Volume 1
Architectural & Structural

PROJECT

New Police Building

Maidstone, Saskatchewan

PROJECT No.	SET No.
29/2013	
DATE	
2014-12-08	

Volume 2
Mechanical & Electrical
Civil & Landscape

PROJECT

New Police Building

Maidstone, Saskatchewan

PROJECT No.	SET No.
29/2013	
DATE	
2014-12-08	

LIST OF DRAWINGS

Drawing No.	Title	Latest Issue No. / Date
	ARCHITECTURAL	
A0	COVER SHEET	0 / 2014-12-08
A1.1	SITE PLAN	0 / 2014-12-08
A1.2	DETAIL SITE PLAN	0 / 2014-12-08
A1.3	SITE DETAILS	0 / 2014-12-08
A2.1	MAIN FLOOR PLAN / WALL TYPES / PARTITION TYPES	0 / 2014-12-08
A2.2	SERVICE SPACE PLAN / DOOR, FRAME, & WINDOW TYPES	0 / 2014-12-08
A2.3	ROOF PLAN	0 / 2014-12-08
A2.4	LARGE SCALE PLANS	0 / 2014-12-08
A2.5	CEILING PLAN	0 / 2014-12-08
A3.1	BUILDING ELEVATIONS	0 / 2014-12-08
A3.2	BUILDING ELEVATIONS	0 / 2014-12-08
A3.3	BUILDING SECTIONS	0 / 2014-12-08
A4.1	PLAN DETAILS	0 / 2014-12-08
A4.2	SECTION DETAILS	0 / 2014-12-08
A4.3	SECTION DETAILS	0 / 2014-12-08
A4.4	SECTION DETAILS	0 / 2014-12-08
A4.5	SECTION DETAILS	0 / 2014-12-08
A4.6	WINDOW DETAILS	0 / 2014-12-08
A4.7	WINDOW DETAILS DOOR DETAILS	0 / 2014-12-08
A4.8	DOOR DETAILS	0 / 2014-12-08
A4.9	DOOR DETAILS	0 / 2014-12-08
A4.10	DOOR DETAILS	0 / 2014-12-08
A4.11	CELL DETAILS	0 / 2014-12-08
A4.12	DETAILS	0 / 2014-12-08
A5.1	INTERIOR ELEVATIONS	0 / 2014-12-08
A5.2	INTERIOR ELEVATIONS	0 / 2014-12-08
A5.3	INTERIOR ELEVATIONS	0 / 2014-12-08
A5.4	INTERIOR ELEVATIONS	0 / 2014-12-08
A5.5	INTERIOR ELEVATIONS	0 / 2014-12-08
A6.1	MILLWORK DETAILS	0 / 2014-12-08
A6.2	MILLWORK DETAILS	0 / 2014-12-08
A6.3	MILLWORK DETAILS	0 / 2014-12-08
A7.1	FINISHES PLAN	0 / 2014-12-08
A8.1	FURNITURE PLAN (NOT IN CONTRACT)	0 / 2014-12-08

Part 1 General

1.1 WORK COVERED BY CONTRACT DOCUMENTS

.1 Work of this Contract comprises the construction of a new 1-storey steel framed and load bearing concrete block building and all associated Work. The building is located in Maidstone Saskatchewan and is 905m² in area.

1.2 WORK SEQUENCE

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

1.3 CONTRACTOR USE OF PREMISES

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

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

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

1.4 EXISTING SERVICES

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

.2 Where Work involves breaking into or connecting to existing servicescarry out work at times as directed by governing authorities with minimum disturbance to pedestrian and vehicular traffic.

.3 Establish location and extent of service lines in area of work before starting Work. Locations of utilities shown on drawings are approximate. Notify Departmental Representative of findings.

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

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

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

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

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

END OF SECTION

Part 1 General

1.1 SPECIAL REQUIREMENTS

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

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

1.2 RCMP SECURITY CLEARANCE REQUIREMENTS (LAW ENFORCEMENT CHECKS)

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

.2 After interim completion of the project, all personnel engaged in the execution of the work on the interior of an RCMP occupied and/or unoccupied building shall have at a minimum, the requisite RCMP Reliability (RRS) clearance.

.3 A minimum of four months prior to interim completion of the project, the Contractor shall prepare and submit the following attached requisite forms and documents for an RRS clearance, for each Contractor employee and sub-contractor employee to be engaged in the work on the interior of an occupied and/or unoccupied building after interim completion of the project:

.1 RCMP Contractor/Consultant Information Sheet

.2 TBS 330-23e – Personnel Screening, Consent and Authorization Form

.3 TBS 330-60e – Security Clearance Form

.4 Security/Reliability Interview Pre-Interview Questionnaire

.4 Also, contractor's employees and sub-contractor employees must include with their completed requisite forms, the following documents:

.1 Valid government issued photo identification: photocopy of front and back of document (photo must be clear), certified to be a true copy by their supervisor or colleague. Examples of government issued photo identification include Driver's License, Passport or Treaty card.

.2 Birth certificate: photocopy of front and back of document, certified to be a true copy by their supervisor or colleague.

.3 Two sets of roll and ink fingerprints on Form C-216 (Contractor cost): Fingerprints must be taken/obtained from a Corp of Commissionaires office.

.4 Two current Passport Style Photographs (Contractor cost).

.5 In addition to the requirements noted in .3 above, Contractor employees and sub-contractor employees must undertake the following additional clearance requirements to obtain the RCMP Reliability Status clearance:

.1 Undertaking of a Reliability interview as scheduled by the RCMP.

.6 To eliminate delays in the clearance process, all clearance forms/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. The RCMP will not accept/cannot process documents with ANY requested information missing as per instruction sheets provided – NO

EXCEPTIONS (ie. no abbreviations on documents anywhere ie. “AB”, “CA”). *All incomplete forms will be returned to the Contractor (ensure instructions for completion of documents noted in .2 above are read and followed by each applicant, prior to submitting to the RCMP).*

.7 The Contractor should batch the fully completed submissions, based on priority work on site and allow for a minimum eighty (80) working days processing time in the project schedule for the review to occur (from the date the “fully 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.

.8 After interim completion of the project, the Contractor’s employees and sub-contractor employees shall only mobilize in the interior of an occupied and/or unoccupied building, once the requisite RCMP RRS clearance has been granted.

1.3 BUILDING SMOKING ENVIRONMENT

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

END OF SECTION

RCMP National Project Delivery Office, Regina
Contractor/Consultant Information Sheet

PLEASE PRINT LEGIBLY / ALL INFORMATION MUST BE PROVIDED

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

CONTRACTORS/CONSULTANTS MUST PROVIDE THE FOLLOWING INFORMATION:	
1. Your Complete Legal Name: *(First/Middle or "no Middle Name"/ Last Name)*	
2. Name of Company That You Work For:	
3. Company Telephone Number :	
4. Project That You Are Working On: (*Name of Project/Building/City/Province*)	Maidstone Det. Construction, Maidstone, SK SRCL #2014-11123144
5. Access Period (Start & End Dates): (*If exact dates unknown, estimated dates*)	

CONTRACTORS/CONSULTANTS MUST PROVIDE PHOTOCOPIES OF:	
	MARK 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** as follows (handwrite/print): 'Certified True Copy"; thereafter, the person certifying true copy would print and sign their First and Last Name. 2. ***Note:*** If you do not have a Driver's License, please provide other government issued photo identification (passport, treaty card).	
3. **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** as follows (handwrite/print): 'Certified True Copy"; thereafter, the person certifying true copy would print and sign their First and Last Name.	

CONTRACTORS/CONSULTANTS MUST PROVIDE THE FOLLOWING DOCUMENTS WITH THEIR COMPLETED:

1. TBS 330-23E,

2. TBS 330-60E &

3. SECURITY/RELIABILITY PRE-INTERVIEW QUESTIONNAIRE:

DOCUMENTS ATTACHED:	**MARK YES / NO:**
1. **Two current Passport Style Photographs** (do not have to be certified)	
2. **Two sets of Fingerprints on Form C-216** ("Roll and Ink" style) – must be obtained from a Corp of Commissionaires office.	

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 project it was issued for.
3) The access tag must be returned to the RCMP issuing office or site foreman (if approved) at the end of each day.
4) No access to areas that you have not been cleared will be allowed and if found in these areas your clearance will be revoked and you will be removed from the site.

Employee Signature:	Signed on Date:

EMPLOYER TO REVIEW (not employee applicant of this form), COMPLETE&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" - 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, Driver's 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: 1)_____**Number**_____

2)_____**Number**_____

Employers Name: _____
(First Name and Last Name)

Employers Signature: _____

Date of signature: _____

Government of Canada / Gouvernement du Canada

PROTECTED (when completed)

PERSONNEL SCREENING, CONSENT AND AUTHORIZATION FORM

OFFICE USE ONLY		
Reference number	Department/Organization number	File number

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

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

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

The requested level of reliability/security check(s)

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

☐ Other _____

PARTICULARS OF APPOINTMENT/ASSIGNMENT/CONTRACT

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

Justification for security screening requirement

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

B BIOGRAPHICAL INFORMATION (To be completed by the applicant)

Surname (Last name)	Full given names (no initials) underline or circle usual name used	Family name at birth
All other names used (i.e. Nickname)	Sex ☐ Male ☐ Female	Date of birth Y M D

Country of birth	Date of entry into Canada if born outside Canada Y M D

RESIDENCE (provide addresses for the last five years, starting with the most current)
Home address

Daytime telephone number ( )	E-mail address

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

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

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

CRIMINAL CONVICTIONS IN AND OUTSIDE OF CANADA (see instructions)

Have you ever been convicted of a criminal offence for which you have not been granted a pardon? ☐ Yes ☐ No	If yes, give details. (charge(s), name of police force, city, province/state, country and date of conviction) ▼

Charge(s)	Name of police force	City

Province/State	Country	Date of conviction ▶ Y M D

Government of Canada / Gouvernement du Canada

PERSONNEL SCREENING, CONSENT AND AUTHORIZATION FORM

PROTECTED (when completed)

Surname and full given names	Date of birth (Y M D)

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

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

The Privacy Act Statement

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

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

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)

Government of Canada / Gouvernement du Canada

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, 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".

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 (for which a pardon has NOT been granted):
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").

Note: If more than one conviction, list additional criminal convictions in and outside of Canada, on a separate sheet of paper and sign this attached sheet of paper.

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. 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						
6						
7						
8						
9						
10						
11						
12						
13						

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)
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)

Government of Canada / Gouvernement du Canada

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

Government of Canada / Gouvernement du Canada

PROTECTED (When complete

OFFICE USE ONLY		
Reference number	Department number	File number

SECURITY CLEARANCE FORM

The Privacy Act Statement

The information on this form is required for the purpose of providing a security 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. 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).

Please typewrite or print in block letters.

NOTE: Level I and II must complete sections A to J inclusive and P.
Level III must complete all sections.

