total static pressure, bhp, efficiency, revolutions per minute, power, model, size, sound power data and as indicated on schedule.

.2 Fans: statically and dynamically balanced, constructed in conformity with AMCA 99.

.3 Sound ratings: comply with AMCA 301, tested to AMCA 300. Unit shall bear AMCA certified sound rating seal.

.4 Performance ratings: based on tests performed in accordance with ANSI/AMCA 210, and ANSI/ASHRAE 51. Unit shall bear AMCA certified rating seal, except for propeller fans smaller than 300 mm diameter.

.5 Motors:

.1 In accordance with Section [23 05 13 - Common Motors Requirements for HVAC Equipment] supplemented as specified herein.

.2 For use with variable speed controllers.

.3 Sizes as specified.

.6 Accessories and hardware: matched sets of V-belt drives, adjustable slide rail motor bases, belt guards, coupling guards fan inlet and/or outlet safety screens as indicated and as specified in Section 23 05 13 - Common Motor Requirements for HVAC Equipment. outlet dampers and vanes and as indicated.

.7 Factory primed before assembly in colour standard to manufacturer.

.8 Scroll casing drains: as indicated.

.9 Bearing lubrication systems plus extension lubrication tubes where bearings are not easily accessible.

.10 Vibration isolation: to Section 23 05 48 - Vibration and Seismic Controls for HVAC Piping and Equipment.

.11 Flexible connections: to Section 23 33 00 - Air Duct Accessories.

2.2 CENTRIFUGAL FANS

.1 Fan wheels:

.1 Welded aluminum construction.

.2 Maximum operating speed of centrifugal fans not more than 40 % of first critical speed.

.3 Air foil, forward curved, or backward inclined blades, as indicated.

.2 Bearings: heavy duty flange mounted grease lubricated ball or roller self aligning type with oil retaining, dust excluding seals and a certified minimum rated life of 200,000 h.

.3 Housings:

.1 Volute with inlet cones: fabricated steel for wheels 300 mm or greater, [cast iron], [steel], [aluminum], for smaller wheels, braced, and with welded supports.

.2 For horizontally and vertically split housings provide flanges on each section for bolting together, with gaskets of non-oxidizing non-flammable material.

.3 Provide [bolted] [latched] airtight access doors with handles.

.4 Variable volume control devices:

.1 Mounted by fan manufacturer.

.2 Adjustable inlet vanes: operated from a centre mechanism linked to each damper vane. Support each vane at ends in bronze bearings. On DWDI fans interconnect vanes to operate in unison. Provide locking devices for manual operation.

.3 Variable Speed Drives: Refer to Section 25 30 03 - Variable Frequency Drives.

2.3 CABINET FANS - GENERAL PURPOSE

.1 Fan characteristics and construction: as centrifugal fans.

.2 Cabinet hung single or multiple wheel with DWDI centrifugal fans in factory fabricated casing complete with vibration isolators and seismic control measures, motor, variable speed drive or V-belt drive and guard inside or outside casing.

.3 Fabricate casing of zinc coated or phosphate treated steel of thickness as indicated reinforced and braced for rigidity. Provide removable panels for access to interior. Uncoated, steel parts shall be painted over with corrosion resistant paint to CGSB 1-GP-181M. Finish inside and out, over prime coat, with rust resistant enamel.

2.4 IN-LINE CENTRIFUGAL FANS

.1 Characteristics and construction: as for centrifugal fan wheels, with axial flow construction and direct or belt drive as noted.

.2 Provide AMCA arrangements 1 or 9 as indicated with stiffened flanges, smooth rounded inlets, and stationary guide vanes.

2.5 PROPELLER FANS

.1 Fabricate multibladed propellers of aluminum within bell mouth entrance on integral mounts, with grease lubricated ball bearings, with extended lubrication fittings, suited for operating in any position, direct or belt driven, complete with motor as indicated.

.2 Provide blade guards, bird screen and automatic back draft dampers on discharge, with gasketted edges.

Part 3 Execution

3.1 FAN INSTALLATION

.1 Install fans as indicated, complete with resilient mountings specified in Section [23 05 48 - Vibration and Seismic Controls for HVAC Piping and Equipment], flexible electrical leads and flexible connections in accordance with Section [23 33 00 - Air Duct Accessories].

.2 Provide sheaves and belts required for final air balance.

.3 Bearings and extension tubes to be easily accessible.

.4 Access doors and access panels to be easily accessible.

END OF SECTION

Part 1 General

1.1 REFERENCES

.1 AMCA 201- [1990] , AMCA Fan Application Manual - Fans and Systems.

.2 ANSI/AMCA 210- [85] , Laboratory Methods of Testing Fans for Rating.

.3 AMCA 301- [1990] , Methods for Calculating Fan Sound Ratings from Laboratory Test Data.

.4 AMCA 300- [85 Rev. 87] , Reverberant Room Method for Sound Testing of Fans.

.5 AMCA 302- [73] , Application of Sone Ratings for Non-Ducted Air Moving Devices.

.6 AMCA 303- [79] , Application of Sound Power Level Ratings for Fans.

.7 ANSI/ASHRAE 51- [1985] , Laboratory Methods of Testing Fans for Rating.

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].

1.4 EXTRA MATERIALS

.1 Provide maintenance materials in accordance with Section [01 78 00 - Closeout Submittals].

.2 Furnish list of individual manufacturer's recommended spare parts for equipment such as bearings and seals, and addresses of suppliers, together with list of specialized tools necessary for adjusting, repairing or replacing, for placement into operating manual.

1.5 CERTIFICATION OF RATINGS

.1 Catalogued or published ratings shall be those obtained from tests carried out by manufacturer or those ordered by him from independent testing agency signifying adherence to codes and standards.

Part 2 Products

2.1 FANS GENERAL

.1 Standard of rating:

.1 AMCA 201 for fan application.

.2 AMCA 302 for application of sone loudness ratings for non-ducted air moving devices.

.3 AMCA 303 for application of sound power ratings for ducted air moving devices.

.4 Performance: to ANSI/AMCA 210 and ANSI/ASHRAE 51. Unit to bear AMCA certified seal .

.2 Pwl sound ratings to comply with AMCA 301, tested to AMCA 300 Unit to bear AMCA certified sound rating seal.

2.2 EXTERIOR MOUNTED DISCHARGE FANS

.1 Wall or Roof mounted, direct driven centrifugal fan, ball bearing thermally protected motor.

.2 Sizes and capacity: as indicated.

.3 Control: as indicated.

.4 Rust resistant aluminum with aluminum backdraft damper, complete with foam cushioned frame.

Part 3 Execution

3.1 INSTALLATION

.1 Install in accordance with manufacturer's recommendations.

3.2 ANCHOR BOLTS AND TEMPLATES

.1 Supply for installation by other Divisions.

END OF SECTION

Part 1 General

1.1 RELATED SECTIONS

.1 Section [01 33 00 - Submittal Procedures].

.2 Section [01 74 19 - Construction/Demolition Waste Management And Disposal].

.3 Section [01 78 00 - Closeout Submittals].

.4 Door grilles: Section [08 90 00 - Louvres and Vents].

1.2 PRODUCT DATA

.1 Submit product data in accordance with Section [01 33 00 - Submittal Procedures].

.2 Indicate the following:

.1 Capacity.

.2 Throw and terminal velocity.

.3 Noise criteria.

.4 Pressure drop.

1.3 SAMPLES

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

1.4 CERTIFICATIONS

.1 Catalogued or published ratings shall be those obtained from tests carried out by manufacturer or those ordered by him from independent testing agency signifying adherence to codes and standards.

1.5 WASTE MANAGEMENT AND DISPOSAL

.1 Separate and recycle waste materials in accordance with Section [01 74 19 - 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] packaging material in appropriate on-site bin for recycling in accordance with site waste management program.

1.6 EXTRA MATERIALS

.1 Provide maintenance materials in accordance with Section [01 78 00 - Closeout Submittals].

.2 Include:

.1 Keys for volume control adjustment.

.2 Keys for air flow pattern adjustment.

Part 2 Products

2.1 GENERAL

.1 To meet capacity, pressure drop, terminal velocity, throw, noise level, neck velocity [as indicated].

.2 Frames:

.1 Full perimeter gaskets.

.2 Plaster frames where set into plaster or gypsum board at all locations and as specified.

.3 Concealed fasteners.

.3 Concealed manual volume control damper operators.

.4 Colour: as directed by Consultant.

2.2 MANUFACTURED UNITS

.1 Grilles, registers and diffusers of same generic type to be product of one manufacturer.

2.3 SUPPLY GRILLES AND REGISTERS

.1 General: with opposed blade dampers.

2.4 RETURN AND EXHAUST GRILLES AND REGISTERS

.1 General: with opposed blade dampers.

2.5 DIFFUSERS

.1 General: volume control dampers with flow straightening devices and blank-off quadrants and gaskets.

Part 3 Execution

3.1 INSTALLATION

.1 Install in accordance with manufacturer's instructions.

.2 Install with painted flat head screws in countersunk holes where fastenings are visible.

.3 Provide concealed safety chain on each grille, register and diffuser in gymnasium and similar game rooms and elsewhere as indicated.

END OF SECTION

Part 1 General

1.1 RELATED SECTIONS

.1 Section [01 33 00 - Submittal Procedures].

.2 Section [01 74 19 - Construction/Demolition Waste Management And Disposal].

1.2 REFERENCES

.1 American National Standards Institute (ANSI)/ National Fire Protection Association (NFPA)

.1 ANSI/NFPA 96-[01], Standard for Ventilation Control and Fire Protection of Commercial Cooking Operations.

.2 American Society for Testing and Materials (ASTM)

.1 ASTM E90-[99], Method for Laboratory Measurement of Airborne Sound Transmission Loss of Building Partitions and Elements.

.3 Sheet Metal and Air Conditioning Contractors' National Association (SMACNA)

.4 Society of Automotive Engineers (SAE)

1.3 PRODUCT DATA

.1 Submit product data in accordance with Section [01 33 00 - Submittal Procedures].

.2 Indicate the following:

.1 Pressure drop.

.2 Face area.

.3 Free area.

1.4 TEST REPORTS

.1 Submit certified data from independent laboratory substantiating acoustic and aerodynamic performance to ASTM E90.

1.5 CERTIFICATION OF RATINGS

.1 Catalogued or published ratings shall be those obtained from tests carried out by manufacturer or those ordered by him from independent testing agency signifying adherence to codes and standards.

1.6 WASTE MANAGEMENT AND DISPOSAL

.1 Separate and recycle waste materials in accordance with Section [01 74 19 - Construction/Demolition Waste Management And Disposal].

.2 Unused metal materials are to be diverted from landfill to a metal recycling facility as approved by the Consultant.

.3 Remove from site and dispose of packaging materials at appropriate recycling facilities.

.4 Dispose of corrugated cardboard, polystyrene, plastic, packaging material in appropriate on-site bin for recycling in accordance with site waste management program.

Part 2 Products

2.1 GRAVITY ROOF OUTSIDE AIR INTAKES AND RELIEF VENTS

.1 Factory manufactured aluminum.

.1 Complete with integral birdscreen of [2.7] mm diam aluminum wire.

.2 Backdraft dampers on [four] [two] faces.

.3 Maximum throat velocity: 3.3 m/s intake.

.4 Maximum loss through unit: 15 Pa static pressure.

.5 Maximum velocity through damper area: 1.5 m/s.

.6 Shape: as indicated.

.2 Birdscreens:

.1 Complete with integral birdscreen of [2.7] mm diameter aluminum wire. Use 12 mm mesh on exhaust and 19 mm mesh on intake.

2.2 GOOSENECK HOODS

.1 Thickness: to and SMACNA.

.2 Fabrication: to SMACNA.

.3 Joints: to SMACNA and/or proprietary manufactured duct joint. Proprietary manufactured flanged duct joint shall be considered to be a class A seal.

.4 Supports: as indicated.

.5 Complete with integral birdscreen of 2.7 mm diameter aluminum wire. Use 12 mm mesh on exhaust, 19 mm mesh on intake.

2.3 FIXED LOUVRES - ALUMINUM

.1 Construction: welded with exposed joints ground flush and smooth.

.2 Material: extruded aluminum alloy 6063-T5.

.3 Blade: stormproof pattern with centre watershed in blade, reinforcing bosses and maximum blade length of 1500 mm.

.4 Frame, head, sill and jamb: 100 mm deep one piece extruded aluminum, minimum 3 mm thick with approved caulking slot, integral to unit.

.5 Mullions: at 1500 mm maximum centres.

.6 Fastenings: stainless steel (Society of Automotive Engineers) SAE-194-8F with SAE-194-SFB nuts and resilient neoprene washers between aluminum and head of bolt, or between nut, ss washer and aluminum body.

.7 Screen: 12 mm exhaust, 19 mm intake mesh, 2 mm diameter wire aluminum birdscreen on inside face of louvres in formed U-frame.

.8 Finish: factory applied enamel. Colour: to Consultant's approval.

Part 3 Execution

3.1 INSTALLATION

.1 In accordance with manufacturer's and SMACNA recommendations.

.2 Reinforce and brace as indicated.

.3 Anchor securely into opening. Seal with caulking around to ensure weather tightness.

END OF SECTION

Part 1 General

1.1 RELATED SECTIONS

.1 Section 01 33 00 - Submittal Procedures.

.2 Section 01 74 19 - Construction/Demolition Waste Management And Disposal.

.3 Section 01 78 00 - Closeout Submittals.

1.2 REFERENCES

.1 American Boiler Manufacturer's Association (ABMA)

.2 American National Standards Institute (ANSI)

.1 ANSI Z21.13-[2000]/CSA 4.9-[2000], Gas-Fired Low-Pressure Steam and Hot Water Boilers.

.3 American National Standards Institute (ANSI)/ American Society of Mechanical Engineers (ASME)

.1 ANSI/ASME Boiler and Pressure Vessel Code, Section IV, [2001].

.4 Canadian Gas Association (CGA)

.1 CAN1-3.1-[77(R2001)], Industrial and Commercial Gas-Fired Package Boilers.

.2 CSA-B149.1-[00], Natural Gas and Propane Installation Code.

.5 Canadian Standards Association (CSA)

.1 CSA B51-[97], Boiler, Pressure Vessel, and Pressure Piping Code.

.2 CSA B139-[00], Installation Code for Oil Burning Equipment.

.3 CSA B140.7.2-[1967(R2001)], Oil-Fired Steam and Hot Water Boilers for Commercial and Industrial Use.

.6 Electrical and Electronic Manufacturer's Association of Canada (EEMAC)

1.3 SHOP DRAWINGS

.1 Submit shop drawings in accordance with Section [01 33 00 - Submittal Procedures].

.2 Indicate the following:

.1 General arrangement showing terminal points, instrumentation test connections.

.2 Clearances for operation, maintenance, servicing, tube cleaning, tube replacement.

.3 Foundations with loadings, anchor bolt arrangements.

.4 Piping hook-ups.

.5 Equipment electrical drawings.

.6 Burners and controls.

.7 All miscellaneous equipment.

.8 Flame safety control system.

.9 Breeching and stack configuration.

.3 Engineering data to include:

.1 Boiler efficiency at 25%, 50%, 75%, 100%, of design capacity.

.2 Radiant heat loss at 100% design capacity.

1.4 CLOSEOUT SUBMITTALS

.1 Submit operation and maintenance data for incorporation into manual specified in Section [01 78 00 - Closeout Submittals].

1.5 WASTE MANAGEMENT AND DISPOSAL

.1 Separate and recycle waste materials in accordance with Section 01 74 19 - Construction/Demolition Waste Management And Disposal.

.2 Divert unused metal and wiring materials from landfill to metal recycling facility approved by Consultant.

.3 Dispose of unused paint material at official hazardous material collections site approved by Consultant.

.4 Do not dispose of unused paint material into sewer system, into streams, lakes, onto ground or in any other location where it will pose health or environmental hazard.

.5 Remove from site and dispose of packaging materials at appropriate recycling facilities.

.6 Dispose of corrugated cardboard, polystyrene, and plastic packaging material in appropriate on-site bin for recycling in accordance with site waste management program.

1.6 MAINTENANCE

.1 Maintenance materials to include:

.1 Special tools for burners, manholes, handholes and Operation and Maintenance.

.2 Spare parts for [1] year of operation.

.3 Spare gaskets.

.4 Spare gauge glass inserts.

.5 Probes and sealants for electronic indication.

.6 Spare burner tips.

.7 Spare burner gun.

.8 Safety valve test gauge.

Part 2 Products

2.1 GENERAL

.1 Packaged boiler:

.1 Complete with burner and necessary accessories and controls.

.2 Factory tested at rated capacity to, and bearing seal or nameplate certifying compliance with, CSA B140.7.2.

.3 Ready for attachment to piping, electrical power, controls.

.4 Designed and constructed to ANSI/ASME Boiler and Pressure vessel Code.

.5 CRN (Canadian Registration Number), to CSA B51.

.6 Boiler/burner package to bear CGA label.

.2 Performance:

.1 In accordance with American Boiler Manufacturers Association (ABMA), or ANSI Z21.13/CSA 4.9 (gas burning) testing procedures.

.2 Firing Fuel: Natural gas.

.3 Boiler efficiency: 80 % minimum at 30% to 100% firing rates.

.4 Flue gas temperature leaving boiler:

.1 Not to exceed 260°C.

.2 Above dewpoint conditions at minimum firing rate.

.3 Electrical:

.1 Power: 120 V, 1 phase, 60Hz.

.2 Controls: 120 V, 1 phase, 60Hz.

.3 Electrical components: CSA approved.

.4 Controls: factory wired. Enclosed in Electrical and Electronic Manufacturers' Association of Canada (EEMAC) steel cabinet.

.5 Thermal insulation:

.1 50 mm thick mineral fibre. Seal insulation at handholes, manholes, mudholes, piping connections with insulating cement or asphaltic paint. Finish with heat resisting paint.

.6 Jackets: heavy gauge metal, finished with heat resisting paint.

.7 Mounting:

.1 Structural steel base, lifting lugs.

.8 Anchor bolts and templates:

.1 Supply for installation by other Divisions. [Anchor bolts to be sized to Section

.9 Start-up, instruction, on-site performance tests: 3 days per boiler.

.10 Trial usage:

.1 Owner may use boilers for test purposes prior to acceptance and commencement of warranty period.

.2 Supply labour, materials and instruments required for tests.

.11 Temporary use by contractor:

.1 Contractor may use boilers only after written approval from Consultant.

.2 Monitor and record performance continuously. Keep log of maintenance activities carried out.

.3 Refurbish to as-new condition before final inspection and acceptance.

2.2 MODULAR HOT WATER BOILER, NATURAL GAS PULSE FIRED, CONDENSING TYPE

.1 Heating boiler seasonal efficiency rating: 90 %. Flue gas exhaust temperature: 45 to 55 °C, when operating in condensing mode.

.2 Flue gas: individually direct vented. Combustion air: individually drawn from outdoors through plastic pipes as indicated and as recommended by manufacturer.

.3 Factory-assemble each module to include combustion air inlet chamber, pre-purge blower assembly, air-gas fuel control valve, cast pulse combustion chamber, welded absorption chamber with spiralled fire tubes and exhaust chamber. Assembly to be housed in insulated jacket which includes boiler mounted electrical control panel enclosure with operation sequence indicator lights. Provide coupling on combustion air inlet and exhaust chambers for connections of plastic piping, PVC for outside air intake and CPVC for outside exhaust. Provide condensate drain fitting on exhaust chamber. Boiler materials will enable operation with flue gas temperature below dewpoint without corrosion.

.4 Absorption unit: constructed in accordance with Section IV of ASME Boiler and Pressure Vessel Code for Low Pressure Heating Boilers for 207 kPa working pressure.