A ADMINISTRATIVE INFORMATION (To be completed by Department/Agency/Organization)

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

Level: ☐ I (CONFIDENTIAL) ☐ II (SECRET) ☐ III (TOP SECRET) ☐ other _____

Department/Agency/Organization	Employee ID number/PRI/Rank and Service number (if applicable)	Organization number

B BIOGRAPHICAL INFORMATION (To be completed by the applicant)

1. Surname (Last name)	2. Full given names (no initials) underline or circle usual name used	3. Family name at birth

4. All other names used (i.e. Nickname)	5. Sex ☐ Male ☐ Female	6. Date of birth Y M D

7. Place of birth (city)	Province/State	Country

8. Name change (other than marriage)	From	To

9. Place of change (city, province or state, and country)	10. Method (authority)

C SECURITY SCREENING

1. Have you previously completed a Government of Canada security screening form? ☐ Yes ☐ No	If yes, give name of department/agency/organization, and the year and level of clearance. Y

D MARITAL STATUS/COMMON-LAW PARTNERSHIP

Current status
☐ Married ☐ Common-Law Partnership ☐ Separated ☐ Widowed ☐ Divorced ☐ Single

1

A) CURRENT SPOUSE/COMMON-LAW PARTNER: Surname, given names	B) Maiden Name (if applicable)	C) Present citizenship of current spouse/common-law partner

D) Date of marriage/ common-law partnership Y M D	E) City, province or state, and country of marriage/common-law partnership

F) City, province or state, and country of birth	G) Date of birth Y M D

H) Present address (apartment number, street number, street name, civic number (if applicable), city, province or state and country)	I) If separated, widowed or divorced, specify date Y M D

J) Name and address of employer (job title)

2

A) PREVIOUS SPOUSE/COMMON-LAW PARTNER: Surname, given names (cover only the past five years)	B) Present citizenship of former spouse/common-law partner

C) Date of marriage/ common-law partnership Y M D	D) City, province or state, and country of marriage/common-law partnership

E) Date of divorce/ separation/ deceased Y M D	F) City, province or state, and country of divorce

G) Country of Birth (if known)	H) Date of birth Y M D

E IMMEDIATE RELATIVES (including those living outside Canada) (see instructions)

NOTE: Do not use initials

1

A) Full name (surname and all given names, including maiden name)	B) Relationship

C) City, province or state, and country of birth	D) Date of birth Y M D

E) Present address (apartment number, street number, street name, civic number (if applicable), city, province or state and country)	F) Date of death (if applicable) Y M D

G) Name and address of employer	H) Job title

Surname and full given names	Date of birth Y M D

E IMMEDIATE RELATIVES (continued)

NOTE: **Do not use initials**

2	A) Full name (surname and all given names, including maiden name)	B) Relationship
	C) City, province or state, and country of birth	D) Date of birth Y M D
	E) Present address (apartment number, street number, street name, civic number (if applicable), city, province or state and country)	F) Date of death (if applicable) Y M D
	G) Name and address of employer	H) Job title
3	A) Full name (surname and all given names, including maiden name)	B) Relationship
	C) City, province or state, and country of birth	D) Date of birth Y M D
	E) Present address (apartment number, street number, street name, civic number (if applicable), city, province or state and country)	F) Date of death (if applicable) Y M D
	G) Name and address of employer	H) Job title
4	A) Full name (surname and all given names, including maiden name)	B) Relationship
	C) City, province or state, and country of birth	D) Date of birth Y M D
	E) Present address (apartment number, street number, street name, civic number (if applicable), city, province or state and country)	F) Date of death (if applicable) Y M D
	G) Name and address of employer	H) Job title
5	A) Full name (surname and all given names, including maiden name)	B) Relationship
	C) City, province or state, and country of birth	D) Date of birth Y M D
	E) Present address (apartment number, street number, street name, civic number (if applicable), city, province or state and country)	F) Date of death (if applicable) Y M D
	G) Name and address of employer	H) Job title
6	A) Full name (surname and all given names, including maiden name)	B) Relationship
	C) City, province or state, and country of birth	D) Date of birth Y M D
	E) Present address (apartment number, street number, street name, civic number (if applicable), city, province or state and country)	F) Date of death (if applicable) Y M D
	G) Name and address of employer	H) Job title
7	A) Full name (surname and all given names, including maiden name)	B) Relationship
	C) City, province or state, and country of birth	D) Date of birth Y M D
	E) Present address (apartment number, street number, street name, civic number (if applicable), city, province or state and country)	F) Date of death (if applicable) Y M D
	G) Name and address of employer	H) Job title

F 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

G FOR COMPLETION BY PERSONS BORN OUTSIDE CANADA OR BORN IN CANADA HOLDING DUAL CITIZENSHIP (see instructions)

1. Date of entry into Canada Y M D	2. Present citizenship	
3. If you are a naturalized Canadian, give the certificate number and date of issue Y M D Certificate No. _____	4. If you are not naturalized, have you applied for Canadian citizenship? Please provide copy of Immigrant Visa or Record of Landing documentation ☐ Yes ☐ No	Date of application Y M D
5. Do you maintain citizenship of a country other than Canada? If yes, please provide the name of the country and explain why. ☐ Yes ☐ No (If yes) Name of Country: _____ Explain:	6. Have you used a passport other than a Canadian one? If yes, explain why. ☐ Yes ☐ No (If yes) Explain:	

Surname and full given names	Date of birth Y M D

H RESIDENCE (there should be no gaps)

List addresses where you have lived during the last 10 years, starting with the most current. (Rural address to include lot and civic number.)

1	Apartment number	Street number	Street name		Civic number (if applicable)	**From** Y M	**To** **present**
	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 ( )		
3	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 ( )		
4	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 ( )		
5	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 ( )		

I EMPLOYMENT (last 10 years) (see instructions for self-employed and consultants) (there should be no gaps)

Would your employment be jeopardized if your current supervisor, below, is contacted? ☐ Yes ☐ No

If yes, provide the name of an alternate employment contact and telephone number.

Were you dismissed or asked to resign from any position(s) as listed below? ☐ Yes ☐ No

If yes, give name of employer, supervisor, and date.

Name of employer	Supervisor	Position title	Date Y M

1	A) Name of employer - do not use initials (department/organization/agency, if applicable)	B) **From** Y M	**To**	**present**	
	C) Job-site address (street number, street name, city, province or state and country)				
	D) Job title/Description	E) Rank and service number (if applicable)			
	F) Supervisor's name in full	G) Supervisor's telephone number ( )			
2	A) Name of employer - do not use initials (department/organization/agency, if applicable)	B) **From** Y M	**To** Y M		
	C) Job-site address (street number, street name, city, province or state and country)				
	D) Job title/Description	E) Rank and service number (if applicable)			
	F) Supervisor's name in full	G) Supervisor's telephone number ( )			
3	A) Name of employer - do not use initials (department/organization/agency, if applicable)	B) **From** Y M	**To** Y M		
	C) Job-site address (street number, street name, city, province or state and country)				
	D) Job title/Description	E) Rank and service number (if applicable)			
	F) Supervisor's name in full	G) Supervisor's telephone number ( )			
4	A) Name of employer - do not use initials (department/organization/agency, if applicable)	B) **From** Y M	**To** Y M		
	C) Job-site address (street number, street name, city, province or state and country)				
	D) Job title/Description	E) Rank and service number (if applicable)			
	F) Supervisor's name in full	G) Supervisor's telephone number ( )			

Surname and full given names	Date of birth Y M D

J FOREIGN EMPLOYMENT

1. Are you now or have you **ever** been employed by or acted as a consultant for a foreign government, firm, or agency? ☐ Yes ☐ No	If yes, give details (country, organization, nature of work and dates) Include military (cadets), law enforcement and security intelligence employment

SECTIONS "K" TO "O" MUST ALSO BE COMPLETED FOR LEVEL III ONLY

K TRAVEL

List countries visited within the last five years for personal travel and/or non-Government business, other than Canada, the USA and Mexico.

Country	Purpose	From Y M	To Y M

L FOREIGN ASSETS

Do you have any business, financial or personal assets outside Canada? ☐ Yes ☐ No	If yes, list the relevant countries (exclude stocks and mutual funds purchased in Canada)

M CHARACTER REFERENCES IN CANADA (see instructions)

List three character references (non-family members) and one neighbourhood reference

1	Name in full (no initials)	Relationship	Period known
	Complete home address		Telephone Number ( )
	Complete title and business address		Business Telephone Number ( )
2	Name in full (no initials)	Relationship	Period known
	Complete home address		Telephone Number ( )
	Complete title and business address		Business Telephone Number ( )
3	Name in full (no initials)	Relationship	Period known
	Complete home address		Telephone Number ( )
	Complete title and business address		Business Telephone Number ( )

Neighbourhood reference (see instructions)

Name in full (no initials)	Telephone Number ( )
Complete home address	Business Telephone Number ( )

N EDUCATION

1. Name of the last school or university you attended full time	2. Student ID number (if known)	3. Location of institution	4. Period of attendance From Y M To Y M

5. Field of study (Diploma or degree obtained)

O MILITARY SERVICE

Military service in the Canadian Armed Forces: Regular, Reserves and Sea, Army and Air Cadets (from the period since your 16th birthday).

1. Name and last location	2. Rank and Service no.	3. Period of service From Y M	To Y M

P CERTIFICATION

I hereby certify that the information set out by me in this document is true and correct to the best of my knowledge and belief.

1. Signature	2. Date Y M D	3. Telephone (Home) ( )	3. Telephone (Business) ( )

ALL INFORMATION SUPPLIED IS SUBJECT TO VERIFICATION BY INVESTIGATION

Government of Canada | Gouvernement du Canada

INSTRUCTIONS FOR COMPLETION OF SECURITY CLEARANCE FORM TBS/SCT 330-60E (Rev. 2006-02)

General:

- Once completed this form shall be safeguarded and handled at the level of PROTECTED A.
- If clarification of information is required, a Canadian Government Official may contact the applicant to obtain additional information in order to complete the security screening investigation and an interview of the applicant may be requested.
- This form is to be completed using an automated system or if not available using a typewriter or printing in block letter format in black ink.
- Please read and follow these instructions carefully.
- The original signed copy must be submitted.
- It is important that a copy of the completed questionnaire be retained by the applicant for future reference.
- Incomplete or illegible forms will NOT be considered.
- All names are to be in full (no initials) (Maternal and Paternal or other names used).
- Addresses are to include, where applicable civic or township name and the lot and concession numbers.
- If information is not known or is unavailable please indicate this on the form and on a separate sheet of paper explain the cause of circumstance.
- All dates are to be entered in order of YEAR, MONTH, and DAY as applicable.
- If space allotted in any portion is insufficient please use separate sheet using same format.

Detailed Instructions:

SECTION A
- To be completed by the department, agency or organization.
- "Other" This should be used to identify if the security screening is for Site Access, NATO, SIGINT etc.

SECTION B (Remainder of the form is to be completed by the applicant)
- Complete as requested.

SECTION C
- Complete as requested.

SECTION D
"common-law partner" - in relation to an applicant, means a person who is cohabiting with the individual in a conjugal relationship, having so cohabited for a period of at least one year. This includes persons of the same sex.

- 1. includes current spouse and common-law partner as applicable.
- If any person is deceased, date of death and last address while living are to be shown.
- 2. includes previous spouse and common-law partner as applicable during the last five years.
- If a person is deceased, date of death is to be shown in 2e.
- All other questions to be answered as set forth.

SECTION E
- Questions 1 to 8 - experience has shown that incomplete answers to these questions are the most common cause of delay. Please follow the instructions carefully.
- For all security clearance requests all Immediate Relative(s) information must be provided.
- Immediate family includes the following:
- All children 18 years and over that you or your spouse or common-law partner have a parental relationship.
- Your father, mother, brothers, sisters. Include "half" or "step" relatives in this category.
- Your current spouse's or common-law partner's father and mother. Include "half" or "step" relatives in this category.

If any person is deceased, date of death and last address while living are to be shown.

SECTION F
- 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.

SECTION G
- If a naturalized Canadian, it is important to show the certificate number, date of issue. Attach a photocopy of the certificate.
- If born abroad of Canadian parents, please provide a copy of your Certificate of Registration of Birth Abroad.
- If not a Canadian Citizen indicate if application has been made for Citizenship. In this case, passport or identity card number and particulars should be recorded in box "6". Please provide copy of Immigrant Visa or Record of Landing documentation.
- Questions 5 and 6 - Attach a separate sheet of paper if more space is required. Each sheet must be signed.

SECTION H
- As set forth, ensuring current address is recorded first.
- The Postal code is mandatory for the current address, and if known, for previous addresses.
- For rural area, include civic number or lot, concession and township number.

SECTION I
- Record your present employment first.
- Please note that it may be necessary to contact your present employer.
- Time at school and periods of unemployment are also to be shown; (as well as, secondments, educational leave, and courses of over six months' duration; include supervisor or colleague's name).
- Job-site address is the address where your work is performed and may be different from your employer's address.

NOTE: If you are self-employed or a consultant, or have been self-employed or a consultant, provide the following:
a) Name of employer - give your business name; if not applicable, give your name;
b) No change;
c) Job-site address - give your permanent business address; if not applicable, give your residence address;
d) No change;
e) No change;
f) Supervisor's name - give a name of a person who can verify your employment;
g) No change.

SECTION J
- Is related to determining past employment of security concern. A security official may ask for further details.

SECTION K
- Travel record is for less than six months, if more than this period it is to be recorded as residence in part "H".
- One day visits to countries, such as cruise stopover, do not have to be recorded.
- A security official may ask for details of travel.
- An employee or contractor on Canadian Government business is not required to record details of travel in this section.

SECTION L
- A security official may ask for details in terms of the type of assets and estimated value.

SECTION M
- Character references must be colleagues, peers, and friends who have known you well for over three years and should be able to cover your non-work environment and activities.
- Character references are NOT to include relatives and MUST be residing in Canada.
- Faster processing is facilitated if references listed are in your geographic area.
- Neighbourhood reference is an individual who has known you for over six months preferably at your current address. If not, the individual has been a neighbour during the past five years.

SECTION N
- Complete as requested.

SECTION O
- Question to be answered if not covered in employment section. List last or current unit and dates of total service in the Canadian Armed Forces.
- If more space is required use a separate sheet of paper. Each sheet must be signed.

SECTION P
- Complete as requested.

SUPPLEMENTAL INFORMATION REQUIREMENTS
Persons who have previously completed a SECURITY CLEARANCE and subsequently marry, remarry or commence a common-law partnership are required to submit an original Security Clearance Form with the following parts completed:

For all Security Clearances

Part A - As set forth in each question
Part B - As set forth in each question
Part C - As set forth in each question
Part D - As set forth in each question
Part E - Provide details on parents of new spouse/common-law partner and any children (over the age of 18 years) of the new spouse/common-law partner
Part P - To be signed by person submitting the form

Note: In addition to the above, in those cases where an individual marries or commences a common-law partnership with a Non-Canadian National or Landed Immigrant who has not yet arrived in Canada, the following information is required:

Parts A-D As set forth in each question
Part E - Parents of new spouse/common-law partner, brothers, sisters (include "half and "step" relatives) and any children (over the age of 18 years) of the new spouse/common-law partner
Part H - For new spouse/common-law partnership
Part I - For new spouse/common-law partnership
Part P - To be signed by person submitting the form

CYCLICAL UPDATE REQUIREMENTS
- Levels I+II (10 year update). Complete all portions of the form as per instructions above.
- Level III (5 year update cycle)

With the exceptions of Parts H and I, where the information required is that which covers the period of time since the last submission of a questionnaire, **ALL OTHER** parts of the questionnaire must be completed **IN FULL**.

INSTRUCTIONS FOR COMPLETION OF GOVERNMENT OF CANADA SECURITY CLEARANCE FORM (Form No. TBS 330-60E)

Listed below are instructions for completion of the TBS 330-60E. In addition to reviewing the notes below, please review the attached "Government of Canada Instructions For Completion of Security Clearance Form".

NOTE:

1. **All information requested on Form TBS 330-60E MUST be provided (ie. do not leave any "blanks").**

2. **Failure to provide ALL requested information will result in forms being returned to the General Contractor or General Consultant (as per contract specifications).**

3. **PLEASE NOTE: NO ABBREVIATIONS ARE TO BE USED ON THIS FORM (ie. "CA" for Canada, "AB" for Alberta etc.)**

Page 1 of Form:

Section A. Administrative Info.: do not complete (to be completed by 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. a,) Place of Birth: the city or town or village that you were born in.
   b.) Province/State: the province or state that you were born in (no abbreviations)
   c.) Country: the country that you were born in (no abbreviations)

8. Name Change (other than marriage): your former surname and/or first, middle name(s) and the "From" and "To" dates of your name change (2012-01 (Month) – 01 (Day) format).

9. Place of change: City, province or state and country where your name was changed.

10. Method: Authority that authorized your name change ie. Alberta Vital Statistics

INSTRUCTIONS FOR COMPLETION OF GOVERNMENT OF CANADA SECURITY CLEARANCE FORM (Form No. TBS 330-60E)

Section C. Security Screening: ***To be completed by applicant***

1. 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").

Section D. Marital Status/Common-Law Partnership: ***To be completed by applicant:***

- Current Status: current marital status – check off applicable box.

1. Current Spouse or common-law partner:
   a. Surname, First and Middle Name (use format : ie. SMITH, Judy Carol)
      **Circle usual first name used;
      **If no middle name, state "no middle name" on the form.
   b. Maiden Name; if no maiden name, state "none".
   c. Present Citizenship of current spouse/common-law partner ie. "Canadian"
   d. Date of marriage/common-law partnership: Year-Month-Day format (ie. 2012-01-01)
   e. City, province or state, and country of marriage/common-law partnership (ie. Regina, Saskatchewan, Canada) – no abbreviations.
   f. City, province or state, and country of birth: of your spouse/common-law partner (ie. Regina, Saskatchewan, Canada) – no abbreviations.
   g. Date of Birth: of your spouse/common-law partner – Year-Month-Day format
   h. Present Address: Apartment number, street number, street name, city, province or state, and country (Do not abbreviate province and country)
      - If address is not a street address, you must provide a legal land description for rural addresses (ie. SW-12-13-33-W1), followed by Town (or RM) (ie. Lacombe or RM of Sherwood or County of Smith), followed by Province and Country (no abbreviations – Saskatchewan Canada).
      - **Do not provide any Post Office Box No's** – need physical address of residence / not where your mail is forwarded to (PO Box no.).
   i. If separated, widowed or divorced, specify date: Year-Month-Day format (ie. 2012-01-01)
   j. Name and address of employer (job title): Include the following:
      - Name of Company that your spouse is employed by – ie. "Smith's Plumbing
      - Complete Street Address or Legal Land Description of Company that your spouse is employed by – ie. 245 – 7 Street, Regina, Saskatchewan, Canada (do not abbreviate province and country)
      - **Do not provide any Post Office Box No's** – need physical address of residence / not where your mail is forwarded to (PO Box no.).
      - Job Title of your spouse (ie. Financial Officer).

INSTRUCTIONS FOR COMPLETION OF GOVERNMENT OF CANADA SECURITY CLEARANCE FORM (Form No. TBS 330-60E)

2. Previous Spouse/Common-Law Partner (cover only the past 5 years only/during the past 5 years):
   - If no previous spouse/common-law partner, state "None"; if previous spouse/common-law partner:

   a. Surname, First and Middle Name (use format: ie. SMITH, Judy Carol)
      **Circle usual first name used;
      **If no middle name, state "no middle name" on the form.
   b. Present Citizenship of Former Spouse/Common-law partner: ie. "Canadian"
   c. Date of marriage/common-law partnership: Year-Month-Day format (ie. 2012-01-01)
   d. City, province or state, and country of marriage/common-law partnership: (ie. Regina, Saskatchewan, Canada) – no abbreviations.
   e. Date of divorce/separation/deceased: Year-Month-Day format
   f. City, province or state, and country of divorce: (ie. Regina, Saskatchewan, Canada) – no abbreviations.
   g. Country of Birth (if known): of your former spouse/common-law partner – Year-Month-Day format
   h. Date of Birth: of your former spouse/common-law partner – Year-Month-Day

Section E. Immediate Relatives: To be completed by applicant (Page 1 & continued on Page 2)

a. Full Name: (Surname, First and Middle Name, including Maiden Name in brackets):
   - Circle usual first name used;
   - If no middle name, state "no middle name" on the form.

b. Relationship: include son or daughter (*if they are over 18 years of age*), mother, father, brothers, sisters – include "half" or "step" relatives in this category; AND mother-in-law, father-in-law – include "half" or "step" relatives in this category.

c. City, Province or State, and Country of Birth: of your immediate relative – ie. Regina, Saskatchewan, Canada (do not abbreviate province and country).

d. Date of Birth: of your relative Year-Month-Day format

e. Present address: where your relative currently resides as follows:
   - Apartment number, street number, street name, city, province or state, and country (Do not abbreviate province and country)
   - If address is not a street address, you must provide a legal land description for rural addresses (ie. SW-12-13-33-W1).
   - **Do not provide any Post Office Box No's** – need physical address of residence / not where your mail is forwarded to (PO Box no.).
   - If person is deceased, the last address while living is to be shown (if unknown, state "unknown").

f. Date of death (if applicable): Year-Month-Day format

g. Name and address of employer: Include the following information:
   - Name of Company that your relative is employed by – ie. "Smith's Plumbing"
   - Complete Street Address or Legal Land Description of Company that your spouse is employed by – ie. 245 – 7 Street, Regina, Saskatchewan, Canada (do not abbreviate province and country)
   - **Do not provide any Post Office Box No's** – need physical address of residence / not where your

INSTRUCTIONS FOR COMPLETION OF GOVERNMENT OF CANADA SECURITY CLEARANCE FORM (Form No. TBS 330-60E)

mail is forwarded to (PO Box no.)

- If not working, state "unemployed" or if deceased, state "deceased".

h. Job Title: of your immediate relative (ie. Financial Officer)

Page 2 of Form:

Top of Page: Surname, and full given names (First and Middle Names) – use this format.

Section F. Criminal Convictions In And Outside Canada: ***To be completed by applicant***

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

Notes: List only criminal convictions for which a pardon has NOT been granted. If more than one conviction, list additional criminal convictions in and outside of Canada, on a separate sheet of paper and sign this attached sheet of paper.

Section G. For Completion By Persons Born Outside Canada etc.: ***To be completed by applicant***

- Only complete as requested if born outside of Canada OR born in Canada Holding Dual Citizenship.

Page 3 of Form:

Top of Page: Surname, and full given names (First and Middle Names) – use this format.

Section H. Residence (no gaps in date) ***: To be completed by applicant***

- Include last TEN years of residences, starting with your current home address. If you do not have enough spaces to list residences from the past ten years on the attached form, photocopy this page and list additional residences (include your Surname, Full Given Names and Date of Birth at the top of each additional page).

1. a. Apartment number, b. street number, c. street name, c. city, d. province or state, and e. country (Do not abbreviate province and country)
   - If address is not a street address, you must provide a legal land description for rural addresses (ie. SW-12-13-33-W1).
   - **Do not provide any Post Office Box No's** – need physical address of residence / not where your mail is forwarded to (PO Box no.)

2. From and To dates that you resided at each residence (Year and Month format); ***no gaps in dates*****
DATES MUST BE CONSECUTIVE–NO BREAKS IN TIME PERIODS as stated above.