.5 Controls for each module to include solid state controller with auxiliary relay, fan prove pressure switch and pressure sensing flame safeguard system. Provide combination gas control with manual shut off valve, system pressure controlled regulator, automatic redundant shut off valves, high limit water temperature control with adjustable differential, ASME approved pressure relief valve and temperature/pressure indicator.

.6 Factory wire each module and operationally test. Each module to be suitable for individual firing. Step firing to be accomplished by firing individual modules without reducing their thermal efficiency. Control system: designed and provided for heating plant by manufacturer.

2.3 AUXILIARIES

.1 Provide for each boiler and to meet ANSI/ASME requirements.

.2 Hot water boilers:

.1 Relief valve: ANSI/ASME rated, set at 207 kPa, [to release entire boiler capacity].

.2 Pressure gauge: 90 mm diameter complete with shut-off cock.

.3 Thermometer: 115 mm diameter range 10 to [150] °C.

.4 Low water cut-off: with visual and audible alarms.

.5 Auxiliary low water cut-off: with separate cold water connection to boiler.

.6 Isolating gate valves: on supply and return connections.

.7 Drain valve: NPS.

.8 Stack thermometer: Range 65 to 200 °C.

.9 Outdoor controller: to reset operating temperature controller.

.10 One [1] set of cleaning tools.

2.4 GAS BURNERS

.1 General:

.1 Forced draft with:

.1 Built-in blower to supply combustion air, complete with motor, silencer and damper.

.2 High voltage ignition transformer.

.3 Flame observation port.

.4 Easy access to nozzles and electrodes.

.2 Gas pilot:

.1 To meet all code and provincial regulations including solenoid gas valve, pressure regulator, pressure gauge, manual shut-off valve.

.3 Main gas train:

.1 To meet all code and provincial regulations including masin shut-off valve, pressure regulator, motorized electric shut-off valve, downstream block-test valve with test connection and pressure gauge.

.4 Controls:

.1 Electronic combustion control relay with flame rod flame detector for combustion control and flame supervision.

.2 Control to shut off fuel within [5] seconds upon pilot flame or main flame failure or upon signal of safety interlock and to ensure, when restarted, in sequence:

.1 Pre-purge.

.2 Pilot ignition and supervision.

.3 Main gas valve opening.

.4 Pilot cut-off. Pilot-proving period not to exceed 10 seconds.

.5 Burner operation.

.6 Post-purge burner shut-down.

.3 Static pressure interlock. To shut off burner upon loss of combustion air pressure.

.4 Fuel-air mixture: Control through:

.1 2-position motor with end switch to provide for low-fire start and high fire run.

.2 Two-position motor with linkage to control fuel and air and with end switches to prove low-fire start and energize high fire solenoid valve for high-low fire operation.

.3 Modulating motor with end switch to provide for low-fire start and fully modulating operation down to 20 % of design capacity.

.5 Immersion controllers:

.1 Operating: to start and stop burner, and operating between adjustable setpoints.

.2 Modulating: to modulate burner output.

.6 Visual and audible alarms: to indicate burner shutdown due to flame failure, low water level, high [pressure] [temperature], low air pressure, low gas pressure.

.7 Pilot lights: to indicate:

.1 Normal burner operation.

.8 Burner to start up in low fire position.

Part 3 Execution

3.1 INSTALLATION

.1 Install in accordance with ANSI/ASME Boiler and Pressure Vessels Code Section IV, regulations of Province having jurisdiction, except where specified otherwise, and manufacturers recommendations.

.2 Make required piping connections to inlets and outlets recommended by boiler manufacturer.

.3 Maintain clearances as indicated or if not indicated, as recommended by manufacturer for operation, servicing and maintenance without disruption of operation of any other equipment/system.

.4 Mount unit level.

.5 Pipe hot water relief valves full size to nearest drain.

.6 Natural gas fired installations - in accordance with CSA-B149.1.

3.2 MOUNTINGS AND ACCESSORIES

.1 Safety valves and relief valves:

.1 Run separate discharge from each valve.

.2 Terminate discharge pipe as indicated.

.3 Run drain pipe from each valve outlet and drip pan elbow to above nearest drain.

3.3 COMMISSIONING

.1 Manufacturer to:

.1 Certify installation.

.2 Start up and commission installation.

.3 Carry out on-site performance verification tests.

.4 Demonstrate operation and maintenance.

.2 Provide Consultant at least 24 h notice prior to inspections, tests, and demonstrations. Submit written report of inspections and test results.

END OF SECTION

Part 1 General

1.1 RELATED SECTIONS

.1 Section [01 33 00 - Submittal Procedures].

.2 Section [01 74 19 - Construction/Demolition Waste Management And Disposal].

.3 Section [01 78 00 - Closeout Submittals].

.4 Section [23 11 23 - Facility Natural Gas Piping].

1.2 REFERENCES

.1 American National Standards Institute (ANSI)

.1 ANSI Z83.6-[1990(R1998)], Gas-Fired Infrared Heaters.

.2 Canadian Gas Association (CGA)

.1 CSA-B149.1-[00], Natural Gas and Propane Installation Code.

.2 CAN1-2.16-[M81(R1996)], Gas Fired Infrared Heaters.

.3 Canadian Standards Association (CSA)

.1 CSA C22.2No.0-[M91(R2001)], General Requirements, Canadian Electrical Code, Part II.

1.3 SHOP DRAWINGS

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

1.4 CLOSEOUT SUBMITTALS

.1 Submit maintenance data for incorporation into manual specified in Section 01 78 00 - Closeout Submittals.

1.5 WASTE MANAGEMENT AND DISPOSAL

.1 Separate and recycle waste materials in accordance with Section 01 74 19 - Construction/Demolition Waste Management And Disposal.

.2 Divert unused metal and wiring materials from landfill to metal recycling facility approved by Consultant.

.3 Remove from site and dispose of packaging materials at appropriate recycling facilities.

.4 Dispose of packaging material in appropriate on-site bin for recycling in accordance with site waste management program.

Part 2 Products

2.1 GENERAL

.1 Provide CSA approved, packaged factory assembled components consisting of heat exchangers, burners, controls, air filters, vacuum generators, reflectors, fans.

2.2 CAPACITY

.1 Output: as noted on drawings.

.2 Input: as noted on drawings.

.3 Electrical characteristics: as noted on drawings.

2.3 TYPE

.1 Non-condensing Gravity vented. Low Intensity. Design compatible with natural gas fuel.

2.4 BURNERS

.1 Burners to include following features:

- .1 Manufactured to ANSI Z83.6 (vented infrared heater standards) and CAN1-2.16.
- .2 CSA certified for use with natural gas.
- .3 Air-fuel mixture controlled combustion system designed for compatibility with remote-generated and controlled vacuum.
- .4 Fail-safe design to shut off supply of fuel in following situations:
  - .1 Power failure.
  - .2 Inadequate pilot flame.
  - .3 Inadequate vacuum in combustion chamber.
  - .4 Failure of main fuel valve in open position.
- .5 Combustion air terminal compatible with direct connection of outside air duct.
- .6 Electrical control system isolated from combustion air system.
- .7 Combustion process operational status indicator lights or observation windows.
- .8 Pre-wired burner control system with electric ignition.
- .9 Suitable for operation with 115VAC, single phase, 60 Hz electrical service.
- .10 Enamel-finished steel enclosure complete with removable access panels.
- .11 Heating output capacity compatible with associated downstream radiant tube.

.2 Burners to include following features:

- .1 Manufactured to ANSI Z83.6 (vented infrared heater standards) and CAN1-2.16.
- .2 CSA certified for use with natural gas.
- .3 Air-fuel mixture controlled combustion system designed for compatibility with combustion supply air blower.
- .4 Fail-safe design to shut off supply of fuel in following situations:
  - .1 Blower motor failure.
  - .2 Main flame failure.

.3 Inadequate inlet air.

.4 Excessive flue back pressure.

.5 Combustion air terminal suitable for connection of outside air duct.

.6 Electrical control system isolated from combustion air system.

.7 Combustion process operational status indicator lights or observation windows.

.8 Pre-wired burner control system with electric ignition.

.9 Suitable for operation with 120VAC, single phase, 60 Hz electrical service.

.10 Enamel-finished steel enclosure complete with removable access panels.

.11 Heating output capacity compatible with associated downstream radiant tube.

.12 Centrifugal, direct-drive blower with adequate air flow capacity to accommodate ducted inlet and exhaust air requirements.

2.5 HEAT EXCHANGER

.1 Heat exchanger to consist of radiant piping with following features:

.1 Nominal 89 mm O.D., 0.607 mm thick, aluminized steel spiral pipe.

.2 Removable, heat and corrosion-resistant joint connections designed to accommodate system expansion/contraction.

.3 Length compatible with upstream burner output capacity.

2.6 REFLECTORS

.1 Reflectors to include following features:

.1 Polished aluminium construction complete with corrugations and configuration to maximize radiant heat directed toward floor.

.2 Standard lengths to facilitate installation complete with overlaps at joints to accommodate expansion and contraction.

.3 Hangers/supports at spacing recommended by system manufacturer to maintain maximum reflector efficiency.

.4 Side extension reflector complete with supports, retainers, and brackets, to prevent radiant heat from striking adjacent surfaces.

.5 Barrier reflector shield complete with supports, retainers, and brackets, to prevent radiant heat from striking objects beneath radiant piping.

.6 Factory fabricated corners, joints, tees, end caps, and related accessories.

.7 Egg-crate style aluminum grille beneath reflectors complete with supports, shields, as required, to improve aesthetics of radiant heating system and complement reflector design efficiency.

2.7 OUTSIDE AIR SUPPLY

.1 Outside air supply to include following features:

.1 Ducted outside air supply to each burner to provide sealed-combustion system.

.2 Insulation and vapour barrier on duct to prevent condensation.

.3 Duct size to ensure adequate air supply to each burner.

.4 Exterior air inlet terminal complete with bird screen and weatherproof hood.

.5 Flexible duct connector adjacent to burner complete with removable joint clamp at burner.

2.8 CONTROLS

.1 System controls to include following features:

.1 Pre-wired control panel complete with transformers, relays, terminal blocks, wiring, circuits, hinged door, visible door-mounted system status lights, steel cabinet complete with baked enamel finish and keyed access.

.2 24 V heating thermostat control of all burners complete with radiant heat shields where shown.

.3 Integral prepurge and postpurge cycles for combustion chambers and heat exchanger pipes.

.4 Thermostat radiant heat reflector shields, if exposed to radiant heat.

.5 Vacuum switch interlock with vacuum generator.

Part 3 Execution

3.1 INSTALLATION

.1 Install infrared radiant system in accordance with CSA-B149.1, as recommended by manufacturer and as indicated.

.2 Provide grading of radiant pipe as required.

.3 Make provision for pipe movement caused by normal operation and expansion.

.4 Maintain required clearances from combustibles.

.5 Follow manufacturer's detailed installation, testing, operation and maintenance instructions.

.6 Install thermostats where indicated. Supply heat shields where recommended by manufacturer.

.7 Test radiant system as recommended by manufacturer and required by authorities having jurisdiction. Air test piping for leaks. Check burner safety controls.

.8 Arrange equipment, including burners to facilitate removal without dismantling pipe, reflectors, or associated apparatus.

.9 Provide manufacturer clearance sign c/w chain support suitable to locate sign at proper clearance elevation as per Saskatchewan gas code requirements.

3.2 EQUIPMENT SCHEDULE

.1 As per design drawings.

END OF SECTION

Part 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.

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 Consultant 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 Final Report: submit report to Consultant.

.1 Include measurements, final settings and certified test results.

.2 Bear signature of commissioning technician and supervisor

.3 Report format to be approved by Consultant before commissioning is started.

.4 Revise "as-built" documentation, commissioning reports to reflect changes, adjustments and modifications to EMCS as set during commissioning and submit to Consultant in accordance with Section 01 78 00 - Closeout Submittals .

.5 Recommend additional changes and/or modifications deemed advisable in order to improve performance, environmental conditions or energy consumption.

1.5 CLOSEOUT SUBMITTALS

.1 Provide documentation, O&M Manuals, and training of O&M personnel for review of Consultant before interim acceptance.

1.6 COMMISSIONING

.1 Carry out commissioning under direction of Consultant and in presence of Consultant.

.2 Inform, and obtain approval from, Consultant 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 Correct deficiencies, re-test in presence of Consultant 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.

.5 Load system with project software.

.6 Perform tests as required.

1.7 COMPLETION OF COMMISSIONING

.1 Commissioning to be considered as satisfactorily completed when objectives of commissioning have been achieved and reviewed by Consultant.

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.

Part 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.

Part 3 Execution

3.1 PROCEDURES

.1 Test each system independently and then in unison with other related systems.

.2 Commission each system.

.3 Debug system software.

.4 Optimize operation and performance of systems by fine-tuning PID values and modifying CDLs as required.

.5 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.

3.2 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 Consultant.
- .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.
- .7 After setting, test zero and span in 10 % increments through entire range while both increasing and decreasing pressure.
- .8 Consultant 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 set point.

.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 700kPa.

.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 Consultant. This document will be used in final start-up testing.

.3 Final Start-up Testing: Upon satisfactory completion of tests, perform point-by-point test of entire system under direction of Consultant and provide:

.1 2 technical personnel capable of re-calibrating field hardware and modifying software.

.2 Detailed daily schedule showing items to be tested and personnel available.

.3 Consultant's acceptance signature to be on executive and applications programs.

.4 Commissioning to commence during final start-up testing.

.5 O&M personnel to assist in commissioning procedures as part of training.

.6 Commissioning to be supervised by qualified supervisory personnel and Consultant.

.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 (set points, 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 30consecutive 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.

3.3 ADJUSTING

.1 Final adjusting: upon completion of commissioning as reviewed by Consultant, set and lock devices in final position and permanently mark settings.

3.4 DEMONSTRATION

.1 Demonstrate to Consultant 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.

END OF SECTION

Part 1 General

1.1 SUMMARY

.1 Section Includes.

.1 Requirements and procedures for training program, instructors and training materials, for building Energy Monitoring and Control System (EMCS) Work.

1.2 DEFINITIONS

.1 CDL - Control Description Logic.

.2 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, supplemented and modified by requirements of this Section.

.2 Submit training proposal complete with hour-by-hour schedule including brief overview of content of each segment to Consultant 30 days prior to anticipated date of beginning of training.

.1 List name of trainer, and type of visual and audio aids to be used.

.2 Show co-ordinated interface with other EMCS mechanical and electrical training programs.

.3 Submit reports within one week after completion of Phase 1 and Phase 2 training program that training has been satisfactorily completed.

1.4 QUALITY ASSURANCE

.1 Provide competent instructors thoroughly familiar with aspects of EMCS installed in facility.

.2 Consultant reserves right to approve instructors.

1.5 INSTRUCTIONS

.1 Provide instruction to designated personnel in adjustment, operation, maintenance and pertinent safety requirements of EMCS installed.

.2 Training to be project-specific.

1.6 TIME FOR INSTRUCTION

.1 Number of days of instruction to be as specified in this section (1 day = 8 hours including two 15 minute breaks and excluding lunch time).

1.7 TRAINING MATERIALS

.1 Provide equipment, visual and audio aids, and materials for classroom training.

.2 Supply manual for each trainee, describing in detail data included in each training program.

.1 Review contents of manual in detail to explain aspects of operation and maintenance (O&M).

1.8 TRAINING PROGRAM

.1 To be in 2 phases over 6 month period.

.2 Phase 1: 3 hour program to begin before 30 day test period at time mutually agreeable to Contractor and Owner.

.1 Train O&M personnel in functional operations and procedures to be employed for system operation.

.2 Supplement with on-the-job training during 30 day test period.

.3 Include overview of system architecture, communications, operation of computer and peripherals, report generation.

.4 Include detailed training on operator interface functions for control of mechanical systems, CDL's for each system, and elementary preventive maintenance.

.3 Phase 2: 2 hour day program to begin 8 weeks after acceptance for operators, equipment maintenance personnel and programmers.

.1 Provide multiple instructors on pre-arranged schedule. Include at least following:

.1 Operator training: provide operating personnel, maintenance personnel and programmers with condensed version of Phase 1 training.

.2 Equipment maintenance training: provide personnel with training in maintenance of EMCS equipment, including general equipment layout, trouble shooting and preventive maintenance of EMCS components, maintenance and calibration of sensors and controls.

.3 Programmers: provide personnel with training.

1.9 MONITORING OF TRAINING

.1 Consultant may monitor training program and may modify schedule and content.

Part 2 Products

2.1 NOT USED

.1 Not Used.

Part 3 Execution

3.1 NOT USED

.1 Not Used.

END OF SECTION

Part 1 General

1.1 ACRONYMS, ABBREVIATIONS AND DEFINITIONS

.1 Acronyms used in EMCS.

.1 AI - Analog Input
.2 AO - Analog Output
.3 BACnet - Building Automation and Control Network
.4 CAB - Canadian Automated Building (CAB) Protocol
.5 CAD - Computer Aided Design
.6 CDL - Control Description Logic
.7 COSV - Change of State or Value
.8 CPU - Central Processing Unit
.9 DI - Digital Input
.10 DO - Digital Output
.11 ECU - Equipment Control Unit
.12 EMCS - Energy Monitoring and Control System
.13 HVAC - Heating, Ventilation, Air Conditioning
.14 IDE - Interface Device Equipment
.15 I/O - Input/Output
.16 ISA - Industry Standard Architecture
.17 LAN - Local Area Network
.18 LCU - Local Control Unit
.19 LonTalk - Echelon Corporation (proprietary protocol)
.20 MCU - Master Control Unit
.21 OS - Operating System
.22 O&M - Operation and Maintenance
.23 OWS - Operator Work Station
.24 PC - Personal Computer
.25 PCI - Peripheral Control Interface
.26 PCMCIA - Personal Computer Micro-Card Interface Adapter
.27 RAM - Random Access Memory
.28 ROM - Read Only Memory
.29 TCU - Terminal Control Unit
.30 USB - Universal Serial Bus
.31 UPS - Uninterruptible Power Supply

.2 Definitions:

.1 Point: a point may be logical or physical. Logical points are values calculated by system such as totals, counts, derived corrections i.e. as result of and/or statements in CDL's. Physical points are inputs or outputs which have hardware wired to controllers which are measuring or providing status conditions of

contacts or relays providing interaction with related equipment (stop, start) or valve or damper actuators.

.3 Symbols and engineering unit abbreviations utilized in displays: to ANSI/ISAS 5.5.

.1 Printouts: to ANSI/IEEE 260.

.2 Refer also to Section 25 05 54- EMCS: Identification.

1.2 PERMITS AND FEES

.1 In accordance with General Conditions of Contract.

.2 Submit certificate of acceptance from authority having jurisdiction to Owner.

1.3 GENERAL DESCRIPTION

.1 Work covered by sections referred to above consists of fully operational EMCS, including, but not limited to, following:

.1 Building Controllers MCU, LCU TCU.

.2 Control devices as listed in I/O Summaries.

.3 OWS as noted.

.4 Data communications equipment necessary to effect an EMCS data transmission system.

.5 Field control devices.

.6 Software complete with full documentation for software and equipment.

.7 Complete operating and maintenance manuals and field training of operators, programmers and maintenance personnel.

.8 Acceptance tests, technical support during commissioning, full documentation.

.9 Wiring interface co-ordination of equipment supplied by others.

.10 Miscellaneous work as specified in these sections and as indicated.

1.4 METRIC REFERENCES

.1 Conform to CAN/CSA-Z234.1.

.2 Provide required adapters between Metric and Imperial components.