Section I. Employment: ***To be completed by applicant (Page 3 & continued on Page 4)***

- Include last TEN years of employment, starting with your current employer. If you do not have enough spaces to list employment from the past ten years on the attached form, photocopy this page and list additional employers (include your Surname, Full Given Names and Date of Birth at the top of each additional page).

INSTRUCTIONS FOR COMPLETION OF GOVERNMENT OF CANADA SECURITY CLEARANCE FORM (Form No. TBS 330-60E)

1. Would your employment be jeopardized if your current supervisor, below, is contacted?: Check off applicable box – "Yes" or "No".
   - If Yes, provide the name of an alternate employment contact and telephone number including:
     a. First Name and Surname of Contact Person
     b. Company Name that Contact Person is employed for
     c. Telephone number including area code.

2. Were you dismissed or asked to resign from any position(s) as listed below?: Check off applicable box – "Yes" or "No".
   - If Yes, give the name of employer, supervisor, and date:
     a. Name of Employer: The Company Name
     b. Supervisor: The person's first name and surname
     c. Position Title: Supervisor's Title
     d. Date: Year and Month Format – the date that you were dismissed/asked to resign.

3. Employment History (for the past 10 years):
   a. Name of Employer: The company name of your employer
   b. From: The Year and Month that you started working for the specified employer & To: "present" or the date that you stopped working for the specified employer.
   c. Job-Site Address: Street Number, Street Name, City, Province or state, and Country (no abbreviations for City, Province and/or Country) – **NO POST OFFICE BOX NO.'S, POSTAL CODES OR ABBREVIATIONS.**
   d. Job Title/Description: Your Job Title or Description ie. "Consultant"
   e. Rank and Service number (if applicable): if not applicable state "none"
   f. Supervisor's name in Full: First Name and Surname Name of Supervisor
   g. Supervisor's Telephone Number: Include area code in brackets.

   NOTE: there cannot be any gaps in dates; if you were unemployed for a short duration, include "unemployed" along with the "From and To" dates on the attached form – 10 years must be included on the form, even if you were "unemployed" or a "student".

Page 4 of Form:

Top of Page: Surname, and full given names (First and Middle Names) – use this format.

Section J. Foreign Employment: ***To be completed by applicant***

1. Are you now or have you ever been employed by or acted as a consultant for a foreign government, firm, or agency?: Check of a box: "Yes" or "No".

2. If yes, give details: Country, organization, nature of work and dates); include military (cadets), law enforcement and security intelligence employment.

INSTRUCTIONS FOR COMPLETION OF GOVERNMENT OF CANADA SECURITY CLEARANCE FORM (Form No. TBS 330-60E)

Section K. Travel: ***To be completed by applicant (you must complete for an RRS clearance)***

1. If you have not visited within the last five years for personal travel and/or non-Government business, other than Canada, the USA and Mexico, state "None".

2. If you have, include: Country, Purpose of Travel and "From" and "To" dates (year and month format).

Section L. Foreign Assets: ***To be completed by applicant (you must complete for an RRS clearance)***

1. "No" OR
2. "Yes" - if "Yes", please list the relevant countries (exclude stocks and mutual funds purchased in Canada).

Section M. Character References In Canada: ***To be completed by applicant (you must complete for an RRS clearance)***

- List three character references (non-family members – colleagues, peers, and friends) who have known you well for over three years and should be able to cover your non-work environment and activities AND:
- NOTE: FASTER PROCESSING IS FACILITIES IF REFERENCES LISTED ARE IN YOUR GEOGRAPHIC AREA.
- List one neighborhood reference who has known you for over six months preferably at your current address. If not, the individual has been a neighbor during the past five years.

1. Name in full (no initials): First Name and Last Name of Individual

2. Relationship: ie. Friend, Coworker

3. Period Known: Since (Year) ie. "Since 1975"

4. Complete Home Address – a. Apartment Number, b. House Number, c. Street number or name d. City, Province or State, Country OR Legal Land Description if in a rural area (ie. SW-30-23-45-W4th) - **NO POST OFFICE BOX NO.'S OR POSTAL CODES OR ABBREVIATIONS.**

5. Telephone Number: Home Telephone Number (area code in brackets)

6. Complete Title and Business Address:
   a. Your Reference's Title at Work (ie. Consultant)
   b. Your Reference's Employer/Company Name (ie. Smith Architects)
   c. Your Reference's Business Address (Number, Street No. or Name, City, Province or State, and Country) or Legal Land Description if in a rural area **(NO POST OFFICE BOX NO.'S OR POSTAL CODES, NO ABBREVIATIONS).**

7. Telephone Number: Your Reference's Business Telephone number or Cell Number (include area code).
   - NOTE: Please place an asterisk (*) beside one of the above noted "daytime" telephone numbers of each reference listed, as reference checks will likely be completed during daytime hours.
   - **NOTE: Please ensure that all of your references are at the telephone numbers that you have provided; failure to provide up to date telephone numbers will result in processing delays.**

INSTRUCTIONS FOR COMPLETION OF GOVERNMENT OF CANADA SECURITY CLEARANCE FORM (Form No. TBS 330-60E)

Section N. Education: ***To be completed by applicant (you must complete for an RRS clearance)***

1. Name of the last school or university you attended "full time": ie. Smith Composite High School or York University.

2. Student ID Number: if unknown, state "unknown"

3. Location of institution: City, Province or State and Country (no abbreviations)

4. Period of Attendance: From and To Dates that you attended this institution (Year and Month format)

5. Field of Study: Diploma or degree obtained OR state "Did not obtain Diploma or degree".

Section O. Military Service: ***To be completed by applicant (you must complete for an RRS clearance)***

1. Name and Last Location:

2. Rank and Service No.:

3. Period of Service: From and To Dates that you served (Year and Month format)

OR

- If no Military Service - include "None".

Section P. Certification: ***To be completed by applicant***

1. Signature: Sign your name

2. Date: Today's Date (Year, Month and Day format)

3. Telephone No.: Home (include area code)

4. Telephone No.: Business (include area code)

****Please ensure that you also review "Government of Canada – Instructions For Completion of Security Clearance Form TBS 330-60E (Rev. 2006-02).**

Updated June 14, 2012

SAMPLE OF COMPLETED DOCUMENT

Government of Canada / Gouvernement du Canada

PROTECTED (When completed)

OFFICE USE ONLY		
Reference number	Department number	File number

SECURITY CLEARANCE FORM

The Privacy Act Statement

The information on this form is required for the purpose of providing a security 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. 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).

Please typewrite or print in block letters.

NOTE: Level I and II must complete sections A to J inclusive and P.
Level III must complete all sections.

A ADMINISTRATIVE INFORMATION (To be completed by Department/Agency/Organization)

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

Level: ☐ I (CONFIDENTIAL) ☐ II (SECRET) ☐ III (TOP SECRET) ☐ other

Department/Agency/Organization	Employee ID number/PRI/Rank and Service number (if applicable)	Organization number

B BIOGRAPHICAL INFORMATION (To be completed by the applicant)

1. Surname (Last name)	2. Full given names (no initials) underline or circle usual name used	3. Family name at birth
SMITH	(JOHN) (no middle name)	SMITH

4. All other names used (i.e. Nickname)	5. Sex	6. Date of birth (Y M D)
Johnny	☒ Male ☐ Female	1960 01 27

7. Place of birth (city)	Province/State	Country
EDMONTON	ALBERTA	CANADA

8. Name change (other than marriage)	From	To
NONE	—	—

9. Place of change (city, province or state, and country)	10. Method (authority)
—	

C SECURITY SCREENING

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

If yes, give name of department/agency/organization, and the year and level of clearance.
CORRECTIONAL SERVICES CANADA
RELIABILITY STATUS CLEARANCE (RRS) Y 2001

D MARITAL STATUS/COMMON-LAW PARTNERSHIP

Current status: ☒ Married ☐ Common-Law Partnership ☐ Separated ☐ Widowed ☐ Divorced ☐ Single

1

A) CURRENT SPOUSE/COMMON-LAW PARTNER: Surname, given names	B) Maiden Name (if applicable)	C) Present citizenship of current spouse/common-law partner
SMITH, (JOANNE) JANE	JONES	CANADIAN

D) Date of marriage/common-law partnership (Y M D)	E) City, province or state, and country of marriage/common-law partnership
1981 08 01	EDMONTON, ALBERTA, CANADA

F) City, province or state, and country of birth	G) Date of birth (Y M D)
CALGARY, ALBERTA, CANADA	1960 02 01

H) Present address (apartment number, street number, street name, civic number (if applicable), city, province or state and country)	I) If separated, widowed or divorced, specify date (Y M D)
1257 Cooper Avenue, Peace River, alberta, Canada	

J) Name and address of employer (job title)
PEACE RIVER Health Region, 123-2 Avenue, Peace River, Alberta, Canada (NURSE)

2

A) PREVIOUS SPOUSE/COMMON-LAW PARTNER: Surname, given names (cover only the past five years)	B) Present citizenship of former spouse/common-law partner
NONE	

C) Date of marriage/common-law partnership (Y M D)	D) City, province or state, and country of marriage/common-law partnership

E) Date of divorce/separation/deceased (Y M D)	F) City, province or state, and country of divorce

G) Country of Birth (if known)	H) Date of birth (Y M D)

E IMMEDIATE RELATIVES (including those living outside Canada) (see instructions)

NOTE: Do not use initials

1

A) Full name (surname and all given names, including maiden name)	B) Relationship
SMITH, (JERALD) GEORGE	FATHER

C) City, province or state, and country of birth	D) Date of birth (Y M D)
EDMONTON, ALBERTA, CANADA	1940 20 01

E) Present address (apartment number, street number, street name, civic number (if applicable), city, province or state and country)	F) Date of death (if applicable) (Y M D)
235-7 Street, Peace River, Alberta, Canada	2011 06 02

G) Name and address of employer	H) Job title
None - Deceased	None - DECEASED

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

E IMMEDIATE RELATIVES (continued)

NOTE: Do not use initials

2	A) Full name (surname and all given names, including maiden name): SMITH, GAIL (no middle name)	B) Relationship: MOTHER
	C) City, province or state, and country of birth: EDMONTON, ALBERTA, CANADA	D) Date of birth (Y M D): 1941 06 01
	E) Present address (apartment number, street number, street name, civic number (if applicable), city, province or state and country): 235-7 Street, Peace River, Alberta, Canada	F) Date of death (if applicable) (Y M D):
	G) Name and address of employer: Safeway Canada, 213-7 Street, Peace River, Alberta, Canada	H) Job title: Cashier
3	A) Full name (surname and all given names, including maiden name): JONES, JORDAN DALE	B) Relationship: STEP-BROTHER
	C) City, province or state, and country of birth: CALGARY, Alberta, Canada	D) Date of birth (Y M D): 1982 01 07
	E) Present address (apartment number, street number, street name, civic number (if applicable), city, province or state and country): 27 Allan Place, Leduc, Alberta, Canada	F) Date of death (if applicable) (Y M D):
	G) Name and address of employer: UNEMPLOYED	H) Job title:
4	A) Full name (surname and all given names, including maiden name): JONES, Shelley Lynn (Callin)	B) Relationship: MOTHER-IN-LAW
	C) City, province or state, and country of birth: CALGARY, Alberta, Canada	D) Date of birth (Y M D): 1936 07 03
	E) Present address (apartment number, street number, street name, civic number (if applicable), city, province or state and country): 12 Jasper Place, Lamont, Alberta, Canada	F) Date of death (if applicable) (Y M D):
	G) Name and address of employer: Hill Electric, 23-2 Avenue, Lamont, Alberta, Canada	H) Job title: CLEANER
5	A) Full name (surname and all given names, including maiden name): JONES, James Kelly	B) Relationship: FATHER-IN-Law
	C) City, province or state, and country of birth: CALGARY, Alberta, Canada	D) Date of birth (Y M D): 1937 06 01
	E) Present address (apartment number, street number, street name, civic number (if applicable), city, province or state and country): 12 Jasper Place, Lamont, Alberta, Canada	F) Date of death (if applicable) (Y M D): 1999 07 01
	G) Name and address of employer: NONE - DECEASED	H) Job title: None - Deceased
6	A) Full name (surname and all given names, including maiden name): SCHNEIDER, KAREN GAIL	B) Relationship: DAUGHTER
	C) City, province or state, and country of birth: CALGARY, ALBERTA, CANADA	D) Date of birth (Y M D): 1978 02 01
	E) Present address (apartment number, street number, street name, civic number (if applicable), city, province or state and country): SW-4-3-12-W4, Lacombe, Alberta, Canada	F) Date of death (if applicable) (Y M D):
	G) Name and address of employer: ESSO, NE-12-4-36-54, Delburne, Alberta, Canada	H) Job title: OPERATOR
7	A) Full name (surname and all given names, including maiden name):	B) Relationship:
	C) City, province or state, and country of birth:	D) Date of birth (Y M D):
	E) Present address (apartment number, street number, street name, civic number (if applicable), city, province or state and country):	F) Date of death (if applicable) (Y M D):
	G) Name and address of employer:	H) Job title:

F 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

G FOR COMPLETION BY PERSONS BORN OUTSIDE CANADA OR BORN IN CANADA HOLDING DUAL CITIZENSHIP (see instructions)

1. Date of entry into Canada (Y M D):

2. Present citizenship:

3. If you are a naturalized Canadian, give the certificate number and date of issue (Y M D)

Certificate No. _____

4. If you are not naturalized, have you applied for Canadian citizenship? Please provide copy of Immigrant Visa or Record of Landing documentation ☐ Yes ☐ No

Date of application (Y M D):

5. Do you maintain citizenship of a country other than Canada? If yes, please provide the name of the country and explain why. ☐ Yes ☐ No

(If yes) Name of Country: _____

Explain:

6. Have you used a passport other than a Canadian one? If yes, explain why. ☐ Yes ☐ No

(If yes) Explain:

PROTECTED (When completed)

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

H RESIDENCE (there should be no gaps)

List addresses where you have lived during the last 10 years, starting with the most current. (Rural address to include lot and civic number.)

	Apartment number	Street number	Street name	Civic number (if applicable)	From (Y M)	To
1		1257	COOPER AVENUE		2011 01	present
	City: PEACE RIVER	Province or state: ALBERTA	Postal code: T8S 2X9	Country: CANADA	Telephone number: (780) 261-1493	
2			12-13-57-W2		2009 03	2011 01
	City: GRAND CACHE	Province or state: Alberta	Postal code: T0E 0Y3	Country: CANADA	Telephone number: (780) 234-2102	
3			1-87-18-W4		2007 01	2009 03
	City: SASKATOON	Province or state: SASKATCHEWAN	Postal code: S0G 3C0	Country: CANADA	Telephone number: (306) 231-7192	
4		20	HILL AVENUE		2004 01	2007 01
	City: CALGARY	Province or state: Alberta	Postal code: T0G 3C0	Country: CANADA	Telephone number: (403) 239-7186	
5		can't recall	unknown - can't recall		1999 09	2004 01
	City: Calgary	Province or state: Alberta	Postal code: T0G 3C0	Country: Canada	Telephone number: ( ) "unknown - cannot recall"	

I EMPLOYMENT (last 10 years) (see instructions for self-employed and consultants) (there should be no gaps)

Would your employment be jeopardized if your current supervisor, below, is contacted? ☐ Yes ☒ No

If yes, provide the name of an alternate employment contact and telephone number.

Were you dismissed or asked to resign from any position(s) as listed below? ☐ Yes ☒ No

If yes, give name of employer, supervisor, and date.

Name of employer	Supervisor	Position title	Date (Y M)

1	A) Name of employer - do not use initials (department/organization/agency, if applicable): ABC WELDING INCORPORATED	B) From (Y M): 2011 01	To: present
	C) Job-site address (street number, street name, city, province or state and country): 243-7 STREET, PEACE RIVER, ALBERTA, CANADA		
	D) Job title/Description: WELDER	E) Rank and service number (if applicable): NONE	
	F) Supervisor's name in full: GERALD MILLION	G) Supervisor's telephone number (cell): (780) 299-1257	
2	A) Name of employer - do not use initials (department/organization/agency, if applicable): Jim's WELDING	B) From (Y M): 2009 30	To (Y M): 2011 01
	C) Job-site address (street number, street name, city, province or state and country): 637-8 AVENUE, PEACE RIVER, ALBERTA, CANADA		
	D) Job title/Description: WELDER	E) Rank and service number (if applicable): NONE	
	F) Supervisor's name in full: KEVIN HARRIS	G) Supervisor's telephone number (cell): (780) 891-7624	
3	A) Name of employer - do not use initials (department/organization/agency, if applicable): UNEMPLOYED	B) From (Y M): 2007 01	To (Y M): 2009 30
	C) Job-site address (street number, street name, city, province or state and country):		
	D) Job title/Description:	E) Rank and service number (if applicable):	
	F) Supervisor's name in full:	G) Supervisor's telephone number: ( )	
4	A) Name of employer - do not use initials (department/organization/agency, if applicable): KARI'S WELDING	B) From (Y M): 2004 01	To (Y M): 2007 01
	C) Job-site address (street number, street name, city, province or state and country): SW-19-12-24-W4, REDDEER, ALBERTA, CANADA		
	D) Job title/Description: WELDER	E) Rank and service number (if applicable): NONE	
	F) Supervisor's name in full: CORY KARI	G) Supervisor's telephone number: (780) 863-2149	

see pg 2. →

Surname and full given names	Date of birth (Y M D)
SMITH, John (no middle name)	1 1 9 6 0 9 1 2 7

H RESIDENCE (there should be no gaps)

List addresses where you have lived during the last 10 years, starting with the most current. (Rural address to include lot and civic number.)

	Apartment number	Street number	Street name	Civic number (if applicable)	From (Y M)	To (Y M) / present
1						present
	City	Province or state	Postal code	Country	Telephone number ( )	
2						
	City	Province or state	Postal code	Country	Telephone number ( )	
3						
	City	Province or state	Postal code	Country	Telephone number ( )	
4						
	City	Province or state	Postal code	Country	Telephone number ( )	
5						
	City	Province or state	Postal code	Country	Telephone number ( )	

I EMPLOYMENT (last 10 years) (see instructions for self-employed and consultants) (there should be no gaps)

Would your employment be jeopardized if your current supervisor, below, is contacted? ☐ Yes ☐ No

If yes, provide the name of an alternate employment contact and telephone number.

Were you dismissed or asked to resign from any position(s) as listed below? ☐ Yes ☐ No

If yes, give name of employer, supervisor, and date.

Name of employer	Supervisor	Position title	Date (Y M)

(5)

A) Name of employer - do not use initials (department/organization/agency, if applicable): STUDENT

B) From: 1 9 9 9 0 2 To: 2004 01

C) Job-site address (street number, street name, city, province or state and country)

D) Job title/Description

E) Rank and service number (if applicable)

F) Supervisor's name in full

G) Supervisor's telephone number ( )

2

A) Name of employer - do not use initials (department/organization/agency, if applicable)

B) From: Y M To: Y M

C) Job-site address (street number, street name, city, province or state and country)

D) Job title/Description

E) Rank and service number (if applicable)

F) Supervisor's name in full

G) Supervisor's telephone number ( )

3

A) Name of employer - do not use initials (department/organization/agency, if applicable)

B) From: Y M To: Y M

C) Job-site address (street number, street name, city, province or state and country)

D) Job title/Description

E) Rank and service number (if applicable)

F) Supervisor's name in full

G) Supervisor's telephone number ( )

4

A) Name of employer - do not use initials (department/organization/agency, if applicable)

B) From: Y M To: Y M

C) Job-site address (street number, street name, city, province or state and country)

D) Job title/Description

E) Rank and service number (if applicable)

F) Supervisor's name in full

G) Supervisor's telephone number ( )

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

J FOREIGN EMPLOYMENT

1. Are you now or have you **ever** been employed by or acted as a consultant for a foreign government, firm, or agency?	If yes, give details (country, organization, nature of work and dates) Include military (cadets), law enforcement and security intelligence employment
☐ Yes ☒ No	

SECTIONS "K" TO "O" MUST ALSO BE COMPLETED FOR LEVEL III ONLY

K TRAVEL

List countries visited within the last five years for personal travel and/or non-Government business, other than Canada, the USA and Mexico.

Country	Purpose	From (Y M)	To (Y M)
"NONE"			

L FOREIGN ASSETS

Do you have any business, financial or personal assets outside Canada?	If yes, list the relevant countries (exclude stocks and mutual funds purchased in Canada)
☐ Yes ☒ No	

M CHARACTER REFERENCES IN CANADA (see instructions)

List three character references (non-family members) and one neighbourhood reference

1	Name in full (no initials): Allan NiKum	Relationship: FRIEND	Period known: 4 years
	Complete home address: SW-12-6-2-W4, MANNING, ALBERTA, CANADA		Telephone Number: (780) 236-1921
	Complete title and business address: WELDER, ABC WELDING, 243-7 Street, Peace River, Alberta, CANADA		Business Telephone Number: (780) 236-0012 *
2	Name in full (no initials): CORY Timothy	Relationship: COLLEAGUE	Period known: 6 years
	Complete home address: 17 ANGLE STREET, ORANGE, ALBERTA, CANADA		Telephone Number (cell): (780) 892-1343 *
	Complete title and business address: WELDER, ABC Welding, 19-3 Avenue, Manning, Alberta, Canada		Business Telephone Number: (780) 892-1691
3	Name in full (no initials): Dennis James	Relationship: FRIEND	Period known: 9 years
	Complete home address: 123-2 Avenue, MANNING, ALBERTA, CANADA		Telephone Number (cell): (780) 777-1992 *
	Complete title and business address: CONSULTANT, PEACE FINANCIAL, 2-3 Street, Manning, Alberta, Canada		Business Telephone Number: (780) 823-1111
Neighbourhood reference (see instructions)			
Name in full (no initials): BRIAN ANDERS			Telephone Number: (780) 236-1111 *
Complete home address: 1253 COOPER STREET, PEACE RIVER, ALBERTA, CANADA			Business Telephone Number: ( ) NONE

N EDUCATION

1. Name of the last school or university you attended full time	2. Student ID number (if known)	3. Location of institution	4. Period of attendance (Y M)
NAIT	UNKNOWN	EDMONTON, ALBERTA, CANADA	From 1978 09 To 1979 06

5. Field of study (Diploma or degree obtained): WELDING CERTIFICATE

O MILITARY SERVICE

Military service in the Canadian Armed Forces: Regular, Reserves and Sea, Army and Air Cadets (from the period since your 16th birthday).

1. Name and last location	2. Rank and Service no.	3. Period of service (Y M)
NONE		From To

P CERTIFICATION

I hereby certify that the information set out by me in this document is true and correct to the best of my knowledge and belief.

1. Signature	2. Date (Y M D)	3. Telephone (Home)	3. Telephone (Business)
John Smith	2011 11 20	(780) 261-1493	(780) 299-1111

ALL INFORMATION SUPPLIED IS SUBJECT TO VERIFICATION BY INVESTIGATION

Government of Canada / Gouvernement du Canada

INSTRUCTIONS FOR COMPLETION OF SECURITY CLEARANCE FORM TBS/SCT 330-60E (Rev. 2006-02)

General:

- Once completed this form shall be safeguarded and handled at the level of PROTECTED A.
- If clarification of information is required, a Canadian Government Official may contact the applicant to obtain additional information in order to complete the security screening investigation and an interview of the applicant may be requested.
- This form is to be completed using an automated system or if not available using a typewriter or printing in block letter format in black ink.
- Please read and follow these instructions carefully.
- The original signed copy must be submitted.
- It is important that a copy of the completed questionnaire be retained by the applicant for future reference.
- Incomplete or illegible forms will NOT be considered.
- All names are to be in full (no initials) (Maternal and Paternal or other names used).
- Addresses are to include, where applicable civic or township name and the lot and concession numbers.
- If information is not known or is unavailable please indicate this on the form and on a separate sheet of paper explain the cause of circumstance.
- All dates are to be entered in order of YEAR, MONTH, and DAY as applicable.
- If space allotted in any portion is insufficient please use separate sheet using same format. → photocopy applicable sheet + continue adding additional information (ensure name + date of birth are included on the top of each additional sheet.

Detailed Instructions:

SECTION A
- To be completed by the department, agency or organization.
- "Other" This should be used to identify if the security screening is for Site Access, NATO, SIGINT etc.

SECTION B (Remainder of the form is to be completed by the applicant)
- Complete as requested.

SECTION C
- Complete as requested.

SECTION D
"common-law partner" - in relation to an applicant, means a person who is cohabiting with the individual in a conjugal relationship, having so cohabited for a period of at least one year. This includes persons of the same sex.

- 1. includes current spouse and common-law partner as applicable.
- If any person is deceased, date of death and last address while living are to be shown.
- 2. includes previous spouse and common-law partner as applicable during the last five years.
- If a person is deceased, date of death is to be shown in 2e.
- All other questions to be answered as set forth.

SECTION E
- Questions 1 to 8 - experience has shown that incomplete answers to these questions are the most common cause of delay. Please follow the instructions carefully.
- For all security clearance requests all Immediate Relative(s) information must be provided.
- Immediate family includes the following:
- All children 18 years and over that you or your spouse or common-law partner have a parental relationship.
- Your father, mother, brothers, sisters. Include "half" or "step" relatives in this category.
- Your current spouse's or common-law partner's father and mother. Include "half" or "step" relatives in this category.

If any person is deceased, date of death and last address while living are to be shown.

SECTION F
- 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.

SECTION G
- If a naturalized Canadian, it is important to show the certificate number, date of issue. Attach a photocopy of the certificate.
- If born abroad of Canadian parents, please provide a copy of your Certificate of Registration of Birth Abroad.
- If not a Canadian Citizen indicate if application has been made for Citizenship. In this case, passport or identity card number and particulars should be recorded in box "6". Please provide copy of Immigrant Visa or Record of Landing documentation.
- Questions 5 and 6 - Attach a separate sheet of paper if more space is required. Each sheet must be signed.

SECTION H
- As set forth, ensuring current address is recorded first.
- The Postal code is mandatory for the current address, and if known, for previous addresses.
- For rural area, include civic number or lot, concession and township number. → SW-3-12-24-N4 ie.

SECTION I
- Record your present employment first.
- Please note that it may be necessary to contact your present employer.
- Time at school and periods of unemployment are also to be shown; (as well as, secondments, educational leave, and courses of over six months' duration; include supervisor or colleague's name).
- Job-site address is the address where your work is performed and may be different from your employer's address.

NOTE: If you are self-employed or a consultant, or have been self-employed or a consultant, provide the following:
a) Name of employer - give your business name; if not applicable, give your name;
b) No change;
c) Job-site address - give your permanent business address; if not applicable, give your residence address;
d) No change;
e) No change;
f) Supervisor's name - give a name of a person who can verify your employment;
g) No change.

SECTION J
- Is related to determining past employment of security concern. A security official may ask for further details.

SECTION K
- Travel record is for less than six months, if more than this period it is to be recorded as residence in part "H".
- One day visits to countries, such as cruise stopover, do not have to be recorded.
- A security official may ask for details of travel.
- An employee or contractor on Canadian Government business is not required to record details of travel in this section.

SECTION L
- A security official may ask for details in terms of the type of assets and estimated value.

SECTION M
- Character references must be colleagues, peers, and friends who have known you well for over three years and should be able to cover your non-work environment and activities.
- Character references are NOT to include relatives and MUST be residing in Canada.
- Faster processing is facilitated if references listed are in your geographic area.
- Neighbourhood reference is an individual who has known you for over six months preferably at your current address. If not, the individual has been a neighbour during the past five years.

SECTION N
- Complete as requested.

SECTION O
- Question to be answered if not covered in employment section. List last or current unit and dates of total service in the Canadian Armed Forces.
- If more space is required use a separate sheet of paper. Each sheet must be signed.

SECTION P
- Complete as requested.

SUPPLEMENTAL INFORMATION REQUIREMENTS
Persons who have previously completed a SECURITY CLEARANCE and subsequently marry, remarry or commence a common-law partnership are required to submit an original Security Clearance Form with the following parts completed:

For all Security Clearances

Part A - As set forth in each question
Part B - As set forth in each question
Part C - As set forth in each question
Part D - As set forth in each question
Part E - Provide details on parents of new spouse/common-law partner and any children (over the age of 18 years) of the new spouse/common-law partner
Part P - To be signed by person submitting the form

Note: In addition to the above, in those cases where an individual marries or commences a common-law partnership with a Non-Canadian National or Landed Immigrant who has not yet arrived in Canada, the following information is required:

Parts A-D As set forth in each question
Part E - Parents of new spouse/common-law partner, brothers, sisters (include "half and "step" relatives) and any children (over the age of 18 years) of the new spouse/common-law partner
Part H - For new spouse/common-law partnership
Part I - For new spouse/common-law partnership
Part P - To be signed by person submitting the form

CYCLICAL UPDATE REQUIREMENTS
- Levels I+II (10 year update). Complete all portions of the form as per instructions above.
- Level III (5 year update cycle)

With the exceptions of Parts H and I, where the information required is that which covers the period of time since the last submission of a questionnaire, **ALL OTHER** parts of the questionnaire must be completed **IN FULL**.

* Please ensure you review "Additional Instruction" sheet for Form TBS 330-23E

Canada

Royal Canadian Mounted Police / Gendarmerie royale du Canada

PROTECTED B
when completed
PIB CMP PPU 065

SECURITY/RELIABILITY INTERVIEW PRE-INTERVIEW QUESTIONNAIRE

- The Pre-Interview Security/Reliability Questionnaire and the Security/Reliability Interview are both integral parts of the RCMP recruiting and security process. They, and the subsequent field investigation, are used to assist in determining suitability and reliability and contribute to the security screening assessment of individuals who seek employment as a member, employee or volunteer of the RCMP or under a contract awarded to, or administered by, the RCMP. Verifications to issue security clearances are carried out to assess an individual's loyalty and reliability as it relates to loyalty. Reliability checks are done to assess an individual's reliability. This is being done in accordance to the Policy on Government Security (PGS) which became effective July 1, 2009.
- You are required to fill the Pre-Interview Questionnaire and return it to the RCMP Human Resources Section when completed. You will soon be contacted to meet with an interviewer to complete the Security/ Reliability Interview.
- Please carefully read and follow the instructions below.

Instruction for the Applicant

- The Pre-Interview Questionnaire (Form 1020-1) is available in both official languages. You may complete the Pre-Interview Questionnaire in the language of your choice.
- Your decision to complete the Pre-Interview Questionnaire and the subsequent Security/Reliability Interview must be voluntary and be based on your desire to pursue employment with, or at, the RCMP.
- You should answer the questions contained in the Pre-Interview Questionnaire accurately, completely, thoroughly and honestly to the best of your knowledge and belief. You should answer the questions contained in the Pre-Interview Questionnaire on your own without the assistance of third parties (e.g. family or friends), considering the personal and sensitive nature of the information provided. You may withdraw from the process at any time or refuse to provide answers to any or all of the questions contained in the Pre-Interview Questionnaire. You should, however, be advised that an incomplete Pre-Interview Questionnaire may result in your disqualification from the employment process.
- You are not required to provide any information in the Pre-Interview Questionnaire that relates to a conviction for which a pardon has been received, or a matter that was processed pursuant to the *Young Offenders Act (R.S.C. 1985, c. Y-1, now repealed)* or the *Youth Criminal Justice Act (S.C. 2002, c. 1).*
- You are under no obligation to provide information about third parties, (e.g. individuals other than yourself), in the Pre-Interview Questionnaire.
- You are under no obligation to disclose any information regarding a crime where you were a victim or complainant.
- You should be aware that, in the event of significant discrepancy between the information you provide in this Pre-Interview Questionnaire and in the context of the Security/Reliability Interview, and the information that surfaces from the RCMP's background investigation, you may be asked to undergo a second interview to explain adverse information.

- Deceit, dishonesty or non-disclosure in answer to questions contained in the Pre-Interview Questionnaire are likely to result in your disqualification from the employment process.
- Should you apply for any other employment with, or at, the RCMP within the next five (5) years, the information provided in this Pre-Interview Questionnaire may be used to reassess your suitability and reliability and for security screening purposes. This may result in your disqualification from the employment process.
- If you are currently employed by, or working at, the RCMP, you should be advised that the information provided in this Pre-Interview Questionnaire may be used in reassessing your suitability and reliability, and in carrying out the security screening process. This may result in your disqualification from the employment process in question. This may also lead, where applicable, to a review for cause and possible revocation of an existing clearance or reliability status, and consequently the dismissal from your current employment with the RCMP.

Notices regarding prior serious criminal offences and serious risk to yourself or the safety of others.

- The information you provide on the Questionnaire and during the Security/Reliability Interview process is collected and used by the RCMP for the purposes of an employment application and security screening. However, if you admit to having committed a serious undetected criminal offence, or are deemed to pose a serious risk to yourself or to the safety of others, the RCMP may disclose information to entities with lawful authority to collect such information (e.g. police of jurisdiction or child protection agencies) for a law enforcement or public safety purpose. While cases of such disclosure are rare and exceptional, the RCMP strongly discourages you from completing the Pre-Interview Questionnaire or attending the Security/ Reliability Interview if you believe this Notice applies to you.

Examples of serious criminal offences include, but are not limited to:
- murder;
- sexual assault;
- child pornography: accessing, possession, distribution, or the making of;
- any crime involving children;
- arson resulting in loss of life or substantial damage;
- forcible confinement;
- robbery;
- crime committed with a facial covering and/or a weapon.

Should you be uncertain if this applies to you, you should consult a lawyer to obtain independent legal advice.

- If you nonetheless chose to pursue the process and admit, on the Pre-Interview Questionnaire or in the context of the Security/Reliability Interview, to having committed one or a number of serious criminal offence(s), be advised that the information may be disclosed to entities with lawful authority to collect such information (e.g. police of jurisdiction or child protection agencies).
- If, in light of the information provided on the Pre-Interview Questionnaire or in the context of the Security / Reliability Interview, you are deemed to pose a serious threat to yourself or to the safety of others, be advised that the information may be disclosed to the entities with lawful authority to collect such information (police of jurisdiction or child protection agencies).
- You are also advised that such disclosures could lead to incident reports being entered into police databases, which could impact future employment or volunteering opportunities, or other activities that require security screening (e.g. employment with schools, banks, etc.).
- You are further advised that such disclosures could also lead to an investigation, arrest, charge(s), criminal prosecution, conviction, and, ultimately, the imposition of a sentence.