1.5 STANDARDS COMPLIANCE

.1 All equipment and material to be 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. Label or listing of specified organization is acceptable evidence.

.4 For materials whose compliance with organizational standards/codes/specifications is not regulated by an organization using its own listing or label as proof of compliance, furnish certificate stating that material complies with applicable referenced standard or specification.

1.6 EXISTING CONTROL COMPONENTS

.1 Utilize any existing control wiring and/or piping as practicable.

.2 Field control devices that are usable in their original configuration may be re-used provided that they conform to applicable codes, standards, specifications. Do not modify original design of any existing devices without written permission from Consultant. Provide for new, properly designed device where components are not certain as to reusability. Provide list of equipment so included in bid. Include unit price of all for this equipment.

.3 Within 30 days of award of contract, and prior to installation of any new devices, inspect and test all existing devices intended for re-use. Furnish test report listing each component to be re-used and indicating whether it is in good order or requires repair.

.4 Non-functioning items:

.1 Provide with report specification sheets or written functional requirements to support findings.

.5 Submit written request for permission to disconnect any controls and to obtain equipment downtime before proceeding with work.

.6 Assume responsibility for existing controls to be incorporated into EMCS, to commence upon approval for disconnection of controls or equipment downtime.

.1 Be responsible for repair costs due to negligence or abuse of Owner's equipment.

.2 Responsibility for existing devices to terminate upon acceptance of EMCS or applicable portions thereof.

.7 Remove existing controls not re-used or not required. Place in approved storage for disposition as directed.

1.7 EMCS CONTRACTOR QUALIFICATIONS

.1 EMCS contractor to:

.1 Be Andover with installer approved by the Owner.

.2 Have local office within 300 km of project for at least 5 years, staffed by trained personnel capable of providing instruction, routine maintenance, emergency service on systems,

.3 Provide record of successful installations performed by Contractor submitting tender of experience with similar computer-based systems.

.4 Have access to local supplies of essential parts and provide 7 year guarantee of availability of spare parts after obsolescence.

1.8 SYSTEM DESIGN RESPONSIBILITY

.1 Design and provide all conduit and wiring linking all elements of system, including future capability.

.2 Supply sufficient programmable controllers of all types to meet project requirements. Quantity and points contents to be approved by Consultant prior to installation.

.3 Location of controllers to be approved by Consultant prior to installation.

.4 Provide utility and emergency power to controllers.

1.9 LANGUAGE OPERATING REQUIREMENTS

.1 Operator to interface to system in English through operator selectable access codes.

.2 Use non-linguistic symbols for displays on graphic terminals wherever possible. All other information to be in English.

.3 Operating system executive: primary hardware-to-software interface (specified as part of hardware purchase) with associated documentation to be in English.

.4 System manager software: to include 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. These functions to be in English.

.5 EMCS operator: include, in English:

.1 All input and output commands and messages from operator-initiated functions and/or field related changes and/or alarms as defined in CDL's or assigned limits (i.e. all 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 all specified OWS and to be able to operate one terminal in English and second in French. Point name expansions in both languages.

.3 Reporting function such as trend log, trend graphics, alarm report logs, energy report logs, maintenance generated logs.

1.10 MATERIALS DELIVERY SCHEDULE

.1 Provide Consultant with "Materials Delivery Schedule" within 2 weeks after award of Contract.

Part 2 Products

2.1 ACCEPTABLE SYSTEMS MANUFACTURERS

.1 Andover.

2.2 LOCKABLE PANELS

.1 Panel to be NEMA rated to suit environmental requirements.

.2 To have hinged doors equipped with standard keyed-alike cabinet locks, keyed to same key.

Part 3 Execution

3.1 MANUFACTURER'S RECOMMENDATIONS

.1 Installation to be to manufacturer's recommendations. Provide printed copies of recommendations with shop drawings or product data.

3.2 PAINTING

.1 Clean and touch up marred or scratched surfaces of factory finished equipment to match original finish.

.2 Restore to new condition, finished surfaces which have been damaged too extensively to be primed and touched up to make good.

.3 Clean and prime exposed hangers, racks, fastenings, and other support components.

.4 Paint all unfinished equipment installed indoors to CEMA 2Y.1.

END OF SECTION

Part 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 Names of sub-contractors and site-specific key personnel.

.5 Sketch of site-specific system architecture.

.6 Specification sheets for each item including memory provided, programming language, speed, type of data transmission.

.7 Descriptive brochures.

.8 Sample CDL and graphics (systems schematics).

.9 Response time for each type of command and report.

.10 Item-by-item statement of compliance.

1.4 SUBMITTALS

.1 Submittals in accordance with Section 01 33 00 - Submittal Procedures and coordinate with requirements in this Section.

.2 Shop Drawings to consist of 3 hard copies and 1 soft copy of design documents, shop drawings, product data and software.

.3 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.

.4 Soft copy to be in AutoCAD - latest version and Microsoft Word latest version format, structured using menu format for easy loading and retrieval on OWS.

1.5 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 Wiring diagrams.

.9 Piping diagrams and hook-ups.

.10 Interface wiring diagrams showing termination connections and signal levels for equipment to be supplied by others .

.11 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 Set points, 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.

.12 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.

.13 Graphic system schematic displays of all systems with point identifiers and textual description of system, and typical floor plans as specified.

.14 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.

.15 Listing and example of specified reports.

.16 Listing of time of day schedules.

.17 Mark up to-scale construction drawing to detail control room showing location of equipment and operator work space.

.18 Type and size of memory with statement of spare memory capacity.

.19 Full description of software programs provided.

Part 2 Products

2.1 NOT USED

.1 Not Used.

Part 3 Execution

3.1 NOT USED

.1 Not Used.

END OF SECTION

Part 1 General

1.1 SUMMARY

.1 Section Includes.

.1 Requirements and procedures for final control diagrams and operation and maintenance (O&M) manual, for building Energy Monitoring and Control System (EMCS) Work.

1.2 DEFINITIONS

.1 BECC - Building Environmental Control Centre.

.2 OWS - Operator Work Station.

.3 For additional acronyms and definitions refer to Section 25 05 01 - EMCS: General Requirements.

1.3 SUBMITTALS

.1 Submits to be provided to Consultant in English.

.2 Provide soft copies and hard copies in hard-back, 50 mm 3 ring, D-ring binders.

.1 Binders to be 2/3 maximum full.

.2 Provide index to full volume in each binder.

.3 Identify contents of each manual on cover and spine.

.4 Provide Table of Contents in each manual.

.5 Assemble each manual to conform to Table of Contents with tab sheets placed before instructions covering subject.

1.4 AS-BUILTS

.1 Provide 1 copy of detailed shop drawings generated in Section 25 05 02 - EMCS: Submittals and Review Process and include:

.1 Changes to contract documents as well as addenda and contract extras.

.2 Changes to interface wiring.

.3 Routing of conduit, wiring and control air lines associated with EMCS installation.

.4 Locations of obscure devices to be indicated on drawings.

.5 Listing of alarm messages.

.6 Panel/circuit breaker number for sources of normal/emergency power.

.7 Names, addresses, telephone numbers of each sub-contractor having installed equipment, local representative for each item of equipment, each system.

.8 Test procedures and reports: provide records of start-up procedures, test procedures, checkout tests and final commissioning reports as specified in Section 25 01 11 - EMCS: Start-up, Verification and Commissioning.

.9 Basic system design and full documentation on system configuration.

.2 Submit for final review by Consultant.

.3 Provide before acceptance 4 Hard and 1 soft copy incorporating changes made during final review.

1.5 O&M MANUALS

.1 Custom design O&M Manuals (both hard and soft copy) to contain material pertinent to this project only, and to provide full and complete coverage of subjects referred to in this Section.

.2 Include complete coverage in concise language, readily understood by operating personnel using common terminology of functional and operational requirements of system. Do not presume knowledge of computers, electronics or in-depth control theory.

.3 Functional description to include:

.1 Functional description of theory of operation.

.2 Design philosophy.

.3 Specific functions of design philosophy and system.

.4 Full details of data communications, including data types and formats, data processing and disposition data link components, interfaces and operator tests or self-test of data link integrity.

.5 Explicit description of hardware and software functions, interfaces and requirements for components in functions and operating modes.

.6 Description of person-machine interactions required to supplement system description, known or established constraints on system operation, operating procedures currently implemented for implementation in automatic mode.

.4 System operation to include:

.1 Complete step-by-step procedures for operation of system including required actions at each OWS.

.2 Operation of computer peripherals, input and output formats.

.3 Emergency, alarm and failure recovery.

.4 Step-by-step instructions for start-up, back-up equipment operation, execution of systems functions and operating modes, including key strokes for each command so that operator need only refer to these pages for keystroke entries required to call up display or to input command.

.5 Software to include:

.1 Documentation of theory, design, interface requirements, functions, including test and verification procedures.

.2 Detailed descriptions of program requirements and capabilities.

.3 Data necessary to permit modification, relocation, reprogramming and to permit new and existing software modules to respond to changing system functional requirements without disrupting normal operation.

.4 Software modules, fully annotated source code listings, error free object code files ready for loading via peripheral device

.5 Complete program cross reference plus linking requirements, data exchange requirements, necessary subroutine lists, data file requirements, other information necessary for proper loading, integration, interfacing, program execution.

.6 Software for each Controller and single section referencing Controller common parameters and functions.

.6 Maintenance: document maintenance procedures including inspection, periodic preventive maintenance, fault diagnosis, repair or replacement of defective components, including calibration, maintenance, repair of sensors, transmitters, transducers, controller and interface firmware's, plus diagnostics and repair/replacement of system hardware.

.7 System configuration document:

.1 Provisions and procedures for planning, implementing and recording hardware and software modifications required during operating lifetime of system.

.2 Information to ensure co-ordination of hardware and software changes, data link or message format/content changes, sensor or control changes in event that system modifications are required.

.8 Programmer control panel documentation: provide where panels are independently interfaced with BECC, including interfacing schematics, signal identification, timing diagrams, fully commented source listing of applicable driver/handler.

Part 2 Products

2.1 NOT USED

.1 Not Used.

Part 3 Execution

3.1 NOT USED

.1 Not Used.

END OF SECTION

Part 1 General

1.1 SUMMARY

.1 Section Includes.

.1 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 SYSTEM DESCRIPTION

.1 Language Operating Requirements: provide identification for control items in English.

1.3 SUBMITTALS

.1 Submittals in accordance with Section 01 33 00 - Submittal Procedures supplemented and modified by requirements of this Section.

Part 2 Products

2.1 NAMEPLATES FOR PANELS

.1 Identify by Plastic laminate, 3 mm thick Melamine, 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 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 and point address.

.5 Companion cabinet: identify interior components using plastic enclosed cards with point name and point address.

2.3 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".

2.4 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.

2.5 PNEUMATIC TUBING

.1 Numbered tape markings on tubing to provide uninterrupted tracing capability.

2.6 CONDUIT

.1 Colour code EMCS conduit.

.2 Pre-paint box covers and conduit fittings.

.3 Coding: use fluorescent orange.

Part 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.

END OF SECTION

Part 1 General

1.1 SYSTEM DESCRIPTION

.1 Electrical:

.1 Provide power wiring from existing emergency power panels to EMCS field panels. Circuits to be for exclusive use of EMCS equipment. Panel breakers to be identified on panel legends tagged and locks applied to breaker switches.

.2 Hard wiring between field control devices and EMCS field panels.

.3 Communication wiring between EMCS field panels and OWSs including main control centre BECC.

.4 Modify existing starters to provide for EMCS as indicated in I/O Summaries and as indicated.

.2 Pneumatic:

.1 Pneumatic tubing, valves and fittings for field control devices.

.3 Mechanical:

.1 Pipe Taps Required For EMCS equipment will be supplied and installed by piping subtrade.

.2 Wells and Control Valves Shall Be Supplied by EMCS Contractor and Installed by piping subtrade.

.4 Structural:

.1 Special steelwork as required for installation of work.

1.2 PERSONNEL QUALIFICATIONS

.1 Qualified supervisory personnel to:

.1 Continuously direct and monitor all work.

.2 Attend site meetings.

1.3 EXISTING CONDITIONS

.1 Repair all surfaces damaged during execution of work.

.2 Turn over to Owner existing materials removed from work not identified for re-use.

Part 2 Products

2.1 SPECIAL SUPPORTS

.1 Structural grade steel, primed and painted after construction and before installation.

2.2 PIPING FOR PNEUMATIC CONTROL SYSTEMS

.1 Copper:

.1 Tubing:

.1 Fittings: wrought copper solder type to ANSI/ASME B16.22, and 95.5 antimonial tin solder. At instruments use compression fittings.

.2 At panels and junction boxes where there is a transition from plastic to copper use bulkhead fittings.

.2 Plastic:

.1 Install in conduit where exposed (i.e. mechanical rooms, rooms without ceilings, etc.).

.2 Flame retardant, black PVC with minimum burst strength 1.3 MPa at 23EC installed in conduit.

.3 Fittings: compression or barbed type as required.

2.3 WIRING

.1 See requirements in Electrical sections of the drawings and specifications.

.2 For 70V and above copper conductor with chemically cross-linked thermosetting polyethylene insulation rated RW90 and 600V. Colour code to CSA 22.1.

.3 For wiring under 70 volts use FT6 rated wiring where wiring is not run in conduit. All other cases use FT4 wiring.

.4 Sizes:

.1 120V Power supply: to match or exceed breaker, size #12 minimum.

.2 Wiring for safeties/interlocks for starters, motor control centres, to be stranded, #14 minimum.

.3 Field wiring to digital device: #18AWG or 20AWG stranded twisted pair.

.4 Analog input and output: shielded #18 minimum solid copper or #20 minimum stranded twisted pair. Wiring must be continuous without joints.

.5 More than 4 conductors: #22 minimum solid copper.

.5 Terminations:

.1 Terminate wires with screw terminal type connectors suitable for wire size, and number of terminations.

2.4 CONDUIT

.1 As per requirements of Electrical sections of the drawings and specifications.

.2 Electrical metallic tubing to CSA C22.2 83. Flexible and liquid tight flexible metal conduit to CSA C22.2 56. Rigid steel threaded conduit to CSA C22.2 45.

.3 Junction and pull boxes: welded steel.

.1 Surface mounting cast FS: screw-on flat covers.

.2 Flush mounting: covers with 25 mm minimum extension all round.

.4 Cabinets: sheet steel, for surface mounting, with hinged door, latch lock, 2 keys, complete with perforated metal mounting backboard. Panels to be keyed alike for similar functions and or entire contract as approved.

.5 Outlet boxes: 100 mm minimum, square.

.6 Conduit boxes, fittings:

.1 Bushings and connectors: with nylon insulated throats.

.2 With push pennies to prevent entry of foreign materials.

.7 Fittings for rigid conduit:

.1 Couplings and fittings: threaded type steel.

.2 Double locknuts and insulated bushings: use on sheet metal boxes.

.3 Use factory "ells" where 90 degree bends required for 25 mm and larger conduits.

.8 Fittings for thin wall conduit:

.1 Connectors and couplings: steel, set screw type.

2.5 WIRING DEVICES, COVER PLATES

.1 Conform to CSA.

.2 Receptacles:

.1 Duplex: CSA type 5-15R.

.2 Single: CSA type 5-15R.

.3 Cover plates and blank plates: finish to match other plates in area.

2.6 STARTERS, CONTROL DEVICES

.1 Across-the-line magnetic starters:

.1 Enclosures: CSA Type 1, except where otherwise specified.

.2 Size, type and rating: to suit motors.

.2 Starter diagrams:

.1 Provide copy of wiring and schematic diagrams - mount one copy in each starter with additional copies for operation and maintenance manual.

.3 Auxiliary Control Devices:

.1 Control transformers: 60 Hz, primary voltage to suit supply, 120 V single phase secondary, VA rating to suit load plus 20% margin.

.2 Auxiliary contacts: one "Normally Open" and one "Normally Closed" spare auxiliary contact in addition to maintained auxiliary contacts as indicated.

.3 Hand-Off-Automatic switch: heavy duty type, knob lever operator.

.4 Double voltage relays: with barrier to separate relay contacts from operating magnet. Operating coil voltage and contact rating as indicated.

2.7 SUPPORTS FOR CONDUIT, FASTENINGS, EQUIPMENT

.1 Solid masonry, tile and plastic surfaces: lead anchors or nylon shields.

.1 Hollow masonry walls, suspended drywall ceilings: toggle bolts.

.2 Exposed conduits or cables:

.1 50 mm diameter and smaller: one-hole steel straps.

.2 Larger than 50 mm diameter: two-hole steel straps.

.3 Suspended support systems:

.1 Individual cable or conduit runs: support with 6 mm diameter threaded rods and support clips.

.2 Two or more suspended cables or conduits: support channels supported by 6 mm diameter threaded rod hangers.

Part 3 Execution

3.1 INSTALLATION

.1 Install equipment, components so that manufacturer's and CSA labels are visible and legible after commissioning is complete.

3.2 TUBING

.1 Install piping straight, parallel and close to building structure with required grades for drainage and venting.

.2 Copper tubing not to come into contact with dissimilar metal.

3.3 PNEUMATIC CONTROL SYSTEMS

.1 General:

.1 Install tubing in accessible concealed locations, straight, parallel and close to building structure with required grades for drainage and venting.

.2 Install drip legs and drains at low points.

.3 Tubing to be free from surface damage.

.4 Tubing NOT to pass through or touch unheated ducts or enclosures.

.5 Do not cover pneumatic tubing with insulation.

.6 Test tubing, check joints after connection to system.

.2 Copper tubing:

.1 Not to come into contact with dissimilar metal. Use non-metallic stand-offs on air handling systems.

.2 Install dielectric couplings where dissimilar metals are connected.

.3 Plastic tubing:

.1 Inaccessible locations: install plastic tubing in conduit.

.2 Inside panels: install in tube trays or racks, or clip individually to back of panel.

.3 Multiple tube bundles: install in tube trays, conduit or armoured flexible cable.

3.4 ELECTRICAL GENERAL

.1 Do complete installation in accordance with requirements of:

.1 Electrical sections of the drawings and specifications.

.2 CSA 22.1 Canadian Electrical Code.

.3 ANSI/NFPA 70.

.4 ANSI C2.

.2 Fully enclose or properly guard electrical wiring, terminal blocks, high voltage above 70 V contacts and mark to prevent accidental injury.

.3 Do underground installation to CAN/CSA C22.3No.7, except where otherwise specified.

.4 Conform to manufacturer's recommendations for storage, handling and installation.

.5 Check factory connections and joints. Tighten where necessary to ensure continuity.

.6 Install electrical equipment between 1000 and 2000 mm above finished floor wherever possible and adjacent to related equipment.

.7 Protect exposed live equipment such as panel, mains, outlet wiring during construction for personnel safety.

.8 Shield and mark live parts "LIVE 120 VOLTS" or other appropriate voltage.

.9 Install conduits, and sleeves prior to pouring of concrete.

.10 Holes through exterior wall and roofs: flash and make weatherproof.

.11 Make necessary arrangements for cutting of chases, drilling holes and other structural work required to install electrical conduit, cable, pull boxes, outlet boxes.

.12 Install cables, conduits and fittings which are to be embedded or plastered over, neatly and closely to building structure to minimize furring.

3.5 CONDUIT SYSTEM

.1 Communication wiring shall be installed in conduit. Provide complete conduit system to link Building Controllers to BECC. Conduit sizes to suit wiring requirements and to allow for future expansion capabilities specified for systems. Maximum conduit fill not to exceed 40%. Design drawings do not show conduit layout.

.2 Install conduits parallel or perpendicular to building lines, to conserve headroom and to minimize interference.

.3 Do not run exposed conduits in normally occupied spaces unless otherwise indicated or unless impossible to do otherwise. Obtain approval from Engineer Consultant before starting such work. Provide complete conduit system to link field panels and devices with main control centre. Conduit size to match conductors plus future expansion capabilities as specified.

.4 Locate conduits at least 150 mm from parallel steam or hot water pipes and at least 50 mm at crossovers.

.5 Bend conduit so that diameter is reduced by less than 1/10th original diameter.

.6 Field thread on rigid conduit to be of sufficient length to draw conduits up tight.

.7 Limit conduit length between pull boxes to less than 30 m.

.8 Use conduit outlet boxes for conduit up to 32 mm diameter and pull boxes for larger sizes.

.9 Fastenings and supports for conduits, cables, and equipment:

.1 Provide metal brackets, frames, hangers, clamps and related types of support structures as indicated and as required to support cable and conduit runs.

.2 Provide adequate support for raceways and cables, sloped vertically to equipment.

.3 Use supports or equipment installed by other trades for conduit, cable and raceway supports only after written approval from Engineer Consultant.

.10 Install polypropylene fish cord in empty conduits for future use.

.11 Where conduits become blocked, remove and replace blocked sections.

.12 Pass conduits through structural members only after receipt of Consultant's written approval.

.13 Conduits may be run in flanged portion of structural steel.

.14 Group conduits wherever possible on suspended or surface channels.

.15 Pull boxes:

.1 Install in inconspicuous but accessible locations.

.2 Support boxes independently of connecting conduits.

.3 Fill boxes with paper or foam to prevent entry of construction material.

.4 Provide correct size of openings. Reducing washers not permitted.

.5 Mark location of pull boxes on record drawings.

.6 Identify AC power junction boxes, by panel and circuit breaker.

.16 Install bonding conductor for 120 volt and above in conduit.

3.6 WIRING

.1 Install multiple wiring in ducts simultaneously.

.2 Do not pull spliced wiring inside conduits or ducts.

.3 Use CSA certified lubricants of type compatible with insulation to reduce pulling tension.

.4 Tests: use only qualified personnel. Demonstrate that:

.1 Circuits are continuous, free from shorts, unspecified grounds.

.2 Resistance to ground of all circuits is greater than 50 Megohms.

.5 Provide Consultant with test results showing locations, circuits, results of tests.

.6 Remove insulation carefully from ends of conductors and install to manufacturer's recommendations. Accommodate all strands in lugs. Where insulation is stripped in excess, neatly tape so that only lug remains exposed.

.7 Wiring in main junction boxes and pull boxes to terminate on terminal blocks only, clearly and permanently identified. Junctions or splices not permitted for sensing or control signal covering wiring.

.8 Do not allow wiring to come into direct physical contact with compression screw.

.9 Install ALL strands of conductor in lugs of components. Strip insulation only to extent necessary for installation.

3.7 WIRING DEVICES, COVER PLATES

.1 Receptacles:

.1 Install vertically in gang type outlet box when more than one receptacle is required in one location.

.2 Cover plates:

.1 Install suitable common cover plate where wiring devices are grouped.

.2 Use flush type cover plates only on flush type outlet boxes.

3.8 STARTERS, CONTROL DEVICES

.1 Install and make power and control connections as indicated.

.2 Install correct over-current devices.

.3 Identify each wire, terminal for external connections with permanent number marking identical to diagram.

.4 Performance Verification:

.1 Operate switches and controls to verify functioning.

.2 Perform start and stop sequences of contactors and relays.

.3 Check that interlock sequences, with other separate related starters, equipment and auxiliary control devices, operate as specified.

3.9 GROUNDING

.1 Install complete, permanent, continuous grounding system for equipment, including conductors, connectors and accessories.

.2 Install separate grounding conductors in conduit within building.

.3 Install ground wire in all PVC ducts and in tunnel conduit systems.

.4 Tests: perform ground continuity and resistance tests, using approved method appropriate to site conditions.

3.10 TESTS

.1 General:

.1 Perform following tests in addition to tests specified Section 25 08 20 - EMCS: Warranty and Maintenance.

.2 Give 14 days written notice of intention to test.

.3 Conduct in presence of Engineer Consultant and authority having jurisdiction.

.4 Conceal work only after tests satisfactorily completed.

.5 Report results of tests to Engineer Consultant in writing.

.6 Preliminary tests:

.1 Conduct as directed to verify compliance with specified requirements.

.2 Make needed changes, adjustments, replacements.

.3 Insulation resistance tests:

.1 Megger all circuits, feeders, equipment for 120 - 600V with 1000V instrument. Resistance to ground to be more than required by Code before energizing.

.2 Test insulation between conductors and ground, efficiency of grounding system to satisfaction of Consultant and authority having jurisdiction.

3.11 IDENTIFICATION

.1 Refer to Section 25 05 54- EMCS: Identification.

END OF SECTION

Part 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).

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 Owner.

.3 Submit dated, maintenance task lists to Consultant 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.

.4 Submit network analysis report showing results with detailed recommendations to correct problems found.

.5 Records and logs:

.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 Consultant, after inspection indicating that planned and systematic maintenance have been accomplished.

.6 Revise and submit to Consultant "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 Consultant 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 Consultant.

Part 2 Products

2.1 NOT USED

.1 Not Used.

Part 3 Execution

3.1 FIELD QUALITY CONTROL

.1 Perform one inspection at the end of the warrantee period.

.2 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.

.3 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 Visually check for mechanical faults, air leaks and proper pressure settings on pneumatic components.

.4 Review system performance with Operations Supervisor to discuss suggested or required changes.

.5 Clean OWS(s) peripheral equipment, BC(s), interface and other panels, micro-processor interior and exterior surfaces.

.6 Check signal, voltage and system isolation of BC(s), peripherals, interface and other panels.

.7 Verify calibration/accuracy of each input and output device and recalibrate or replace as required.

.8 Provide mechanical adjustments, and necessary maintenance on printers.

.9 Run system software diagnostics as required.

.10 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.

.4 Rectify deficiencies revealed by maintenance inspections and environmental checks.

.5 Continue system debugging and optimization.

END OF SECTION

Part 1 General

1.1 ACRONYMS

.1 Acronyms used in this section include see Section 25 05 01 - EMCS: General Requirements.

1.2 SYSTEM DESCRIPTION

.1 LAN to network any new OWS's and MCU's to existing network.

1.3 OWS/MCU PANEL SUPPORT

.1 OWS and MCU to reside directly on LAN so that communications may be executed directly between work-stations and controllers on peer-to-peer basis.

1.4 DYNAMIC DATA ACCESS

.1 LAN to provide capabilities for OWS devices to be able 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 or building equipment.

Part 2 Products

2.1 NOT USED

.1 Not Used.

Part 3 Execution

3.1 NOT USED

.1 Not Used.

END OF SECTION

Part 1 General

1.1 TERMS AND DEFINITIONS

.1 Terms used in this section.

.1 Point Object Type - refers to all points as Object types - AI, AO, DI, DO, TCU, ECU.

.2 Point Name - when used includes - Point Identifier and Point Expansion.

1.2 ACRONYMS

.1 Acronyms used in this section include: see Section 25 05 01 - EMCS: General Requirements.

1.3 OWS SYSTEM DESCRIPTION

.1 No new OWS is required for this work. All new programming, graphics, etc. to be carried out on existing OWS.

Part 2 Products

2.1 NOT USED

.1 Not Used.

Part 3 Execution

3.1 NOT USED

.1 Not Used.

END OF SECTION

Part 1 General

1.1 ACRONYMS

.1 Acronyms used in this section include: see Section 25 05 01 - EMCS: General Requirements.

1.2 SUBMITTALS

.1 In accordance with Section 25 05 02 - EMCS: Shop Drawings, Product Data and Review Process submit product data sheets for each product item proposed for this project.

Part 2 Products

2.1 SYSTEM DESCRIPTION

.1 General: A network of Controllers comprising of MCU('s), LCU('s), ECU('s) or TCU('s) to be provided as required 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 Controllers quantity, and point contents to be approved by Consultant at time of preliminary design review.

.2 Controllers to be stand-alone intelligent Control Unit. Controllers to:

- .1 Incorporate programmable microprocessor, non-volatile program memory, RAM, power supplies, as required to perform specified functions.
- .2 Incorporate communication interface port for communication to Local Controller's LAN to exchange information with other Controllers.
- .3 Be capable of interfacing with operator interface device.
- .4 Interface with field sensors via input output termination board to be part of Controllers or located remotely.
- .5 Execute its logic and control (direct digital or closed loop process) having primary inputs (input or outputs which have direct interaction with logic processing) connected directly to its onboard input/output field terminations or slave devices, and without need to interact with other processor. Secondary input used for reset such as outdoor air temperature to be located in other Controller(s).

.3 Interface to include provisions for use of dial-up modem for interconnection with remote LAN modem. Dial-up communications to use Hayes compatible 14.4/28.8/56 Kbit modems and voice grade telephone lines. Each stand-alone panel may have its own modem or a group of stand-alone panels may share modem.

2.2 BASIC FUNCTIONAL REQUIREMENTS

.1 To include:

- .1 Scanning of AIs and DIs connected inputs for detection of change of value and processing the detection of alarm conditions.
- .2 Perform On-Off digital control of connected points, including the 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 conform to CSA C22.2No.205.

.2 To electronically interface sensors and control devices to processor unit.

.3 To 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 with tamper alarm (unless housed in processor unit 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 shall use conveniently located screw type or spade lug terminals.

.4 AI interface equipment to:

.1 Convert analog signals to digital format with 12 bit analog-to-digital resolution.

.2 Provide for following input signal types and ranges:

.1 4 - 20 mA;

.2 4 - 20 mA.

.3 Meet IEEE 472 surge with stand capability.

.4 Have common mode signal rejection greater than 60 dB to 60 Hz.

.3 Where required, dropping resistors to be certified precision devices which complement accuracy of sensor and transmitter range specified.

.5 AO interface equipment to:

.1 Convert digital data from controller processor to acceptable analog output signals using 12 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 472 surge withstand capability.

.6 DI interface equipment to:

.1 Be able to reliably detect contact change of sensed field contact and feed condition to controller logic processor.

.2 Meet IEEE 472 surge withstand capability.

.3 Accept pulsed inputs up to 2 kHz.

.7 DO interface equipment to:

.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 Controller's and associated hardware and software to operate in conditions of 0EC to 44EC and 20 % to 90 % non-condensing RH.

.4 Controllers (MCU, LCU) to be mounted in wall mounted cabinet with hinged, keyed-alike locked door. Provide for conduit entrance from top, bottom or sides of panel. ECUs to be mounted in equipment enclosures and TCU's in ceiling space. Mounting details to be as approved by the Engineer 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.

2.3 MASTER CONTROL UNIT (MCU)

.1 Primary function of MCU is to provide co-ordination and supervision of subordinate devices. Supervisory role shall include coordination of subordinate devices in the 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.

.3 MCU shall have local I/O capacity as follows;

.1 To have at least 16 I/O points of which minimum to be 2AO, 6AI, 4DI, 4DO.

.2 LCU's to be added to support system functions as indicated in I/O Summary List.

.3 MCU to have 25 % spare input and 25 % output point capacity without addition of cards, terminals, etc.

.4 Central Processor Unit (CPU)

.1 Processor to consist of at minimum a 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 all performance and technical specifications. Memory to include:

.1 Non-volatile EEPROM to contain operating system, executive, application, sub-routine, other configurations definition software. Tape media not acceptable.

.2 Battery backed (72 hr minimum capacity) RAM (to reduce the need to reload operating data in event of power failure) RAM to contain CDLs, application parameters, operating data or software that is required to be modifiable from operational standpoint such as schedules, set points, alarm limits, PID constants and CDL and hence modifiable on-line through operator panel or remote operator's interface. RAM to be down line loadable from OWS, CAB-Gateway, or locally installed floppy disk.

.4 Include uninterruptible clock accurate to plus or minus 5 secs/month, capable of deriving month/day/hour/minute/second, with rechargeable batteries for minimum 72 hr operation in event of power failure.

2.4 LOCAL CONTROL UNIT (LCU)

.1 Design to provide control functions for typical HVAC or Hydronic systems.

.2 Minimum of 16 I/O points of which minimum be 4 AOs, 4 AIs, 4 DIs, 4 DOs.

.3 Points of one Building System to be connected to one controller as listed in I/O Summary designations.

.4 To comprise of microprocessor capable of supporting necessary software and hardware to meet specified requirements. As per MCU requirements above with the following additions:

.1 Include as minimum 2 interface ports for connection local computer terminal.

.2 Design so that shorts, opens or grounds on any 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.

.7 LCU to have 25 % spare input and 25 % output point capacity without addition of cards, terminals, etc.

2.5 EQUIPMENT CONTROL UNIT (ECU)

.1 To consist of microprocessor capable of supporting necessary software and hardware to meet ECU functional specifications. ECU definitions to be consistent with those defined in ASHRAE HVAC Applications Handbook section 45.

2.6 SOFTWARE

.1 General:

.1 Include as minimum: operating system executive, communications, application programs, operator interface, and systems sequence of operation - CDL's.

.2 To include "firmware" or instructions which are programmed into ROM or EPROM, EEPROM other non-volatile memory.

.3 Include initial programming of all 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 such as set points, operating constants, alarm limits in battery-backed RAM or EEPROM for display and modification by operator.

.3 Programming languages:

.1 CDL Control Description Logic software to be programmed 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. GOTO constructs not allowed.

.4 Operator interface:

.1 MCU to perform operating and control functions specified Section 25 10 02 - EMCS: Operator Work Stations (OWS), including:

.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 have access to any value or status in controller or other networked controller so as to define and calculate pseudo point from other values/status of controller. When current pseudo point value is derived, normal alarm checks must be performed or value used to totalize.

.2 Inputs and outputs for any process to be able to 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 any number of other processes (e.g. cascading).

.6 Control Description Logic (CDL):

.1 Capable of generating on-line project-specific control loop algorithms (CDLs). CDLs to be 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 sequence of operation descriptions on MCU, LCU from any 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. set points) to determine operation of algorithm. Operator to be able to alter operating parameters on-line from OWS or MCU and to tune control loops.

.3 Perform changes to CDL on-line.

.4 Control logic to have access to values or status of all points available to controller including global or common values, allowing cascading or inter-locking control.

.5 Energy optimization routines such as enthalpy control, supply temperature reset, etc. 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 plus integral plus Derivative (PID) control.

.3 Automatic control loop tuning.

.7 Control software to provide the ability to define the 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: The system to use a management by exception concept for Alarm Reporting. This is a system wide requirement. This approach will insure that only principal alarms are reported to OWS. Events which occur as a direct result of the primary event to be suppressed by the 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. The exception is, when an air handler which is supposed to stop or start fails to do so under the event condition.

.8 Energy management programs: The following programs shall include specific summarizing reports, to include the date stamp indicating sensor details which activated and or terminated the feature.

.1 MCU in coordination with subordinate LCU, TCU, ECU to provide for the following energy management routines:

.1 Time of day scheduling.
.2 Calendar based scheduling.
.3 Holiday scheduling.
.4 Temporary schedule overrides.
.5 Optimal start stop.
.6 Night setback control.
.7 Enthalpy (economizer) switchover.
.8 Peak demand limiting.
.9 Temperature compensated load rolling.
.10 Fan speed/flow rate control.
.11 Cold deck reset.
.12 Hot deck reset.
.13 Hot water reset.
.14 Chilled water reset.
.15 Condenser water reset.
.16 Chiller sequencing.
.17 Night purge.

.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 Engineer.

.9 Function Totalization: Totalizing 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 Totalization routine to have sampling resolution of 1 min or less.

.3 User to be able to define warning limit and generate user-specified messages when limit reached.

.10 Analog/pulse Totalization: Totalizing features to provide reports which show daily, weekly monthly accumulating totals and which include high rate (time stamped) and low rate (time stamped) and accumulation to date for month.

.1 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.

.2 Totalization to provide calculations and storage of accumulations up to 99,999.9 units (e.g. kWh, litres, tonnes, etc.).

.3 Totalization routine to have sampling resolution of 1 min or less.

.4 User to be able to define warning limit and generate user-specified messages when limit is reached.

.11 Event Totalization: Totalizing features to provide reports which show daily, weekly monthly accumulating totals and which include high rate (time stamped) and low rate (time stamped) and accumulation to date for month.

.1 MCU to automatically count events (number of times pump is cycled off and on) daily, weekly or monthly basis.

.2 Store totalization records with minimum of 9,999,999 events before reset.

.3 User to be able to define warning limit and generate user-specified messages when limit is reached.

2.7 LEVELS OF ADDRESS

.1 Upon operator's request, EMCS to present status of any single 'point', 'system' or point group, an entire 'area', or entire network on printer or OWS as selected by operator. Display analog values digitally to 1 place of decimals with negative sign as required. Update displayed analog values and status when new values received. Flag points in alarm by blinking, reverse video, different colour, bracketed or other means to differentiate from points not in alarm. Updates to be change-of-value (COV)-driven or if polled not exceeding 2 second intervals.

.2 Refer also to Section 25 05 01 - EMCS: General Requirements.

2.8 POINT NAME SUPPORT

.1 Controllers (MCU, LCU) to support PWGSC point naming convention as defined in section 25 90 01. Each point name to include; an identifier field for "area@, "system@, "point@ which has at minimum a 25 character string entry, and, point identifier expansion fields which at minimum support 32 character strings for each "system@ and "point@ identifier. Bilingual systems to include additional point identifier expansion fields of equal capacity for each point name for the second language. System to support

use of numbers and readable characters including blanks, periods or underscores to enhance user readability for each of the above strings.

.2 Upon operator's request, system to present condition of any single point, system, area, or connected points on system to OWS or remote printer as selected by operator. Display analog values digitally to (1) place of decimals with negative sign as required. Update displayed analog values and status when new values received. Flag points in alarm by blinking, reverse video, different colour, bracketed or other means to differentiate from points not in alarm. Updates to be change-of-value (COV)-driven or if polled not to exceed 4 second intervals for points displayed.

.3 Refer also to Section 25 05 01 - EMCS: General Requirements.

Part 3 Execution

3.1 LOCATION

.1 Location of Controllers to be approved by Consultant.

3.2 INSTALLATION

.1 New controllers are required only where new functionality cannot be built into existing controllers.

.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 an emergency and co-ordinating mode.

3.3 COMMISSIONING

.1 Refer to Section 25 08 20 - EMCS: Warranty and Maintenance.

END OF SECTION

Part 1 General

1.1 REFERENCES

.1 American National Standards Institute (ANSI)

.1 ANSI/IEEE C57.13, Requirements for Instrument Transformers.

.2 National Electrical Manufacturer's Association (NEMA)

.1 NEMA 1

.2 NEMA 12

1.2 SUBMITTALS

.1 Submit shop drawings and manufacturer's installation instructions in accordance with Section 25 05 02 - EMCS: Shop Drawings, Product Data and Review Process.

.2 Include:

.1 Information as specified for each device.

.2 Manufacturer's detailed installation instructions.

.3 Manufacturer's Instructions

.1 Submit manufacturer's installation instructions for specified equipment and devices.

1.3 CLOSEOUT SUBMITTALS

.1 Submit operating and maintenance data for inclusion in operation and maintenance manual in accordance with Section 25 05 03 - EMCS: Project Records Documents.

Part 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.

.3 Operating conditions: 0 - 32 °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 to be unaffected by external transmitters (i.e. 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 EEMAC 12 enclosures.

.8 Devices to be installed in user occupied space must not exceed Noise Criteria (NC) of 35. Noise generated by any device must not be detectable above space ambient conditions.