Notice regarding the collection and use of personal information by the RCMP

- The RCMP is collecting, on a voluntary basis, the personal information you provide on the Pre-Interview Questionnaire and in the context of the Security/Reliability Interview to assist in determining your suitability and reliability and for security screening purposes. The information requested is essential for making these determinations and, should it not be provided, may result in your disqualification and/or our inability to proceed with the employment process.
- The information is collected under the authority of the *Royal Canadian Mounted Police Act, R.S.C.1985, c. R-10* and the *Financial Administration Act, R.S.C. 1985, c. F-11.* It is protected and managed in conformity with the provisions of the *Privacy Act, R.S.C. 1985, c. P-21* and the *Privacy Regulations, SOR/83-508.*
- The information collected will be stored by the RCMP in Personal Information Bank CMP PPU 065 and be disclosed in conformity with the *Privacy Act.* Under this Act, you have the right to the protection of, access to and correction of your personal information. More details regarding the collection and use of personal information can be found at www.infosource.gc.ca .

Royal Canadian Mounted Police / Gendarmerie royale du Canada

PROTECTED B when completed
PIB CMP PPU 065

SECURITY/RELIABILITY INTERVIEW PRE-INTERVIEW QUESTIONNAIRE

Office use only	
HRMIS number	File number

Declaration, Acknowledgement, and Consent

Name of applicant	Telephone number

Mailing address

	Applicant's initials
I, the undersigned, have read and understand the previous pages of instruction and notices.	
I am completing this Pre-Interview Questionnaire voluntarily, based on my desire to volunteer, pursue work as a member or employee of the RCMP or under a contract awarded to, or administered by, the RCMP.	
I declare that the information provided in this Pre-Interview Questionnaire is up-to-date, accurate, complete and honest to the best of my knowledge and belief.	
I understand that the consequences of my not being completely honest and forthright in this Pre-Interview Questionnaire could result in me no longer being considered for employment with, or at, the RCMP.	
I understand that I do not have to include any information in this Pre-Interview Questionnaire that relates to a conviction for which a pardon has been received, or a matter that was processed pursuant to the *Young Offenders Act* or the *Youth Criminal Justice Act*.	
I understand that the information provided in this Pre-Interview Questionnaire may affect my opportunities for any other employment with, or at, the RCMP within the next five (5) years, or, where applicable, may affect my current security clearance and employment with, or at, the RCMP.	
I understand that, if I admit to having committed one or more serious undetected criminal offence(s) in this Pre-Interview Questionnaire, actions could be taken, which could lead, ultimately to the imposition of a sentence.	
I understand that, if in light of the answers provided in the Pre-Interview Questionnaire, I am deemed to pose a serious risk to myself or to the safety of others, actions could be taken, which could lead, ultimately to the imposition of a sentence.	
I understand that, in the event of significant discrepancy between the information I provide in this Pre-Interview Questionnaire and in the context of the Security/Reliability Interview and information that surfaces from the RCMP's background investigation, I may be asked to undergo a second interview to explain adverse information for verification and confirmation purposes.	
I declare that I will not divulge the contents and format of this Pre-Interview Questionnaire and of the Security/Reliability Interview to anyone.	
I consent to my personal information being collected, used and disclosed for the purposes identified above.	
I consent to my personal information being used for security screening purposes pursuant to the Treasury Board's Policy on *Government Security*.	

Signature of applicant _____ Date _____

SECURITY/RELIABILITY INTERVIEW
PRE-INTERVIEW QUESTIONNAIRE

PROTECTED B when completed
PIB CMP PPU 065

Please complete the following information and return.This questionnaire will form part of your Security/Reliability Interview that will be completed.

Office use only	
HRMIS number	File number

Name of applicant	Telephone number

1. List the names of everyone of 18 years old or more you have lived with at each of your addresses over the past ten years? (except people who were just visiting for a few days)

2. Do you have any family* or friends** living outside Canada?

☐ Yes If yes, list their names below ☐ No

* Family refers to spouse/cohabitant, parents and/or guardians, spouse's/cohabitant's parents and/or guardians, children, brothers and sisters (including step and half relative).

** Friend refers to persons with whom the interviewee have associated (e.g., person seen frequently) over the last five years, excluding relatives, former employers, supervisors.

SECURITY/RELIABILITY INTERVIEW
PRE-INTERVIEW QUESTIONNAIRE

PROTECTED B when completed
PIB CMP PPU 065

Office use only	
HRMIS number	File number

Name of applicant	Telephone number

3. List the names of your closest friends and associates* and describe your relationship with them (include name, address, relationship and age).

4. List all clubs, organizations, or associations that you belong to or have belonged to or that you have contributed financially or otherwise supported.

* Associate refers to a person who joins with others in some activity and/or keep company with, hang out with.

SECURITY/RELIABILITY INTERVIEW
PRE-INTERVIEW QUESTIONNAIRE

PROTECTED B when completed
PIB CMP PPU 065

Office use only	
HRMIS number	File number

Name of applicant	Telephone number

5. Have you in the past five years traveled outside of Canada, including USA?

☐ No ☐ Yes, complete this section

Bring your passport(s) to the interview for verification and confirmation purposes.

Countries visited	Approx. date (yyyy-mm)	Duration	Reasons	Contact with government officials or police? Difficulties or unusual incidents? (If yes, please specify)

Office use only	
HRMIS number	File number

Name of applicant	Telephone number

6. Financial assessment

Your relationship with money may have an impact in obtaining either, a reliability status, a security clearance and/or site/facilities access. Please answer the following questions and be prepared to explain them to the interviewer.

A - Does your financial situation cause you any stress? If so, what level of stress do you feel: low, medium or high and why?

B - What is your ratio of debt versus income?

C - How has this changed over the past five years, if at all?

D - How do you expect your financial situation to evolve over the next 5 years?

E - If you are not satisfied with your finances, what are you doing to improve your situation?

SECURITY/RELIABILITY INTERVIEW
PRE-INTERVIEW QUESTIONNAIRE

PROTECTED B when completed
PIB CMP PPU 065

Office use only	
HRMIS number	File number

Name of applicant	Telephone number

7. Have any members of your immediate family, close friends or associates been involved (to your knowledge) in criminal activity, meaning been suspected, charged or convicted of any criminal offences? This involvement should not be limited to the following offences (assault, domestic violence, theft, fraud, shoplifting, drug offenses, hack into a computer, drinking and driving, hunting without a permit.)

☐ No ☐ Yes, complete this section.

i)	Name of individual		Date of birth (yyyy-mm-dd)
	Home address	Involvement/Activity	
ii)	Name of individual		Date of birth (yyyy-mm-dd)
	Home address	Involvement/Activity	
iii)	Name of individual		Date of birth (yyyy-mm-dd)
	Home address	Involvement/Activity	
iv)	Name of individual		Date of birth (yyyy-mm-dd)
	Home address	Involvement/Activity	
v)	Name of individual		Date of birth (yyyy-mm-dd)
	Home address	Involvement/Activity	

Analyst/Interviewer/Risk manager comments/notes
(For office use only)

SECURITY/RELIABILITY INTERVIEW
PRE-INTERVIEW QUESTIONNAIRE

PROTECTED B when completed
PIB CMP PPU 065

Office use only	
HRMIS number	File number

Name of applicant	Telephone number

8. Have you ever used or experimented with any illegal drugs and/or have you abused any pharmaceutical (prescription) drugs in the past five years?

☐ No

☐ Yes, please provide the requested information for each drug and/or prescription drugs and explain circumstances of use below.

Drug	Method and frequency of use	Approximate dates of use (first time, last time)	Circumstances/ Motives for use	Means to obtain drugs	Financial outlay (How much do/did you spend on drugs on a monthly basis?)

Analyst/Interviewer/Risk manager comments/notes
(For office use only)

SECURITY/RELIABILITY INTERVIEW
PRE-INTERVIEW QUESTIONNAIRE

PROTECTED B when completed
PIB CMP PPU 065

Office use only	
HRMIS number	File number

Name of applicant

Telephone number

9. Please provide your current e-mail address(es) and briefly describe your on-line activities (e.g. social networking such as Facebook, Twitter, Myspace).

10. Declaration

I, undersigned, hereby declare that the information I have provided in this Security/Reliability Interview - Pre-Interview Questionnaire is up to date, accurate, complete and honest, to the best of my knowledge and belief.

Signature of applicant

Date

Part 1 General

1.1 ADMINISTRATIVE

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

.2 Provide physical space and make arrangements for meetings.

.3 The Consultant shall chair meetings.

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

1.2 PRECONSTRUCTION MEETING

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

.2 Agenda to include:

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

1.3 PROGRESS MEETINGS

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

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

.3 Minutes of meetings will be recorded by the Consultant. Minutes will be distributed within 72 hours.

.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 affect 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 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.

END OF SECTION

1.1 ADMINISTRATIVE

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

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

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

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

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

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

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

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

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

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

1.2 SHOP DRAWINGS AND PRODUCT DATA

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

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

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

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

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

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

.7 Accompany submissions with transmittal letter, containing:

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

.8 Submissions include:

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

.17 Delete information not applicable to project.

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

.19 If upon review by Departmental Representative, no errors or omissions are discovered or if only minor corrections are made, copies will be returned and fabrication and installation of Work may proceed. If shop drawings are rejected, noted copy will be returned and resubmission of corrected shop drawings, through same procedure indicated above, must be performed before fabrication and installation of Work may proceed.

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

.1 This review shall not mean that Departmental Represenetaive approves detail design inherent in shop drawings, responsibility for which shall remain with Contractor submitting same, and such review shall not relieve Contractor of responsibility for errors or omissions in shop drawings or of responsibility for meeting requirements of construction and Contract Documents.

.2 Without restricting generality of foregoing, Contractor is responsible for dimensions to be confirmed and correlated at job site, for information that

pertains solely to fabrication processes or to techniques of construction and installation and for co-ordination of Work of sub-trades.

.21 Electronic submission of Shop Drawings

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

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

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

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

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

1.3 SAMPLES

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

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

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

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

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

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

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

1.4 MOCK-UPS

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

END OF SECTION

Part 1 General

1.1 SITE PROTECTION

.1 Prevent damage to all existing items which are to remain (e.g. fencing, signs, trees, shrubs, turf, natural features, buildings, asphalt, surface or underground utility lines). Make good any damage.

.2 Preserve and protect existing benchmarks and survey monuments. Inform Consultant immediately if benchmarks or survey monuments are encountered during construction. Make good any damage.

1.2 FINES AND PENALTIES

.1 Abuse to any plant material or unauthorized pruning or removal, in whole or in part, of plant material is not permitted.

.2 Be responsible to monitor all sub-trades for plant material abuse. Restitution for all damages found will be solely upon the Contractor.

.3 A fine for not less than plant material repair or replacement costs plus for loss of aesthetic or intrinsic value per individual plant, will be levied. The decision of the Consultant in determination of damage will be final.

1.3 FIRES

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

1.4 DISPOSAL OF WASTES

.1 Burying of rubbish and waste materials on site is not permitted.

.2 Disposal of waste, or volatile materials such as mineral, spirits, oil or paint thinner, into waterways, storm or sanitary sewers prohibited.

.3 Remove rubbish, waste products and debris in accordance with regulations of authorities having jurisdiction.

1.5 CARE OF EXISTING PLANT MATERIAL

.1 Use all means necessary to protect plant materials before start up and during construction.