2.2 TEMPERATURE SENSORS

.1 General: to be resistance or thermocouple type to following requirements:

.1 Thermocouples: to be limited to temperature range of 200 °C and over.

.2 RTD's: 100 ohm at 0 °C (plus or minus 0.2 ohms) platinum element with strain minimizing construction, 3 integral anchored lead wires. Coefficient of resistivity: 0.00385 ohms/ohmEC.

.3 Sensing element: hermetically sealed.

.4 Stem and tip construction: copper or type 304 stainless steel.

.5 Time constant response: less than 3 seconds to temperature change of 10 °C.

.6 Immersion wells: NPS 3/4, stainless steel spring loaded construction, with heat transfer compound compatible with sensor. Insertion length 100 mm as indicated.

.2 Sensors:

.1 Outside air type: complete with probe length 100 - 150 mm long, non-corroding shield to minimize solar and wind effects, threaded fitting for mating to 13 mm conduit, weatherproof construction in EEMAC 12 enclosure.

2.3 TEMPERATURE TRANSMITTERS

.1 Requirements:

.1 Input circuit: to accept 3-lead, 100 ohm at 0 deg C, platinum resistance detectors type sensors.

.2 Power supply: 575 ohms at 24 V DC into load of 575 ohms. Power supply effect less than 0.01 deg 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 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 EC.

.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 EC to plus 50 EC, plus or minus 0.5 EC.

.2 0 to 100 EC, plus or minus 0.5 EC.

.3 0 to 50 EC, plus or minus 0.25 EC.

.4 0 to 25 EC, plus or minus 0.1 EC.

.5 10 to 35 EC, plus or minus 0.25EC.

2.4 PRESSURE/CURRENT (P/I) TRANSMITTERS

.1 Requirements:

.1 Range: as indicated in I/O summaries.

.1 Pressure sensing elements: bourdon tube, bellows or diaphragm type.

.2 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 °C.

.7 Over-pressure input protection to at least twice rated input pressure.

.8 Output short circuit and open circuit protection.

.9 Pressure ranges: see I/O Summaries.

.10 Accuracy: plus or minus 1% of Full Scale.

2.5 DIFFERENTIAL PRESSURE (KPA) 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 °C.

.7 Over-pressure input protection to at least twice rated input pressure.

.8 Output short circuit and open circuit protection.

.9 The unit to have a 12.5 mm N.P.T. conduit connection. The enclosure shall be an integral part of the unit.

2.6 TURBINE FLOW METERS

.1 Requirements:

.1 Flow range: as specified in I/O summaries.

.2 Pressure rating: 1035 kPa (gauge) at 38 °C.

.3 Temperature rating: 73 to 260 °C.

.4 Repeatability: plus or minus 0.1 %.

.5 Accuracy and linearity: plus or minus 0.5 %.

.6 Flow rangability: at least 10:1.

.7 Output voltage: 30 to 300 mV peak-to-peak into 10 Kohm load.

.8 Ends:

.1 NPS 2 and under: screwed.

.2 NPS 2.1/2 and over: flanged.

2.7 FREQUENCY-TO-DC TRANSMITTERS FOR TURBINE METERS

.1 Requirements:

.1 Input: greater than 5000 ohm.

.1 Range: greater than 100 mV less than 20 V peak-to-peak, 200 through 400 Hz.

.2 Span adjustment: fully adjustable.

.3 Zero adjustment: 0 to 10% of output.

.4 Output: 4 to 20 mA into 500 ohm load.

.5 Load effect: plus or minus 0.1 % of span zero to maximum load resistance.

.6 Linearity and repeatability: plus or minus 0.05 % of span.

.7 Power input: 24 V DC plus or minus 10 %.

.8 Input, output and power input transformer isolated.

.9 Enclosure: general purpose NEMA 1.

2.8 PRESSURE AND DIFFERENTIAL PRESSURE SENSORS AND SWITCHES

.1 Requirements:

.1 Range: as indicated in I/O summaries.

.1 Pressure sensing elements: bourdon tube, bellows or diaphragm type.

.2 Adjustable set-point and differential.

.3 Switch: snap action type, rated at 120V, 15 amps AC or 24 V DC.

.4 Sensor assembly: to operate automatically and reset automatically when conditions return to normal. Over-pressure input protection to at least twice rated input pressure.

.5 Accuracy: within 2% repetitive switching.

.6 Provide sensor pressure and accuracy ratings:

.1 Chilled and condenser water: 860 kPa.

.7 Provide sensors with isolation valve and snubber between sensor and pressure source.

.8 Sensors on steam and high temperature hot water service: provide pigtail siphon.

2.9 CURRENT/PNEUMATIC (I/P) TRANSDUCERS

.1 Requirements:

.1 Input range: 4 to 20 mA.

.2 Output range: proportional 20-104 kPa or 20-186 kPa as applicable.

.3 Housing: dustproof or panel mounted.

.4 Internal materials: suitable for continuous contact with industrial standard instrument air.

.5 Combined non-linearity, repeatability, hysteresis effects: not to exceed plus or minus 2 % of full scale over entire range.

.6 Integral zero and span adjustment.

.7 Temperature effect: plus or minus 2.0 % full scale/ 50 °C or less.

.8 Regulated supply pressure: 206 kPa maximum.

.9 Air consumption: 16.5 ml/s maximum.

.10 Integral gauge manifold c/w gauge (0-206 kPa).

2.10 SOLENOID CONTROL AIR VALVES

.1 Coil: 120V AC or 24V DC, as indicated.

.2 Complete with manual over-ride.

.3 Shall have the capacity to pass .07 l/s air at 104 kPa differential.

2.11 AIR PRESSURE GAUGES

.1 Diameter: 38 mm minimum.

.2 Range: zero to two times operating pressure of measured pressure media to nearest standard range.

2.12 ELECTRICAL 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

2.13 CURRENT TRANSDUCERS

.1 Requirements:

.1 Range: as indicated on I/O Summaries.

.2 Purpose: measure line current and produce proportional signal in one of following ranges:

.1 4-20 mA DC.

.2 0-1 volt DC.

.3 0-10 volts DC.

.4 0-20 volts DC.

.3 Frequency insensitive from 10 - 80 Hz.

.4 Accuracy to 0.5% full scale.

.5 Zero and span adjustments. Field adjustable range to suit motor applications.

.6 Adjustable mounting bracket to allow for secure/safe mounting inside the MCC.

2.14 CURRENT SENSING RELAYS

.1 Requirements:

.1 Complete with metering transformer ranged to match load, plug-in base and shorting shunt to protect current transformer when relay is removed from socket.

.2 Suitable for single or 3 phase metering into single relay.

.3 To have adjustable latch level, adjustable delay on latch and minimum differential of 10 % of latch setting between latch level and release level.

.4 3-Phase application: provide for discrimination between phases.

.5 To have adjustable latch level to allow detection of worst case selection. To be powered from control circuit of motor starter being metered. Relay and base to be mounted in adjacent auxiliary cabinet only if control circuit power to be brought into auxiliary cabinet. Adjustments to be acceptable from auxiliary cabinet.

.6 Relay contacts: capable of handling 10 amps at 240 V AC.

2.15 CONTROL VALVES

.1 Requirements:

.1 NPS 2 and under: bronze with screwed ends.

.2 NPS 2 1/2 and over: cast iron with flanged ends.

.3 Trim: type 316 stainless steel.

.4 Leakage: 0.5 % of rated flow maximum.

.5 Two or three port as indicated. Normally Open or Normally Closed, as indicated.

.6 Flow characteristics: linear or equal percentage as indicated.

.7 Rangeability: 50:1 minimum.

.8 Performance: Capacity refer to I/O Summaries and Valve Schedule Division 15.

2.16 ELECTRONIC/ELECTRIC VALVE ACTUATORS

.1 Requirements:

.1 Construction: steel, cast iron, aluminium.

.2 Control voltage: 0-20V DC or 24V AC .

.3 Positioning time: to suit application. 90 sec maximum.

.4 Spring return to normal position as indicated.

2.17 PANELS

.1 Either free-standing or wall mounted enamelled steel cabinets with hinged and key-locked front door.

.2 To be modular multiple panels as required indicated to handle requirements with additional space to accommodate future capacity as required by Engineer Consultant without adding additional cabinets.

.3 Panels to be lockable with same key.

Part 3 Execution

3.1 INSTALLATION

.1 Install field control devices in accordance with manufacturers recommended methods, procedures and instructions.

.2 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 all cases when dissimilar metals make contact.

.3 Support field-mounted transmitters, sensors on pipe stands or channel brackets.

.4 Install wall mounted devices on plywood panel properly attached to wall.

3.2 TEMPERATURE SENSORS

.1 Stabilize to ensure minimum field adjustments or calibrations.

.2 To be readily accessible and adaptable to each type of application so as 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 stainless steel shields.

.2 Install in NEMA 12 enclosures.

.4 Thermowells: install for piping installations. Where pipe diameter is less than well insertion length, locate well in elbow. Thermowell to restrict flow by less than 30%.

3.3 PANELS

.1 Arrange for conduit and tubing entry from top, bottom or either side.

.2 Use modular multiple panels if necessary to handle all requirements, with space for additional 20% PCU or FID if applicable without adding additional panels. Space to accommodate maximum capacity of associated controller (ECU, LCU, MCU, PCU, TCU).

.3 Wiring and tubing within panels: locate in trays or individually clipped to back of panel.

.4 Identify wiring and conduit clearly.

3.4 PRESSURE AND DIFFERENTIAL PRESSURE SWITCHES

.1 Install isolation valve and snubber on sensors between sensor and pressure source. In addition, protect sensing elements on steam and high temperature hot water service with pigtail siphon between valve and sensor.

3.5 I/P TRANSDUCERS

.1 Install air pressure gauge on outlet.

3.6 PRESSURE GAUGES

.1 Install on pneumatic systems only.

.2 Install pressure gauges on pneumatic devices, I/P, pilot positioners, motor operators, switches, relays, valves, damper operators, valve actuators.

.3 Install pressure gauge on output of controller and auxiliary cabinet pneumatic devices.

3.7 AIR PRESSURE GAUGES

.1 Install on pneumatic systems only.

.2 Install on pneumatic devices including I/P's, pilot positioners, motor operators.

3.8 FIELD MOUNTED TRANSMITTERS AND SENSORS

.1 Support properly on pipe stands or channel brackets.

.2 Install wall mounted devices on plywood panel attached properly to wall.

3.9 IDENTIFICATION

.1 Identify field devices properly.

.2 Refer to Section 25 05 54 - EMCS: Identification.

3.10 TESTING

.1 Calibrate and test field devices for accuracy and performance. Submit report detailing tests performed, results obtained to Consultant for approval. Consultant will verify results at random. Provide testing equipment and manpower necessary for this verification.

3.11 COMMISSIONING

.1 Refer to Section 25 08 20 - EMCS: Warranty and Maintenance.

END OF SECTION

Part 1 GENERAL

1.1 General

.1 The control sequences contain a general description of the intent of the operation of the systems to be controlled. The Contractor shall review individual systems to ensure equipment and life safety interlocks are not overridden.

.2 The relationships between the points, systems and building are described in the control sequences.

.3 Consult with the Consultant during the shop drawing stage to finalize the control sequences for each system.

.4 All set-points noted herein are to be operator adjustable.

.5 The Division 25 Contractor is responsible to ensure all equipment tie-in points are provided by the equipment manufacturers.

Part 2 PRODUCTS

2.1 Not used

.1 Not used

Part 3 EXECUTION

3.1 General

.1 Provide data base for all hardware points listed for system operation to meet specification operating sequences.

.2 Where future provision for future points is noted, provide for connection of hardware to panels such that no additional hardware interface devices will be required within the panels. Software, including set-up and programming sequences, need not be provided at this time.

Part 4 CONTROL SEQUENCES AND POINTS LISTS

4.1 Pumps P-1, P-2, and P-3,

.1 Sequence

.1 Pumps P-1, P-, are each controlled by the boiler controller unit.

.2 Pump P-3 is controlled by its own integral control system.

.3 No connections to any existing BMS system required from any pump.

.4 P-1, P-2, and P-3 are each rated at 100% of the required design capacity each and are normally activated by the noted control system.

.1 When the system is energized either manually or by a time-clock function within the EMCS, the system shall be energized.

.5 In conjunction with the facility Operator, program a timed start/stop sequence to energize the system. Allow manual override (on and off) onto the EMCS screen graphics.

.6 Each group of pumps shall operate as primary standby with an operator adjustable timed schedule for operation.

.2 Points List

.1 The following points, as a minimum, shall be provided associated with the heating system. .

.1	System Start/Stop	Pseudo point
.2	Lead Pump	Pseudo Point
.3	System Pressure Set Point	Pseudo Point
.4	System Pressure Sensor	AI
.5	P-1 Start-Stop	DO
.6	P-1 Speed Control	AO
.7	P-1 Speed Feedback	AI
.8	P-1 Status Alarm	DI
.9	P-2 Start-Stop	DO
.10	P-2 Speed Control	AO
.11	P-2 Speed Feedback	AI
.12	P-2 Status Alarm	DI
.13	P-3 Start-Stop	DO
.14	P-3 Status Alarm	DI

4.2 GAS FIRED UNIT HEATERS

.1 The wall mounted electric thermostat complete with tamper-proof cover shall cycle the fan motor on a drop in space temperature.

.2 No connections to the BMS are required from any unit heater or force flow.

4.3 GAS FIRED RADIANT HEATERS

.3 The surface mounted electric thermostat complete with tamper-proof cover shall cycle the burners on a drop in space temperature.

.4 No connections to the BMS are required from any unit heater or force flow.

4.4 EXHAUST FAN EF-1A AND EF-1B – HANGAR GARAGE CO EXHAUST FAN

.5 Exhaust fan shall run on when the Hangar Garage carbon monoxide detector unit is in alarm.

.6 Unit shall operate continuously to maintain specified room exhaust capacity as noted on the mechanical drawings.

.7 EF-1A and EF-1B Points List: The following points, as a minimum, shall be provided associated with the exhaust fan.

.1	Exhaust fan Start/Stop	DO
.2	Exhaust fan status	DI

4.5 HANGAR GARAGE FRESH AIR INTAKE DAMPERS

.8 Hanger Garage fresh air intake dampers shall open when the Hangar Garage carbon monoxide detector unit is in alarm.

.9 Unit shall operate continuously to maintain specified room fresh air capacity as noted on the mechanical drawings.

.10 Fresh air intake dampers Points List: The following points, as a minimum, shall be provided associated with the exhaust fan.

.1	Fresh air intake damper position	DO
.2	Fresh air Intake damper status	DI

4.6 CARBON MONOXIDE DETECTOR

.1 Carbon monoxide detector units to be a standalone electronic unit with replaceable calibration cartridges.

.2 Upon detector detecting a high level of carbon monoxide the detector shall alarm and shall energize the associated exhaust fans and fresh air intakes as specified.

.3 Upon a detection of normal carbon monoxide level the detector shall de-energize the systems to normal standby operational parameters.

.4 Provide a temperature sensor and a system timed override switch that can override the system to operate the monoxide extraction system for a pre-set period of time in the event of a high room temperature or other conditions as required by occupants.

.5 Points list : the following points, as a minimum, shall be provided. each point shall also be shown on the heating system DDC system graphic.

.1	unit on/off	DO
.2	unit status	DI
.3	Alarm Status	DI

4.7 MISCELLANSUOUS SENSORS

.1 Provide the following miscellaneous monitoring points, as a minimum.

.1	Outdoor Air Temperature	AI
.2	Outdoor Air Humidity	AI

.3	Room temperature sensor near SNAGS bay emergency shower	AI
.4	Room temperature sensor near POL storage emergency shower	AI

END OF SECTION

PART 1 General

1.1 REQUIREMENTS

.1 The General Conditions of the Contract, Supplementary General Conditions, General Requirements, Instructions to Bidders and Form of Tender, are hereby made part of this Section.

1.2 SECTION INCLUDES

.1 This Section covers items common to Sections of Electrical Contractor. This section supplements requirements of Division 1.

.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 this Division 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.

1.3 CODES AND STANDARDS

.1 Do complete installation in accordance with the 2012 Canadian Electrical Code, Saskatchewan Human Rights Accessibility Standard, local by-laws and utility requirements. Work involving fire protection shall be in accordance with the Underwriter’s Laboratory of Canada, National Building Code, and National Fire Protection Code.

.2 The electrical installation shall comply with all Sask Power requirements and regulations.

.3 In the event of any inspection authority requesting deviation from the design, notify the Consultant and obtain approval before proceeding with any change.

.4 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 Electrical Inspection Department and Supply Authority 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 to 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. 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.

1.10 WORK PROVIDED FOR OTHER DIVISIONS

.1 Provide information as to the location and exact size of all openings through floors and walls.

.2 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 the Mechanical Division. Special

control equipment being supplied by Mechanical Division shall be installed and wired by that contractor.

1.11 WORK PROVIDED BY OTHER DIVISIONS

.1 Installation and framing of all openings in walls or floors larger than 150 mm diameter, or rectangular, with one dimension greater than 150 mm.

.2 Openings in millwork for electrical outlets and conduits.

.3 Painting of all panelboard and communication panel trims to match colour scheme where exposed in finished areas.

1.12 WORK NOT PROVIDED BY THIS DIVISION

.1 Control wiring below 50V for Mechanical Control equipment beyond terminal section of each motor control centre or motor starter, unless specifically indicated otherwise.

1.13 COORDINATION WITH OTHER DIVISIONS

.1 Cooperate fully with the General Contractor, consultant, and owner 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, 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.

.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, or Division 6.

.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 circuitry is properly tested and meets the CSA Ground Resistance Requirements. A 600 volt megger or hi-pot procedures shall be used for all such tests.

.4 On the request of the Consultant, a staff supervisor shall be made available to assist in this inspection work.

.5 Acceptance tests and commissioning shall be conducted for systems and/or equipment where indicated in the specifications. Acceptance tests shall include, but not be limited to, the following Sections:

.1 263623 – Automatic Transfer Switch
.2 265000 - Lighting

.6 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.

.7 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.

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 262726 – Wiring Devices
.2 262823 – Disconnect Switches – Fused and Non-Fused
.3 263623 – Automatic Transfer Switch
.4 265000 – Lighting

.2 Review of shop drawings shall be for general design, arrangement and appearance only. This Division shall check and correct, if necessary, all manufacturer's 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.

.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 Where changes to design occur, materials shall be priced at published standard trade net cost. Labour shall be established by N.E.C.A. units. The maximum labour rate shall not exceed the prevailing union rate, and an average of eight men. The eight men shall consist of one foreman, three journeymen, two 4th year apprentices, one 3rd year apprentice and one 2nd year apprentice. Non-productive labour, estimating, material handling, supervision, telephone, storage, tools, etc., shall not exceed 30% of the above average labour rate. Payroll burden shall not exceed 40% of the above total, and mark-ups for overhead and profit shall be in accordance with the general and supplementary conditions.

.2 Changes to design involving an extra net difference shall be calculated on the same basis as indicated above, but the mark-up shall only apply to the net difference.

.3 Deletions only shall be credited with a minimum mark-up of 5%.

.4 Submit complete itemized breakdowns of all extras, deletions, and changes to the Consultant. Breakdown to include quantities, unit costs and extensions. If requested, support claim by certified copies of supplier's invoices.

.5 The right is reserved to move equipment 3000mm 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 provided by the Consultant. The Electrical contract price shall be broken down into twelve (12) 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.

1.19 OPERATING INSTRUCTIONS AND SERVICE MANUALS

.1 Upon completion of the installation, provide three (3) complete and comprehensive identical sets of operating and maintenance manuals. Refer top Section 01 78 00 – Closeout Submittals

.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:

.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 envelopes.
.5 Schematic drawings for all systems indexed and contained in suitably sized envelopes.
.6 Catalogue brochures for panelboards, wiring devices, light fixtures, fire alarm, etc.
.7 Certificate of Owner’s electrical equipment training.
.8 Acceptance Test reports.

The above information shall be bound in black, hard-backed, three-ring, letterhead size binders. 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. All riser conduits, panel feeds, conduit runs over 200 amp and main communications 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.

.5 The Owner's personnel shall be instructed in the operation and maintenance of miscellaneous equipment for a total of two (2) hours.

.6 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.

.7 Operating and maintenance manuals shall include written documentation bearing name and signature of Owner's personnel who received the above instructions.

.8 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. The only exceptions are incandescent lighting which shall be guaranteed for a period of four (4) months only.

.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 23 and shown on mechanical drawings.

1.23 COORDINATION OF PROTECTIVE DEVICES

.1 Ensure circuit protective devices such as overcurrent trips, relays and fuses are installed to required values and settings.

.2 Ensure that all overcurrent devices provided in this renovation are coordinated with existing

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 Identify electrical equipment with nameplates and labels as follows:

.2 Nameplates:

Lamecoid 3 mm thick plastic engraving sheet, black face, white core, mechanically attached with self tapping screws.

NAMEPLATE SIZES

Size 1	10 x 50 mm	1 line	3 mm high letters
Size 2	12 x 70 mm	1 line	5 mm high letters
Size 3	12 x 70 mm	2 lines	3 mm high letters
Size 4	20 x 90 mm	1 line	8 mm high letters
Size 5	20 x 90 mm	2 lines	5 mm high letters
Size 6	25 x 100 mm	1 line	12 mm high letters
Size 7	25 x 100 mm	2 lines	6 mm high letters

.3 Labels: Embossed plastic labels with 6 mm high letters unless specified otherwise.

.4 Wording on nameplates and labels to be approved by Consultant prior to manufacture.

.5 Allow for average of twenty-five (25) letters per nameplate and label.

.6 Identification to be English.

.7 Nameplates for terminal cabinets and junction boxes to indicate system and/or voltage characteristics.

.8 Identify equipment with Size 3 labels engraved "ASSET INVENTORY No. ___". Number as and if directed by Consultant.

.9 Disconnects, starters and contactors: indicate equipment being controlled and voltage.

.10 Terminal cabinets and pull boxes: indicate system and voltage.

.11 Branch circuit identification shall be provided on all plug-in type receptacles and local switches, and shall be identified by a clear 12mm laminated marker tape with contrasting black lettering.

.12 The cover plates for all receptacles fed from the ground fault interrupters shall also contain the wording “G.F.I.”

.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 Connections in equipment shall be made Phase 'A', 'B', 'C', from left to right when viewing wiring from front or accessible direction.

.4 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

.5 Colour code: to CSA C22.1. 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.

.2 Code with plastic tape or paint at points where conduit or cable enters wall, ceiling or floor, and at 15 m intervals.

.3 Colours: 25mm wide prime colour and 20mm wide auxiliary colour.

	Prime	**Auxiliary**
up to 250 V	Yellow	
up to 600 V	Yellow	Green
up to 5 kV	Yellow	Blue
up to 15 kV	Yellow	Red
Telephone	Green	
Other Communication Systems	Green	Blue
Fire Alarm	Red	
Emergency Voice	Red	Blue
Other Security Systems	Red	Yellow

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.

1.33 LOAD BALANCE

.1 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.

.2 Measure phase voltages at loads and adjust transformer taps to within 2% of rated voltage of equipment.

.3 Submit, at completion of work, report listing phase and neutral currents on panelboards, 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.

1.35 MATERIAL TO BE TURNED OVER TO THE OWNER

.1 Materials as indicated in various sections of this specification shall be turned over to the Owner. Obtain a signed receipt for each item turned over to the Owner. Include receipts in the operating and maintenance manuals.

1.36 SCHEDULING OF WORK AND DEMOLITION

.1 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.

.2 All outages shall be less than two (2) hours in duration unless otherwise approved. The contractor shall submit the method and procedure of all changeovers for approval by the Consultant and the Owner a minimum of ten (10) working days in advance.

.3 The existing fire alarm system shall be maintained in a fully operational state while modifications and additions to the system are installed.

.4 Relocate and reconnect existing exterior wall pack lighting fixtures, existing obstruction lighting fixture and existing special purpose receptacle outlets as indicated on the floor plans.

.5 All salvaged materials shall remain the property of the Owner unless otherwise noted. Materials that are turned over to Owner shall be stockpiled as per the Owner’s instruction.

.6 Refer to the overall project schedule for further scheduling requirements.

1.37 SITE EXAMINATION

.1 The contractor shall visit the existing construction 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.

1.38 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.

1.39 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".

END OF SECTION

PART 1 General

1.1 SECTION INCLUDES

.1 Materials and installation for wire and box connectors.

1.2 REFERENCES

.1 CSA C22.1-12, Canadian Electrical Code, Part 1, 2012

.2 Canadian Standards Association (CSA International) (Latest Editions)

.1 CAN/CSA-C22.2No.18, Outlet Boxes, Conduit Boxes, Fittings and Associated Hardware.

.2 CSA C22.2No.65, Wire Connectors.

.3 Electrical and Electronic Manufacturers' Association of Canada (EEMAC)

.1 EEMAC 1Y-2, 1961 Bushing Stud Connectors and Aluminum Adapters (1200 Ampere Maximum Rating).

.4 National Electrical Manufacturers Association (NEMA)

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 Bolts for copper conductors

.5 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 Install mechanical pressure type connectors and tighten screws with appropriate compression tool recommended by manufacturer. Installation shall meet secureness tests in accordance with CSA C22.2 No.65.

.2 Install fixture type connectors and tighten. Replace insulating cap.

.3 Install bushing stud connectors in accordance with EEMAC 1Y-2.

END OF SECTION

PART 1 General

1.1 RELATED SECTIONS

.1 Section 26 05 20 - Wire and Box Connectors - 0 - 1000 V.

1.2 REFERENCES

.1 CSA C22.1-12, Canadian Electrical Code, Part 1, 2012

.2 CSA C22.2 No .0.3-96, Test Methods for Electrical Wires and Cables.

.3 CAN/CSA-C22.2 No. 131-M89(R1994), Type TECK 90 Cable.

1.3 PRODUCT DATA

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

PART 2 Products

2.1 BUILDING WIRES

.1 Conductors: stranded for #10 AWG and larger. Minimum size: #12 AWG for branch circuit wiring and #14 AWG for fire alarm signaling systems.

.2 Copper conductors: sizes as indicated, with 600V insulation of chemically cross-linked thermosetting polyethylene material rated RW90 or RWU90.

.3 All conductors # 12 AWG to # 8 AWG shall be rated for minimum 600V RW-90 XLPE. Conductors # 6 AWG and larger shall be rated for minimum 600V RW-90 XLPE. All conductor for motor feeds from variable frequency drives, shall be rated for minimum 1000V RW-90 XLPE. Wiring in channel back of fluorescent fixtures shall be 600 volt Type GTF or TEW. Size, grade of insulation, voltage and manufacturer's name shall be marked at regular intervals.

.4 Conductors utilized in conduit runs under slab on grade or in underground conduit shall be Type ‘RWU-90’.

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 Type: ethylene propylene rubber.

.2 Chemically cross-linked thermosetting polyethylene rated type RW90, 600V to 1000V as noted above.

.3 Inner jacket: polyvinyl chloride material

.4 Armour: interlocking aluminum

.5 Overall covering: polyvinyl chloride material

.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 at 300mm centers.

.3 Threaded rods: 6 mm dia. to support suspended channels.

.5 Connectors:

.1 Watertight, approved for TECK cable.

2.3 ARMOURED CABLES

.1 Conductors: insulated, copper, size as indicated.

.2 Type: AC90

.3 Armour: interlocking type fabricated from aluminum strip

.4 Type: ACWU90 – PVC flame retardant 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.

.5 Connectors: as required.

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 Conductors up to and including No. 6 AWG gauge shall be spliced with nylon insulated expandable spring type connectors. Large conductors shall be spliced together using inline compression sleeves. Provide sufficient length for joint remake, and no less than 200 mm spare length.

.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.

.1 Group cables wherever possible on channels.

.2 Terminate cables in accordance with Section 26 05 20 - Wire and Box Connectors - 0-1000V.

.3 All cables shall be installed in accordance with the manufacturers recommendations, in suitable cable tray as specified within the specifications.

.4 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.

.5 All cable installed in cable tray shall be installed at one diameter spacing.

.6 Teck cabling shall be used only where noted on plans.

.7 Plastic zip ties shall not be used for securing cabling.

3.3 INSTALLATION OF ARMOURED CABLES

.1 Group cables wherever possible.

.2 Armoured cables may be used for connection between above ceiling distribution outlet boxes and wiring devices within the partitions and at system furniture terminal connections.

.3 Where armoured cabling is allowed, it may not be run horizontally through walls.

.4 Terminate cables in accordance with Section 26 05 20 - Wire and Box Connectors – 0 - 1000V.

.5 Connectors: as required.

END OF SECTION

Part 1 General

1.1 SECTION INCLUDES

.1 Materials and installation for connectors and terminations.

1.2 RELATED SECTIONS

.1 Section 01 33 00 Submittal Procedures.

.2 Section 26 05 33 - Raceway and Boxes for Electrical Systems.

1.3 REFERENCES

.1 Canadian Standards Association (CSA International)

1.4 PRODUCT DATA

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

Part 2 Products

2.1 CONNECTORS AND TERMINATIONS

.1 Copper compression connectors to CSA as required sized for conductors.

.2 Splices shall be used only where specifically noted on plans. All splicing shall be compression type splices. Verify splicing method with consultant prior to completing work.

Part 3 Execution

3.1 INSTALLATION

.1 Install terminations, and splices in accordance with manufacturer's instructions.

.2 Bond and ground as required

END OF SECTION

PART 1 General

1.1 RELATED SECTIONS

.1 Section 26 05 01 - Common Work Results - Electrical.

.2 Section 27 00 00 – Communication Requirements

1.2 REFERENCES

.1 CSA C22.1-12, Canadian Electrical Code, Part 1, 2012

.2 American National Standards Institute (ANSI)/Institute of Electrical and Electronics Engineers (IEEE)

.1 ANSI/IEEE 837-1989(R1996), Qualifying Permanent Connections Used in Substation Grounding.

PART 2 Products

2.1 EQUIPMENT

.1 Grounding conductors: bare stranded copper, minimum #12.

.2 Insulated grounding conductors: green. Exposed sheath shall be FT4, if located in a plenum space the sheath shall be FT6.

.3 Ground bus: copper, complete with insulated supports, fastenings, connectors.

.4 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.

.5 All ground conductors shall be bare or insulated, stranded, medium hard drawn copper wire. All insulated ground wires shall be green.

.6 Exposed copper shall be cleaned to a bright surface, and shall be finished with two coats of clean, insulating varnish.

.7 All connections to the ground bus or risers shall be thermowelded, or shall utilize compression connections. Clamp type connections shall only be allowed to individual pieces of equipment.

.8 Where bonds are covered with soil, the conductors are to be coated with anti-corrosion compound 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 The existing building ground network shall remain unchanged.

.3 All metallic raceways and conduits for communications, cable, and conductors shall be grounded.

.4 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.

.5 Lay-in trays and feeder conduits shall be connected to the ground bus.

.6 All 120/208 volt and 347/600 volt wiring shall be run in rigid conduit, or may be run in EMT if a separate ground wire is run from the panel or switch to each piece of equipment. The ground conductor shall be connected to the housing of each piece of equipment and the outlet box. Where rigid conduit is employed, all terminations of these conduit runs are to be with double locknuts, grounding bushings with jumper wires run between the bushing lug and the box or panel enclosure. Care shall be taken in conduit runs to ensure that all rigid pipe couplings and fittings are wrench tight.

.7 All new panel feeds at 600 volt and 208 volt shall include a building network ground conductor.

.8 All grounding conductors outside the electrical rooms and closets shall be insulated and installed in conduits, unless otherwise noted.

.9 Install connectors in accordance with manufacturer's instructions.

.10 Protect exposed grounding conductors from mechanical injury.

.11 Use mechanical connectors for grounding connections to equipment provided with lugs.

.12 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.

.13 Install flexible ground straps for bus duct enclosure joints, where such bonding is not inherently provided with equipment.

.14 Structural steel and metal siding to ground by welding copper to steel.

.15 Make grounding connections in radial configuration only, with connections terminating at single grounding point. Avoid loop connections unless indicated otherwise.

.16 Use mechanical connectors for grounding connections to equipment provided with lugs.

.17 Soldered joints not permitted.

.18 Bond single conductor, metallic armoured cables to cabinet at supply end, and provide non-metallic entry plate at load end.

.19 Ground secondary service pedestals.

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, steel work, ladders and distribution panels.

3.4 FIELD QUALITY CONTROL

.1 Perform tests described herein and 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 neutral points and equipment shall be made with thermowelds or brass, bronze or copper bolts and connectors.

END OF SECTION

PART 1 General

1.1 REFERENCE

.1 CSA C22.1-12, Canadian Electrical Code, Part 1, 2012

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 diameter threaded rods and spring clips.

.2 Support 2 or more cables or conduits on channels supported by 6 mm diameter 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 Consultant.

.12 Install fastenings and supports as required for each type of equipment cables and conduits, and in accordance with manufacturer's installation recommendations.

END OF SECTION

PART 1 General

1.1 REFERENCE

.1 CSA C22.1-12, Canadian Electrical Code, Part 1, 2012

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 25mm 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 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.

3.2 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.

3.3 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.

END OF SECTION

PART 1 General

1.1 REFERENCES

.1 CSA C22.1-12, Canadian Electrical Code, Part 1, 2012

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 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 Outdoors or damp locations, boxes shall be cast Feraloy or aluminum type 'FS' with threaded hubs and vapourproof covers.

.11 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.

.12 Standard octagon boxes shall be 100mm diameter, 53mm deep minimum. Increase depth where area fill requires. Equip each box used for fixture hanging with a fixture stud.

.13 Two gang or larger shall be solid type with raised cover for tile, block or gyproc finish.

.14 Wood strapping with steel studs shall not be utilized for supporting outlet boxes.

.15 Set boxes plumb and level within 6mm of finished surface. Mats not permitted.

.16 Where required, provide voltage separation boxes.

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 CONCRETE BOXES

.1 Electro galvanized sheet steel concrete type boxes for flush mount in concrete with matching extension and plaster rings as required.

2.4 CONDUIT BOXES

.1 Outdoor 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. Boxes shall be hot dip galvanized to ASTM a 924(M) designation zinc coating Z180(G60).

.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.

2.5 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, paneling, 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 Multi-gang boxes for use with 347 volt switches 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.

.12 Attention is directed to special outlet box locations for 347 volt switches requiring wider mount spacing rejection feature.

END OF SECTION

PART 1 General

1.1 REFERENCES

.1 CSA C22.1-12, Canadian Electrical Code, Part 1, 2012

.2 Canadian Standards Association (CSA)

- .1 CAN/CSA C22.2 No. 18-04, Outlet Boxes, Conduit Boxes, and Fittings and Associated Hardware.
- .2 CSA C22.2 No. 45, Rigid Metal Conduit
- .3 CSA C22.2 No. 56-2004, Flexible Metal Conduit and Liquid-Tight Flexible Metal Conduit.
- .4 CSA C22.2 No. 83-2004, Electrical Metallic Tubing.
- .5 CSA C22.2 No. 211.2, Rigid PVC (Unplasticized) Conduit
- .6 CAN/CSA C22.2 No. 227.3-2004, Flexible Nonmetallic Tubing.

PART 2 Products

2.1 CONDUITS

.1 All cabling shall be in conduit unless specifically noted otherwise.

.2 Rigid metal conduit: to CSA C22.2 No. 45, hot dipped galvanized steel threaded.

.3 Epoxy coated conduit: to CSA C22.2 No. 45, with zinc coating and corrosion resistant epoxy finish inside and outside.

.4 Electrical metallic tubing (EMT): to CSA C22.2 No. 83, with couplings.

.5 Rigid PVC conduit: to CSA C22.2 No. 211.2.

.6 Flexible metal conduit: to CSA C22.2 No. 56, liquid-tight flexible metal.

.7 Flexible PVC conduit: to CAN/CSA C22.2 No. 227.3

.8 Flexible electrical nonmetallic tubing (ENT): to CAN/CSA standard C22.2, No. 227.1 and C22.2 No. 85. NEMA TC-13 Electrical Nonmetallic Tubing.

.9 Conduit for use in corrosive atmospheres shall be rigid PVC or rigid steel with extruded PVC jacketed. Refer to drawings for areas requiring PVC.

.10 Condulets shall be of a type wherein cover screws do not enter the wire chamber.

.11 Flexible conduit connections to all mechanical equipment shall be of 'Sealtite' manufacture.

.12 Flexible conduit connectors shall be of the insulated throat type.

.13 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.

.14 Expansion joints shall be installed with ground jumper.

.15 All conduits shall be terminated with a suitable bushing.

.16 Flexible conduit and EMT 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 diameter 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.

.3 Watertight connectors and couplings for EMT. Set-screws are not acceptable. Watertight connectors are required only in Mechanical, Electrical, Communications Rooms.

2.4 EXPANSION FITTINGS FOR RIGID CONDUIT

.1 Weatherproof expansion fittings with internal bonding assembly suitable for 100mm linear expansion.

.2 Watertight expansion fittings with integral bonding jumper suitable for linear expansion and 19mm 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 18 meters..

.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 2000mm 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: 21 mm.

.18 Bend conduit cold. Replace conduit if kinked or flattened more than 1/10th of its original diameter. Mechanically bend steel conduit over 16mm dia.

.19 Install pull-twine in all empty conduits / raceways and conduits / raceways that are less than 40% filled.

.20 Remove and replace blocked conduit sections. Do not use liquids to clean out conduits.

.21 Dry conduits out before installing wire.

.22 Conduits, raceways, cabling shall not run within in-slab concrete floors and ceilings. Any conduit, cable, raceways required to run along the concrete slabs shall be surface runs; not run

in the concrete. Any instances where cabling is required to be run in concrete may be run in rigid PVC conduit or non-metallic flexible raceways, and shall transition to EMT or rigid steel with interfacing connectors or junction boxes being provided as required. This specification contains reference 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 meter 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.

END OF SECTION

PART 1 General

1.1 RELATED SECTIONS

.1 Section 01 33 00 - Submittal Procedures.

1.2 REFERENCES

.1 CSA C22.1-12, Canadian Electrical Code, Part 1, 2012

.2 Canadian Standards Association (CSA International)

.1 CSAC22.2No.26, Construction and Test of Wireways, Auxiliary Gutters and Associated Fittings.

PART 2 Products

2.1 WIREWAYS

.1 Wireways and fittings: to CSA C22 No.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.

END OF SECTION

PART 1 General

1.1 SECTION INCLUDES

.1 Materials and components for dry type transformers up to 600 V primary, equipment identification and transformer installation.

1.2 RELATED SECTIONS

.1 Section 01 33 00 - Submittal Procedures.

.2 Section 26 05 01 - Common Work Results - Electrical.

1.3 REFERENCES

.1 2012 Canadian Electrical Code

.2 Canadian Standards Association (CSA International)

.1 Transformers shall be dry type ANN, 60 cycle, air cooled, and shall meet as minimum requirement the latest IEEE, ASA C57.12, NEMA TPI, TP2, CEMA L2, CAN/CSA-C22.2 No. 47-M90, C9-M1981 and C9.1 M1981, CAN/CSA-C802.2.

.3 National Electrical Manufacturers Association (NEMA)

1.4 SHOP DRAWINGS AND PRODUCT DATA

.1 Submit shop drawings and product data in accordance with Section 01 33 00 - Submittal Procedures and 26 05 01 – Common Work Results - Electrical

PART 2 Products

2.1 TRANSFORMERS

.1 Use transformers of one manufacturer throughout project.

.2 Three phase transformers shall be three coil double winding configuration with 600 volt delta connected primary and 120/208 volt wye connected secondary, unless otherwise noted. Autotransformer or two coil 'T' connected are not acceptable.

.3 All transformers shall be provided with taps on the H.V. windings arranged to give two - 2.5% F.C.A.N. and two - 2.5% F.C.B.N. taps. Tap changes shall be accomplished without disturbing H.V. feeder conductor terminations.

.4 The transformers shall have CEMA 1 code gauge steel enclosure complete with removable metal side panels c/w adequate ventilation openings covered with expanded metal grill and, wall mounting brackets up to 75 KVA. Paint finish shall be ASA-61 light grey baked enamel. Provide suitable lifting hooks.

.5 Transformer shall be Class 220 system 'H' design with an average temperature rise of 150 degrees C. for the windings, with hottest spot winding rise of 180 degrees maximum winding temperature of 220 degrees C. in a maximum ambient of 40 degrees C. when operated continuously at rated voltage and full load current.

.6 Damage curve information shall be provided for overcurrent protection coordination. Coordinate with fuse manufacturer to ensure fuse size shown on drawings will protect transformer. Increase or Decrease above fuse size as required for transformer protection.

.7 Only where specifically noted, transformers shall be rated K13 factor to withstand and minimize the harmful effects of non-linear loads. All shop drawings shall indicate compliance.

.8 Losses shall not exceed CSA standard C802.2-00, Maximum Losses for Distribution, Power and Dry-Type Transformers. All shop drawings shall indicate compliance.

.9 Enclosures for transformers located indoors, in areas where sprinklers are present shall comply with the requirements of CSA Standard CAN/CSA-C22.2 No. 94 for enclosure type 3R except that the test requirements for protection against sleet and the formation of ice on the enclosure shall not apply and shall be so marked.

.10 All transformers shall be manufactured by Hammond, Schneider Electric, Cutler Hammer, Siemens, Delta, or Rex

2.2 EQUIPMENT IDENTIFICATION

.1 Provide equipment identification in accordance with Section 26 05 01 - Common Work Results - Electrical.

.2 Label size: 7.

.3 Nameplate wording: as per drawings

PART 3 Execution

3.1 INSTALLATION

.1 Mount dry type transformers up to 45 kVA as indicated.

.2 Mount dry type transformers above 45 kVA on floor unless noted otherwise

.3 Ensure adequate clearance around transformer for ventilation.

.4 Install transformers in level upright position.

.5 Remove shipping supports only after transformer is installed and just before putting into service.

.6 Loosen isolation pad bolts until no compression is visible.

.7 Make primary and secondary connections in accordance with wiring diagram.

.8 Energize transformers after installation is complete.

.9 Transformers shall be mounted on platform suspended from ceiling slab with spring loaded isolation hangers to minimize noise and vibration transmission, unless otherwise noted on the drawings.

.10 All conduit connections and conductor terminations to transformer shall be located within bottom one third of transformer enclosure and be of the flexible type to minimize vibration transfer. Under no circumstances shall conduit connections be installed in removable access covers or in top of enclosure.

.11 Ground secondary neutral and non-current carrying metal parts to building ground network.

.12 An overcurrent coordination study and the final testing, cleaning and calibration of protective relays, meters and circuit breaker trips shall be carried out by electrical contractor. Provide all necessary technical information and support to the testing facility to assist them in co-ordination study and testing.

END OF SECTION

PART 1 General

1.1 SECTION INCLUDES

.1 Materials and installation for standard and custom breaker type panelboards.

1.2 RELATED SECTIONS

.1 Section 01 33 00 - Submittal Procedures.

.2 Section 26 05 01 - Common Work Results - Electrical.

.3 Section 26 28 21 - Moulded Case Circuit Breakers.

1.3 REFERENCES

.1 2012 Canadian Electrical Code

.2 Canadian Standards Association (CSA International)

.1 CSA C22.2No.29-M1989(R2000), Panelboards and enclosed Panelboards.

1.4 SHOP DRAWINGS

.1 Submit shop drawings in accordance with Section 01 33 00 - Submittal Procedures and 26 05 01 – Common Work Results – Electrical.

.2 Drawings to include electrical detail of panel, branch breaker type, quantity, ampacity and enclosure dimension.

.3 Include time-current characteristic curves for breakers with ampacity of 50 A and over and with interrupting capacity of 18,000 A symmetrical (rms) or greater.Products

1.5 PANELBOARDS

.1 All panels shall be of the dead front, molded case circuit breaker type, as shown, sized and located on the drawings.

.2 Panel trim shall be furnished for flush or surface mounting as indicated on the drawings. Panel trim shall be removed for painting, and allowed to dry before final placement.

.3 Surface mounted panels shall have manufacturer's standard trim, and shall be finished with two coats of grey ASA #61.

.4 Panels shall be equipped with a flush type combination lock-latch. Two keys shall be provided for each panel, and all locks shall be keyed alike.

.5 Panels shall have mains of voltage and capacity and shall be complete with branch breakers, spares and spaces, as shown on the drawings. "Spaces" shall be understood to include necessary bus work such that Owners, at a later date, need buy only breakers.

.6 Panelboards: to CSA C22.2No.29 and product of one manufacturer.

.1 Install circuit breakers in panelboards before shipment.

.2 In addition to CSA requirements manufacturer's nameplate must show fault current that panel including breakers has been built to withstand.

.7 Sequence phase bussing with odd numbered breakers on left and even on right, with each breaker identified by permanent number identification as to circuit number and phase.

.8 Each panel shall be complete with a typed directory, which shall be mounted inside the door in a metal frame with clear plastic cover.

.9 Flush panels shall have concealed hinges and flush type combination lock-latch. Doors shall open minimum 135 degrees. Trims shall have fasteners concealed.

.10 Cabinets shall be fabricated of code gauge steel, with ample wiring gutters for all wiring connections.

.11 All panels shall have main bus bar equipped with solderless lug and be capable of accepting any arrangement of single, two or three pole breakers.

.12 Branch circuit breaker shall have quick-make, quick-break toggle mechanism with single, two or three pole common trip thermal magnetic units in ampere ratings as designated on the drawings. Breaker handles shall have three positions: 'on', 'off' and 'tripped'. All circuit breakers and panel bus shall have an interrupting capacity of 10,000 amps symmetrical.

.13 Panels for 120/208 volt, 3 phase, 4 wire systems, shall be complete with bolt-in type breakers, with a minimum nominal width of 20 mm per pole, and a bus of sufficient capacity to feed the number of branch circuit breakers indicated.

.14 Panels for 347/600 volt, 3 phase, 4 wire systems shall be complete with bolt-in type breakers, and a bus of sufficient capacity to feed the number of branch circuit breakers indicated.

.15 All panels shall be specification grade and of the same manufacture. Load centres are not acceptable.

.16 All branch circuit spaces shall be fitted with filler plates.

.17 Each panel shall be equipped with a ground bus suitable for terminating one ground conductor per load circuit.

.18 Panels shall be Siemens, Cutler Hammer or Schneider Electric.

.19 Refer to schematic details on plans.

1.6 BREAKERS

.1 Refer to Section 26 28 21 - Moulded Case Circuit Breakers.

.2 Lock-on devices for fire alarm circuits.

1.7 EQUIPMENT IDENTIFICATION

.1 Refer to Section 26 05 01 - Common Work Results – Electrical.

.2 Nameplate for each panelboard size 4 engraved as indicated.

.3 Nameplate for each circuit in distribution panelboards size 2 engraved.

.4 Complete circuit directory with typewritten legend showing location and load of each circuit.

PART 2 Execution

2.1 INSTALLATION

.1 Locate panelboards as indicated and mount securely, plumb, true and square, to adjoining surfaces.

.2 Install surface mounted panelboards on plywood backboards. Where practical, group panelboards on common backboard.

.3 Electrical panels shall, where possible, be mounted with top of trim at uniform height of 2000 mm.

.4 Panels, shown adjacent to other panels, shall have adjacent edges of different panels mounted parallel to each other with a gap of 75 mm.

.5 For panels recessed in a finished wall, provide for every six branch circuit spaces and spares, or fractions thereof, one 20 mm empty conduit up to furred ceiling space, and one (1) 20 mm empty conduit down to ceiling space of floor below, and cap for future wiring.

.6 Confirm all panel locations with the Construction Manager to ensure adequate mounting depth and mounting hardware for all panels.

.7 Connect neutral conductors to common neutral bus.

END OF SECTION

PART 1 General

1.1 SHOP DRAWINGS AND PRODUCT DATA

.1 Submit shop drawings and product data in accordance with Section 01330 - Submittal Procedures.

PART 2 Products

2.1 REQUIREMENTS

.1 Switches and receptacles shall comply with requirements of CSA, U.S. Federal Specification WS896E (switches), WC596F (receptacles) and NEMA Standard WD-1.

.2 Determine on drawings from the circuit identification given the voltage of the branch circuit from which the device is connected or controlling.

.3 Switches and receptacles shall be of the same manufacturer.

.4 Refer to drawing symbol legend for further requirements.

2.2 SWITCHES

.1 15, 20 A, 120 V or 347 V single pole, double pole, three-way, four-way switches.

.2 Manually-operated general purpose ac switches with following features:

- .1 Grade: Specification grade
- .2 Terminal holes approved for No. 10 AWG wire.
- .3 Silver alloy contacts.
- .4 Urea or melamine molding for parts subject to carbon tracking.
- .5 Suitable for back and side wiring.
- .6 WHITE rocker type.

.3 Switches controlling motors shall be K.W. (H.P.) rated and approved for motor control service.

.4 Set switches flush in all finished areas, or in surface box where conduit or wireway is exposed.

2.3 RECEPTACLES

.1 Duplex receptacles, CSA type 5-15 R, 125 V, 15 A, U ground, with following features:

- .1 Grade: Specification grade
- .2 WHITE urea molded housing style
- .3 Suitable for No. 10 AWG for back and side wiring.
- .4 Break-off links for use as split receptacles.
- .5 Eight back wired entrances, four side wiring screws.
- .6 Triple wipe contacts and rivetted grounding contacts.

.2 Other receptacles with ampacity and voltage as indicated.

.3 Receptacles of one manufacturer throughout project.

.4 Set receptacles flush in all finished areas, or in surface box where conduit or wireway is exposed

2.4 SPECIAL WIRING DEVICES

.1 Ground Fault Circuit Interrupter (GFCI) Convenience Outlets:

.1 Grade: Specification grade

.2 WHITE high impact chemical resistant molded nylon or polycarbonate face.

.3 Decora style

.4 NEMA 5-15R

.5 Suitable for No. 10 AWG, side wired.

.6 Have a feed-through capability for protecting downstream on the same circuit.

.7 Class A rated with 5 milliampere ground fault trip level and a 20 ampere feed through rating.

.8 'Safe Lock' protection such if critical components are damaged and ground fault protection is lost, power to the receptacle is disconnected.

.9 Test and Reset buttons, LED trip indicator light

.2 Special convenience outlets for specific equipment, straight blade or locking wiring devices, shall be specification grade, identified by the CEMA configuration for the device as indicated on the drawings.

2.5 COVER PLATES

.1 Cover plates from one manufacturer shall be used throughout project.

.2 Stainless steel cover plates for wiring devices mounted in flush-mounted outlet box.

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 Mount toggle switches at height specified in Section 260501- Common Work Results, Electrical or as indicated.

.2 Receptacles:

.1 Install receptacles in gang type outlet box when more than one receptacle is required in one location.

.2 Mount receptacles at height specified on drawings.

.3 Where split receptacle has one portion switched, mount vertically and switch upper portion.

.4 Co-ordinate with architectural and mechanical drawings for location of all counter tops, millwork and feature walls, to ensure proper location and mounting height.

.5 All convenience outlets shall meet tension tests as per CSA requirements, and will be subjected to 'on site' tests during final inspection.

.3 Cover plates:

.1 Protect stainless steel 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.

END OF SECTION

PART 1 General

1.1 SECTION INCLUDES

.1 Materials for molded-case circuit breakers, and ground-fault circuit-interrupters.

1.2 REFERENCES

.1 CSA C22.1-12, Canadian Electrical Code, Part 1, 2012

.2 Canadian Standards Association (CSA International).

.1 CSA-C22.2 No. 5-02, Molded-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).

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.

.4 Circuit breakers to have minimum of 10,000 A symmetrical rms interrupting capacity rating in breaker panelboards.

.5 Magnetic instantaneous trip elements in circuit breakers to operate only when value of current reaches setting.

.6 New breakers required for installation in existing panels shall be of the same manufacturer and style compatible for the existing panel. IC rating for the new breakers shall match those breakers installed in the panel.

PART 3 Execution

3.1 INSTALLATION

.1 Install circuit breakers as indicated.

END OF SECTION

Part 1 General

1.1 SECTION INCLUDES

.1 Materials and installation for fused and non-fused disconnect switches.

1.2 RELATED SECTIONS

.1 Section 01 33 00 Submittal Procedures.

.2 Section 26 05 01 Common Work Results - Electrical.

1.3 REFERENCES

.1 Canadian Standards Association (CSA International).

.1 CAN/CSA C22.2 No.4-M89 (R2000), Enclosed Switches.
.2 CSA C22.2 No.39-M89 (R2003), Fuseholder Assemblies.

1.4 SUBMITTALS

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

Part 2 Products

2.1 DISCONNECT SWITCHES

.1 Fusible and non-fusible disconnect switch in CSA Enclosure , size as indicated.

.2 Mechanically interlocked door to prevent opening when handle in ON position.

.3 Fuses: size as indicated. Switch fuse units shall be available in 30 through 1200 amp standard industry sizes. They shall be readily removable and interchangeable without modification to bus work or mounting rails

.4 Fuseholders: suitable without adaptors, for type and size of fuse indicated.

.5 Quick make, quick break action.

.6 Fusible switches shall be quick-make, quick-break, visible blades, integral handle mechanism, deionizing arc quenchers, front operation, high pressure fuse clips and recessed live parts.

.7 Operating handles to have provision for padlocking in either 'on' or 'off' position.

.8 Handle to be marked to clearly indicate switch contact positions.

.9 Switch fuse units shall be available in 30 through 1200 amp standard industry sizes.

.10 Shall be readily removable and interchangeable without modification to bus work or mounting rails.

2.2 EQUIPMENT IDENTIFICATION

.1 Provide equipment identification in accordance with Section 26 05 01 Common Work Results - Electrical.

.2 Lamecoid nameplates, approximately 75 mm x 25 mm, shall be provided on front doors of each switch for identification, showing the name and rating.

Part 3 Execution

3.1 INSTALLATION

.1 Install disconnect switches complete with fuses if applicable.

END OF SECTION

PART 1 General

1.1 SECTION INCLUDES

.1 Materials and installation for automatic load transfer equipment which can monitor voltage on all phases of normal power supply, initiate cranking of standby generator unit, transfer loads and shut down standby unit.

1.2 RELATED SECTIONS

.1 Section 26 05 01 - Common Work Results - Electrical.

1.3 REFERENCES

.1 Canadian Standards Association (CSA International)

.1 CAN3-C13-M83(R1998), Instrument Transformers.

.2 and Circuit-Breaker Enclosures (Tri-national standard with UL 489, tenth edition, and the second edition of NMX-J-266-ANCE).

.3 CSA C22.2No.178-1978(R2001), Automatic Transfer Switches.

.2 American National Standards Institute (ANSI)/National Electrical Manufacturers Association (NEMA)

.1 ANSI/NEMA ICS 2-2000, Industrial Control and Systems: Controllers, Contactors, and Overload Relays, Rated Not More Than 2000 Volts AC or 750 Volts DC.

1.4 SYSTEM DESCRIPTION

.1 Automatic load transfer equipment to:

.1 Monitor voltage on phases of normal power supply.

.2 Initiate cranking of standby generator unit on normal power failure or abnormal voltage on any one phase below preset adjustable limits for adjustable period of time.

.3 Transfer load from normal supply to standby unit when standby unit reaches rated frequency and voltage pre-set adjustable limits.

.4 Transfer load from standby unit to normal power supply when normal power restored, confirmed by sensing of voltage on phases above adjustable pre-set limit for adjustable time period.

.5 Shut down standby unit after running unloaded to cool down using adjustable time delay relay.

.2 Should normal power fail, the automatic transfer switch shall sense the voltage failure, send a signal to the standby generator unit to start and transfer the load to the emergency system as soon as voltage appears on the emergency feeds. When normal power is restored, the sequence shall be automatically reversed.

.3 The manufacturer shall be capable of maintaining and servicing this equipment without causing the Owner either to carry expensive parts, or to be subject to the inconvenience of long periods of interrupted service because of lack of available parts.

1.5 SHOP DRAWINGS

.1 Three (3) sets of complete operating, maintenance and parts manuals, drawings, and a sequence of operation covering all equipment shall be provided.

.2 Before fabrication and/or assembly, submit shop drawings and complete wiring diagrams for review.

.3 Submit shop drawings in accordance with Section 01 33 00 - Submittal Procedures.

.4 Include:

.1 Make, model and type.

.2 Single line diagram showing controls and relays.

.3 Description of equipment operation including:

.1 Automatic starting and transfer to standby unit and back to normal power.

.2 Test control.

.3 Manual control.

.4 Automatic shutdown.

1.6 CLOSEOUT SUBMITTALS

.1 Provide operation and maintenance data for automatic load transfer equipment for incorporation into manual.

.2 Detailed instructions to permit effective operation, maintenance and repair.

.3 Technical data:

.1 Schematic diagram of components, controls and relays.

.2 Illustrated parts lists with parts catalogue numbers.

.3 Certified copy of factory test results.

PART 2 Products

2.1 MATERIALS

.1 Instrument transformers: to CAN3-C13.

.2 Contactors: to ANSI/NEMA ICS2.

2.2 CONTACTOR TYPE TRANSFER EQUIPMENT

.1 Contact Type Transfer Equipment: to CSA C22.2No.178.

.2 The emergency power generator automatic transfer switch shall be suitable for resistive or inductive loads, and rated as specified herein, 120/208 volts, 60 Hz, 3 pole for use on a 3 phase, 4 wire system, having available short circuit current of 22,000 amps symmetrical.

.3 Transfer of the neutral bus is not required.

.4 The transfer, bypass and isolation switch shall be of the closed EEMAC 1 enclosure type for mounting on wall, as shown on the drawings. The enclosure & switch shall be factory assembled.

.5 Transfer switch shall be electrically operated, mechanically held, and shall obtain control and transfer power from the source to which it is being transferred. It shall operate so that a neutral position will not be possible, except for requirements noted otherwise.

.6 Full protection shall be provided by means of 3 solid state voltage sensing relays, and these relays shall have adjustable pick-up and drop-out settings.

.7 The transfer switch shall be an open transition switch with a microprocessor based controller with manual bypass-isolation switch. The bypass-isolation switch shall provide manual bypass of the load to either source and shall permit isolation of the automatic transfer switch from all source and load power conductors.

.8 A non-chattering relay shall be provided to prevent transfer to the emergency source until both the frequency and voltage have reached a preset value. An auxiliary contact shall be provided to initiate generator start-up on failure of normal power supply.

.9 The following timing adjustments to be supplied:

.1 Time delay for re-transfer from emergency to normal after restoration of normal power 0-10 minutes.

.2 Time delay normal to emergency 0-60 seconds.

.3 Time delay on engine starting to over-ride momentary voltage fluctuations 0-60 seconds.

.4 Maintained contact Test selector switch to simulate failure of normal power.

.10 As the standby diesel generator will be required to be on line and loaded within 10 seconds, the signal to start the unit shall be sent at the commencement of the 0-10 second time delay.

.11 The transfer switch control panel shall be mounted separately on the door and connected to the transfer switch by means of a wire harness and disconnect plug. The control panel shall also be capable of being removed for bench maintenance, without disturbing the power being supplied to the load.

.12 The by-pass switch shall have the same basic design as the transfer switch and shall have identical electrical ratings. It shall be operated manually by means of a by-pass handle, with quick-make/quick-break action. The handle shall have three positions: automatic, by-pass to normal and by-pass to emergency. In the automatic position, the by-pass to normal and by-pass to emergency contacts shall remain open and not exposed to the destructive effects of full currents of wear during normal operation.

.13 When the isolation switch is in the 'isolate' position, the by-pass switch shall serve as a manual transfer switch, allowing the load to be switched from one source to the other. The isolation switch shall provide a redundant back-up to the transfer switch. Regenerative voltage from the load shall be prevented from feeding back into the transfer switch during the source to source manual transfer.

.14 The isolation switch shall be integrated with the transfer switch and shall be a non-draw out type. Correct alignment in positive connection and disconnect shall be accomplished through the operation of the isolation handle. All power connection shall be made with silver plated copper. Means shall be provided to padlock the isolation handle in the open position.

.15 The by-pass handle shall permit load by-pass to either source without any interruption of the power to the load. There shall be three positions: automatic, by-pass to normal, and by-pass to emergency.

.16 The isolation handle shall be interlocked with the by-pass function and shall be capable of being operated only when the by-pass handle is in the by-pass position. The isolation handle shall have three positions as follows:

.1 Closed - the automatic transfer switch shall be connected to both power sources and the load in the normal operating mode.

.2 Test - in this position the automatic transfer switch shall be withdrawn from the load circuits. However, both sources shall still be connected to allow electrical functional testing without disturbing the load which has been by-passed directly to a source.

.3 Open - all power to the transfer switch shall be disconnected and it shall be completely isolated for maintenance. The transfer switch may be serviced.

.17 Both handles shall be accessible from the exterior of the switchgear. Handle positions and operating instructions shall be clearly indicated. Provide indicator showing:

.1 Utility source available

.2 Emergency source available

.3 By-pass to emergency

.4 By-pass to Utility

.5 Transfer switch closed on Utility

.6 Transfer switch closed on emergency

.18 Transfer switches shall be manufactured and assembled by Asco or approved equal.

.19 The manufacturer shall be brought in to provide commissioning of the transfer switch prior to it being energized and ensure that it is safe to be commissioned with source voltages present. They shall also be used to commission the switch and provide commissioning reports.

2.3 ACCESSORIES

.1 Pilot lights to indicate power availability normal and standby, switch position, green for normal, red for standby, mounted in panel.

.2 Provide the following relays and modules for each transfer switch.

.1 Relay to signal start-up of diesel generator.

.2 Relay to signal other equipment of an emergency power operation.

.3 Time delay relay to signal engine when cool-down period has occurred.

.4 Position sensing contacts for Emergency power Position, Normal Power position, Bypass - Emergency power Position, Bypass - Normal Power position.

.5 Remote Test Input.

.6 Adjustable Pre-transfer contacts

.7 ATS Position pilot lights

.8 Source Availability contacts

.9 3 phase under/over voltage – Emergency and Utility

.10 Phase Rotation Monitor

.11 Maintained Remote Test selector switch

.12 General Transfer Switch Alarm

2.4 EQUIPMENT IDENTIFICATION

.1 Provide equipment identification in accordance with Section 26 05 01 - Common Work Results – Electrical.

.2 Control panel:

.1 For selector switch and manual switch: size 4 nameplates.

.2 For meters, indicating lights, minor controls: size 2 nameplates.

2.5 SOURCE QUALITY CONTROL

.1 Complete equipment, including transfer mechanism, controls, relays and accessories factory assembled and tested in presence of Consultant.

.2 Tests:

.1 Operate equipment both mechanically and electrically to ensure proper performance.

.2 Check selector switch, in modes of operation Test, Auto, Manual, Engine Start and record results.

.3 Check voltage sensing and time delay relay settings.

.4 Check:

.1 Automatic starting and transfer of load on failure of normal power.

.2 Retransfer of load when normal power supply resumed.

.3 Automatic shutdown.

PART 3 Execution

3.1 INSTALLATION

.1 Locate, install and connect transfer equipment.

.2 Check time settings and adjust as required.

.3 The ground bus shall be connected to the ground network. Refer to specifications and the drawings for full grounding requirements.

.4 The Owner's operating and maintenance personnel shall be instructed in the operation and maintenance of the switch for a minimum period of two (2) hours total.

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 American National Standards Institute (ANSI)

.1 American National Standards Institute/Institute of Electrical and Electronics Engineers (ANSI/IEEE)

.2 ANSI/IEEE C62.41, Surge Voltages in Low-Voltage AC Power Circuits.

.3 American Society for Testing and Materials (ASTM)

.4 ASTM F1137, Specification for Phosphate/Oil and Phosphate/Organic Corrosion Protective Coatings for Fasteners.

.5 United States of America, Federal Communications Commission (FCC)

.6 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 a complete list of primary system products offered with their bid.

Part 2 Products

2.1 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.

2.2 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 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.

.10 Provide lighting fixtures of type and quality as specified in the following schedule. Fixtures shall be complete with necessary accessories. The contractor shall advise of any restrictions on providing luminaire and lamp as specified during tender period.

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.

2.3 LUMINAIRE SCHEDULE

.1 Fixture type 'AA'

.1 Luminaire: 2'x2' LED high bay fixture suspended 6500mm A.F.F., five year warranty.

.2 Lamp: 70% lumen maintenance at 100,000 hours 24000 lumens, 4000K colour temperature.

.3 Driver: 347 volt input, over-voltage, over-current and short-circuit protected.

.4 Manufacturer: Phillips FBX-24L-L-40-347 or approved equal

.2 Fixture type ‘A’

.1 Luminaire: Red LED aviation obstruction light, 120V, dual head, bottom mount.

.2 Manufacturers: Point Lighting POL LED v5 Pointspec series or approved equal

.3 Fixture type ‘B’

.1 Luminaire: Exterior wall mount LED suitable for wet locations, die cast aluminum housing, type III full cutoff lighting distribution, five year warranty. Fixture shall be mounted up 2760mm A.F.G.

.2 Lamps: 70% lumen maintenance at 120,000 hours, 18 103 absolute lumens, 220 input watts, 4000K colour temperature.

.3 Driver: 120 volt input, over-voltage, over-current and short-circuit protected.

.4 Manufacturers: Phillips Gardco 161-3-220LA-9670-NW or approved equal.

.4 Fixture type ‘C’

.1 Luminaire: Exterior wall mount LED suitable for wet locations, die cast aluminum housing, type IV full cutoff lighting distribution, five year warranty. Fixture shall be mounted up 7225mm A.F.G.

.2 Lamps: 70% lumen maintenance at 120,000 hours, 17 822 absolute lumens, 220 input watts, 4000K colour temperature.

.3 Driver: 120 volt input, over-voltage, over-current and short-circuit protected.

.4 Manufacturers: Phillips Gardco 161-4-220LA-9670-NW or approved equal.

.5 Fixture type ‘D’

.1 Luminaire: Recessed LED downlight suitable for mounting in soffit, wet location, 152mm diameter aperture, specular reflector with white trim.

.2 Lamps: Lamp shall be a minimum 1000 lumen LED module, 4000K, 80 CRI, 50000 hours at 70% lumen maintenance.

.3 Driver: 120-volt input with cold start temperature -40 degrees Celsius.

.4 Manufacturers:
Cooper Lighting Halo "ML56 LED" series
Elite LED B261C-LED shallow housing
Or approved equal

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 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 Conduit installation shall conform to the specifications.

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 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.

3.5 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 REFERENCES

.1 American Society for Testing and Materials International (ASTM)

.1 ASTM D698-00ae1, Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400ft-lbf/ft^3) (600kN-m/m^3).

1.2 QUALITY ASSURANCE/REGULATORY REQUIREMENTS

.1 Shore and brace excavations, protect slopes and banks and perform work in accordance with Provincial and Municipal regulations whichever is more stringent.

1.3 TESTS AND INSPECTIONS

.1 Testing of materials and compaction of backfill will be carried out by testing laboratory in accordance with Division 01- General Requirements. The cost of the testing shall be borne by the Contractor.

.2 Not later than one week before backfilling or filling, provide to designated testing agency, 23 kg sample of material proposed for use.

.3 Do not begin backfilling or filling operations until material has been approved for use by Departmental Representative.

.4 Not later than 48 hours before backfilling or filling with approved material, coordinate required compaction tests with designated testing agency.

.5 Before commencing work, conduct with Departmental Representative, condition survey of existing structures, trees and other plants, lawns, fencing, service poles, wires and paving, survey bench marks and monuments which may be affected by work.

1.4 EXISTING CONDITIONS

.1 Buried services:

.1 Before commencing work verify location of buried services on and adjacent to site.

.2 Arrange with appropriate authority for relocation of buried services that interfere with execution of work: pay costs of relocating services.

.3 Remove obsolete buried services within 2 m of foundations: cap cut-offs.

1.5 PROTECTION

.1 Protect excavations from freezing.

.2 Keep excavations clean, free of standing water, and loose soil.

.3 Where soil is subject to significant volume change due to change in moisture content, cover and protect to Departmental Representative’s approval.

.4 Protect natural and man-made features required to remain undisturbed.

.5 Existing buried utilities and structures:

.1 Size, depth and location of existing utilities and structures as indicated are for guidance only. Completeness and accuracy are not guaranteed.

.2 Prior to commencing excavation Work, notify applicable authorities having jurisdiction, establish location and state of use of buried utilities and structures. Authorities having jurisdiction to clearly mark such locations to prevent disturbance during Work.

.3 Confirm locations of buried utilities by careful test excavations.

.4 Maintain and protect from damage, water, sewer, gas, electric, telephone and other utilities and structures encountered.

.5 Where utility lines or structures exist in area of excavation, obtain direction of Departmental Representative before removing.

.6 Record location of maintained, re-routed and abandoned underground lines.

.6 Existing buildings and surface features:

.1 Conduct, with Departmental Representative, condition survey of existing buildings, trees and other plants, lawns, fencing, service poles, wires, pavement, survey bench marks and monuments which may be affected by Work.

.2 Protect existing buildings and surface features from damage while Work is in progress. In event of damage, immediately make repair to approval of Departmental Representative.

.7 Protect existing projections from buildings such as window wells, steps and stairs. Temporarily support as required and reinstate to original detail if removal is unavoidable.

Part 2 Products

2.1 MATERIALS

.1 Aggregate Base and Granular Sub-base courses:

.1 Crushed, pit run or screened stone, gravel or sand.

.2 Gradations to be within limits specified when tested to ASTM C136 and ASTM C117. Sieve sizes to CAN/CGSB-8.2.

.3 Table

Sieve Designation	% Passing	
	Aggregate Base (Type 33)	Granular Sub-base (Type 8)
50 mm	-	100
37.5 mm	-	-
25 mm	-	-
18 mm	100	-
12.5 mm	75 - 100	-
9.5 mm	-	-
5.0 mm	50 - 75	-
2.00 mm	32 - 52	0 - 90

Sieve Designation	% Passing	
	Aggregate Base (Type 33)	Granular Sub-base (Type 8)
900 um	20 - 35	-
400 um	15 - 25	0 - 60
160 um	8 - 15	0 - 25
71 um	6 - 11	0 - 15
Plasticity Index	0 - 6	0 - 6
Fractured Face %	50% Minimum	-
Light Weight Pieces %	5% Maximum	-

.2 Cohesive fill: selected material from excavation or other sources, approved by Departmental Representative for use intended, unfrozen and free from rocks larger than 75 mm, cinders, ashes, sods, refuse or other deleterious materials.

.3 Unshrinkable fill: proportioned and mixed to provide:

.1 Maximum compressive strength of 0.4 MPa at 28 days.

.2 Maximum Portland cement content of 25 kg/m^3.

.3 Minimum strength of 0.07 MPa at 24 h.

.4 Concrete aggregates: to CAN/CSA-A23.1/A23.2.

.5 Cement: to CAN/CSA-A3001, Type GU Portland cement: Type 10.

.6 Slump: 160 to 200 mm.

Part 3 Execution

3.1 TEMPORARY EROSION AND SEDIMENTATION CONTROL

.1 Provide temporary erosion and sedimentation control measures to prevent soil erosion and discharge of soil-bearing water runoff or airborne dust to adjacent properties and walkways.

3.2 EXCAVATION

.1 Shore and brace excavations, protect slopes and banks and perform work in accordance with Provincial and Municipal regulations.

.2 Saw cut in a straight line and remove area of existing asphalt and concrete as indicated on drawings for new construction.

.1 Remove and dispose of all removed asphalt and concrete materials.

.3 Excavate as required to carry out work.

.1 Do not disturb soil or rock below bearing surfaces.

.2 Notify Departmental Representative when excavations are complete.

.3 Excavation taken below depths shown without Departmental Representative's written authorization to be filled with concrete of same strength as for footings at Contractor's expense.

.4 Excavate for slabs to subgrade levels.

.1 Remove topsoil, organic matter, debris and other loose and harmful matter encountered at subgrade level.

.5 Remove all topsoil, organic matter, debris and other loose and harmful matter encountered at subgrade level.

3.3 SITE QUALITY CONTROL

.1 Fill material and spaces to be filled to be inspected and approved by Departmental Representative.

3.4 BACKFILLING

.1 Inspection: do not commence backfilling until fill material and spaces to be filled have been inspected and approved by Departmental Representative.

.2 Remove snow, ice, construction debris, organic soil and standing water from spaces to be filled.

.3 Lateral support: maintain even levels of backfill around structures as work progresses, to equalize earth pressures.

.4 Compaction of subgrade: compact existing subgrade under walks, paving, and slabs on grade, to same compaction as specified for fill.

.5 Placing:

.1 Place backfill, fill and base course material in 150 mm lifts: moisture condition as required to achieve specified density.

.6 Upper 500mm of backfill to be local compacted soil where not covered with impermeable material

.7 Compaction: compact each layer of material to following densities for material to ASTM D698:

.1 Below slabs and paving on grade: compact all aggregate base course and granular sub-base course to 98% of standard Proctor density at optimum moisture content.

.2 Building subgrade: 96% of standard Proctor density at optimum moisture content.

.3 Subgrade fill: 96% of standard Proctor density at optimum moisture content.

.4 Landscape subgrade: 90% of standard Proctor density at optimum moisture content.

.8 In trenches:

.1 Up to 300 mm above pipe or conduit: sand placed by hand.

.2 Over 300 mm above pipe or conduit: native material approved by Departmental Representative.

.9 Under seeded and sodded areas: use site excavated material to bottom of topsoil except in trenches and within 600 mm of foundations.

.10 Against foundations (except as applicable to trenches and under slabs and paving): excavated material or imported material with no stones larger than 200 mm diameter within 600 mm of structures.

3.5 GRADING

.1 Grade so that water will drain away from buildings, walls and paved areas, to catch basins and other disposal areas approved by the Departmental Representative.

.1 Grade to be gradual.

3.6 SHORTAGE AND SURPLUS

.1 Supply necessary fill to meet backfilling and grading requirements and with minimum and maximum rough grade variance.

.2 Dispose of surplus material off site.

3.7 CLEANING

.1 Progress Cleaning: clean in accordance with Section 01 74 11 - Cleaning.

.1 Dispose of cleared and grubbed material off site daily.

.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 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 Saskatchewan Highways and Transportation Specifications, January 1996.

.2 American Society for Testing and Materials International, (ASTM)

.1 ASTM D698-00a, Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft^3 (600 kN-m/m^3)).

Part 2 Products

2.1 MATERIALS

.1 Sub-Base Course: Saskatchewan Highways and Transportation specification 3300, Type 8.

.2 Granular Base Course: Saskatchewan Highways and Transportation specification 3505, Type 32 or 33.

.3 Asphalt concrete: spreader-laid hot mix to Saskatchewan Highways and Transportation Mix Design Type 2 (Specification No. 4100). Use AC 150-200A asphalt cement as defined by Saskatchewan Highways and Transportation Specifications for Manufactures Materials (SMM101).

Part 3 Execution

3.1 PAVEMENT STRUCTURE / COMPACTION

.1 Pavement structure thickness:

.1 100 mm asphalt concrete.

.2 200 mm Aggregate Base Course compacted to minimum of 100% Standard Proctor density.

.3 380 mm Granular Sub-Base Course compacted to minimum of 97% Standard Proctor density.

3.2 SUBGRADE PREPARATION

.1 Remove loose fill and other deleterious materials from the proposed pavement area and compact the upper 150 mm of subgrade to at least 96 percent of standard Proctor density at optimum moisture content.

.2 Provide geotextile with a grab tensile strength of 1000 N as required over subgrade soils.

.3 In areas where there is to be no grade raise above the existing ground surface, excavate/subcut the clay to a minimum depth of 0.3 metres below the underside of the granular sub-base. Select clay removed during the subcut that is free from objectionable materials may be stockpiled in an approved storage area, for later re-use. If unconsolidated clay fills or unusually dry clays are encountered below the initial subcut depth then the subcutting shall be increased to the underside of such materials.

.4 The final excavated areas are to be inspected for approval. If any undesirable materials are found they shall be removed. Upon approval, scarify and moisture condition to a depth of 150 mm. Recompact subgrade to a minimum average of 96 percent of Standard Proctor maximum dry density, with no reading falling below 95 percent at a minimum of 1 to 2 percent above optimum moisture content. Compaction shall be undertaken using a heavy sheepfoot vibratory compactor. Should areas require special attention, take remedial construction measures to rectify.

.5 Areas that require a grade raise above the existing ground surface or that will require a significant grade raise shall use select fill consisting of pit run sand, containing less than 10% particles finer than a 80um sieve, to the underside of the sub-base course. All granular fill placed above the subgrade elevation should be placed in thin lifts (maximum 150mm loose) and compacted to a minimum of 98% of standard Proctor density.

.6 Grade finished subgrade surface to promote subdrainage beneath the pavement structure.

.7 Final surface elevations of paved areas shall be positively sloped towards catchbasins and as shown on grading drawing.

.8 All fill materials are to be placed and uniformly compacted in 150mm maximum lifts.

.9 Cohesive soils shall be compacted to the following:

.1 Bottom lifts: compact to minimum average 97 percent of Standard Proctor maximum dry density at a minimum of 1 to 2% wet of optimum water content. No individual density test shall be below 96% of Standard Proctor maximum dry density.

.2 Upper two lifts: (minimum combined thickness of 300mm) compact to minimum 98 percent of Standard Proctor maximum dry density at a minimum of 1% wet of optimum water content.

.10 Do not allow prepared subgrade to dry out prior to placement of the sub-base material.

3.3 FIELD QUALITY CONTROL

.1 Inspection and testing of asphalt paving will be carried out by designated testing laboratory.

.2 Costs of tests will be paid by Contractor.

3.4 FINISH TOLERANCES

.1 Finished asphalt surface to be within 5mm of design elevation but not uniformly high or low.

.2 Finished asphalt surface not to have irregularities exceeding 5 mm when checked with 4.5m straight edge placed in any direction.

END OF SECTION