.2 Do not disturb the existing grade or store heavy equipment within the drip line of existing trees. If access is required within the drip line of existing trees, then protect the access route with a moveable timber bridge to cushion/spread weight of vehicles over a greater surface area. Consultant to approve access route and timber bridge construction before work begins.

.3 Protection of branches that are interfering with construction: All branches that pose temporary interference to the process of construction, are to be tied up or back under the supervision of the Consultant. Bindings thus provided will be removed as soon as feasible by the completion of construction (or phase of construction) to reduce possible water sprouting or structural damage.

.4 Pruning trees that are interfering with construction: Remove interfering branches, without injury to trunks only when directed by the Consultant. The Consultant will determine all trees which require pruning, the extent of pruning allowed, and will identify the amount of compensatory pruning required for loss of roots or tops. The Contractor will adhere to limitations of on-site construction movement around identified trees.

.5 Monitor condition of trees, in particular, possible wind damage or snow load damage to branches that are tied up.

.6 Wash foliage should excessive construction dust build up on plant material.

1.6 TRAFFIC PROVISIONS AND STORAGE

.1 Determine interference of trees and their root zones before moving equipment or supplies on site to avoid any damage to trees.

.2 Traffic provisions:

.1 Use only approved access routes for vehicular and heavy pedestrian movement.

.3 Parking areas shall be pre-designated at each construction site.

.1 Contractor responsible to provide soil aeration of compacted tree root areas through holes bored into the soil at the direction of the Consultant.

.4 Storage:

.1 Store construction materials, fuels, chemicals, etc., in approved areas only.

.2 Store equipment, soil, building materials and debris beyond the drip-line of trees.

1.7 EXCAVATING ADJACENT TO EXISTING TREES

.1 Locate and stake locations of electric service utility lines, and other underground construction.

.2 Excavations within 2.0 metres of trees will be permitted only with prior approval of the Consultant. Prior to excavating, all tree roots along the side to be exposed must be severed with a trencher to a depth of 500mm along the line of excavation. Prune all exposed roots with a sharp pruning tool, in order to provide a clean severance of roots.

.3 Excavations beyond two (2) metres from trees do not require trenching. Immediately after excavation, prune all exposed roots with a sharp pruning tool, in order to provide a clean severance of roots. Place a tarp over excavation wall to prevent exposed roots from drying out. Backfill around tree roots as soon as possible.

1.8 HERBICIDES / PESTICIDES

.1 Use only with approval of Consultant and Owner and in strict accordance with applicable regulations and manufacturer’s instructions.

END OF SECTION

Part 1 General

1.1 REFERENCES

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

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

.1 Material Safety Data Sheets (MSDS).

.3 Province of Saskatchewan

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

1.2 SUBMITTALS

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

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

.1 Results of site specific safety hazard assessment.

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

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

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

.5 Submit copies of incident and accident reports.

.6 Submit WHMIS MSDS - Material Safety Data Sheets in accordance with Section 01 33 00 - Submittal Requirements.

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

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

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

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

1.3 FILING OF NOTICE

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

1.4 SAFETY ASSESSMENT

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

1.5 MEETINGS

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

1.6 REGULATORY REQUIREMENTS

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

1.7 GENERAL REQUIREMENTS

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

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

1.8 RESPONSIBILITY

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

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

1.9 COMPLIANCE REQUIREMENTS

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

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

1.10 UNFORSEEN HAZARDS

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

1.11 HEALTH AND SAFETY CO-ORDINATOR

.1 Employ and assign to Work, competent and authorized representative as Health and Safety Co-ordinator. Health and Safety Co-ordinator must:

.1 Have site-related working experience specific to activities associated with overhead work.

.2 Have working knowledge of occupational safety and health regulations.

.3 Be responsible for completing Contractor's Health and Safety Training Sessions and ensuring that personnel not successfully completing required training are not permitted to enter site to perform Work.

.4 Be responsible for implementing, enforcing daily and monitoring site-specific Contractor's Health and Safety Plan.

.5 Be on site during execution of Work .

1.12 POSTING OF DOCUMENTS

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

1.13 CORRECTION OF NON-COMPLIANCE

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

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

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

1.14 BLASTING

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

1.15 WORK STOPPAGE

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

END OF SECTION

Part 1 General

1.1 REFERENCES AND CODES

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

.2 Meet or exceed requirements of:

.1 Contract documents.

.2 Specified standards, codes and referenced documents.

1.2 BUILDING SMOKING ENVIRONMENT

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

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

END OF SECTION

Part 1 General

1.1 INSPECTION

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

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

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

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

1.2 ACCESS TO WORK

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

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

1.3 PROCEDURES

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

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

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

1.4 REJECTED WORK

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

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

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

1.5 REPORTS

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

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

1.6 TESTS AND MIX DESIGNS

.1 Furnish test results and mix designs as requested.

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

1.7 MOCK-UPS

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

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

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

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

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

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

END OF SECTION

Part 1 General

1.1 SUBMITTALS

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

1.2 INSTALLATION AND REMOVAL

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

.2 Remove from site all such work after use.

1.3 TEMPORARY HEATING AND VENTILATION

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

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

.3 Permanent heating system of building may be used when available. Obtain written approval from Departmental Representative prior to using equipment. Be responsible for damage to heating system if use is permitted.

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

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

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

.7 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.

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

1.4 TEMPORARY POWER AND LIGHT

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

1.5 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.

1.6 FIRE PROTECTION

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

END OF SECTION

Part 1 General

1.1 REFERENCES

.1 Canadian Standards Association (CSA International)

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

1.2 SUBMITTALS

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

1.3 INSTALLATION AND REMOVAL

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

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

.3 Indicate use of supplemental or other staging area.

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

.5 Remove from site all such work after use.

1.4 SCAFFOLDING

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

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

1.5 HOISTING

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

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

.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 CONSTRUCTION PARKING

.1 Parking will be permitted on site.

.2 Provide and maintain adequate access to project site.

1.8 OFFICES

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

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

1.9 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.

1.10 SANITARY FACILITIES

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

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

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

1.11 CONSTRUCTION SIGNAGE

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

1.12 PROTECTION AND MAINTENANCE OF TRAFFIC AND PEDESTRIANS

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

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

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

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

.5 Contractor's traffic on roads selected for hauling material shall not interfere with on-going training on site.

.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.

1.13 CLEAN-UP

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

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

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

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

END OF SECTION

Part 1 General

1.1 INSTALLATION AND REMOVAL

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

.2 Remove from site all such work after use.

1.2 GUARD RAILS, BARRICADES, AND SIGNAGE

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

.2 Provide Construction Zone warning and access control signage.

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

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

1.4 WEATHER ENCLOSURES

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

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

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

1.5 DUST TIGHT SCREENS

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

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

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

1.6 ACCESS TO SITE

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

1.7 PUBLIC TRAFFIC FLOW

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

1.8 FIRE ROUTES

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

1.9 PROTECTION FOR OFF-SITE AND PUBLIC PROPERTY

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

.2 Be responsible for damage incurred.

1.10 PROTECTION OF BUILDING FINISHES

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

.2 Provide necessary screens, covers, and hoardings.

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

1.11 WASTE MANAGEMENT AND DISPOSAL

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

END OF SECTION

Part 1 General

1.1 REFERENCES

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

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

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

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

1.2 QUALITY

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

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

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

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

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

1.3 AVAILABILITY

.1 Immediately upon signing Contract, review product delivery requirements and anticipate foreseeable supply delays for items. If delays in supply of products are foreseeable, notify Consultant 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 Consultant at commencement of Work and should it subsequently appear that Work may be delayed for such reason, Consultant 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, 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 in specifications, install or erect products in accordance with manufacturer's instructions. Do not rely on labels or enclosures provided with products. Obtain written instructions directly from manufacturers.

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

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

1.7 QUALITY OF WORK

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

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

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

1.8 CO-ORDINATION

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

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

1.9 CONCEALMENT

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

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

1.10 REMEDIAL WORK

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

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

1.11 LOCATION OF FIXTURES

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

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

1.12 FASTENINGS

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

.2 Prevent electrolytic action between dissimilar metals and materials.

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

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

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

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

1.13 FASTENINGS - EQUIPMENT

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

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

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

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

1.14 PROTECTION OF WORK IN PROGRESS

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

1.15 EXISTING UTILITIES

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

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

END OF SECTION

Part 1 General

1.1 QUALIFICATIONS OF SURVEYOR

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

1.2 SURVEY REFERENCE POINTS

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

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

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

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

1.3 SURVEY REQUIREMENTS

.1 Existing base horizontal and vertical control points are designated on drawings.

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

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

.4 Stake for grading, fill and top soil placement and landscaping features.

.5 Stake slopes and berms.

.6 Establish pipe invert elevations.

.7 Stake batter boards for foundations.

.8 Establish foundation column locations and floor elevations.

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

1.4 EXISTING SERVICES

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

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

1.5 LOCATION OF EQUIPMENT AND FIXTURES

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

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

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

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

1.6 RECORDS

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

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

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

1.7 ACTION AND INFORMATIONAL SUBMITTALS

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

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

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

END OF SECTION

Part 1 General

1.1 SUBMITTALS

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

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

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

.3 Include in request:

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

1.2 FORMS

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

1.3 MATERIALS

.1 Required for original installation.

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

1.4 PREPARATION

.1 Inspect existing conditions, including elements subject to damage or movement during cutting and patching.

.2 After uncovering, inspect conditions affecting performance of Work.

.3 Beginning of cutting or patching means acceptance of existing conditions.

.4 Provide supports to assure structural integrity of surroundings; provide devices and methods to protect other portions of project from damage.

.5 Provide protection from elements for areas which are to be exposed by uncovering work; maintain excavations free of water.

1.5 EXECUTION

.1 Execute cutting, fitting, and patching including excavation and fill, to complete Work.

.2 Fit several parts together, to integrate with other Work.

.3 Uncover Work to install ill-timed Work.

.4 Remove and replace defective and non-conforming Work.

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

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

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

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

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

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

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

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

.13 Conceal pipes, ducts and wiring in floor, wall and ceiling construction of finished areas except where indicated otherwise. Coordinate Work with mechanical and electrical divisions.

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. Do not burn waste materials on site.

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

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

.5 Dispose of waste materials and debris off site.

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

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

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

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

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

1.2 FINAL CLEANING

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

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

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

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

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

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

END OF SECTION

Part 1 General

1.1 WASTE MATERIAL STORAGE

.1 Provide on-site facilities for collection, handling, and storage of anticipated quantities of waste materials.

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

1.2 DISPOSAL OF WASTES

.1 Do not bury rubbish or waste materials.

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

1.3 USE OF SITE AND FACILITIES

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

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

.3 Burning of waste on site is not permitted.

1.4 SCHEDULING

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

1.5 APPLICATION

.1 Handle waste materials in accordance with appropriate regulations and codes.

1.6 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.

END OF SECTION

Part 1 General

1.1 INSPECTION AND DECLARATION

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

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

.2 Request Departmental Representative Inspection.

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

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

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

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

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

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

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

.6 Commissioning of systems is complete and commissioning forms have been completed.

.7 Work is complete and ready for final inspection.

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

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

1.2 CLEANING

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

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

END OF SECTION

Part 1 General

1.1 SUBMITTALS

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

.2 Refer to Mechanical and Electrical Divisions for information specific to the mechanical and electrical close-out submittals.

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

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

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

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

.7 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.

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

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

.10 Pay costs of transportation.

1.2 FORMAT

.1 Organize data as instructional manual.

.2 Provide four (4) bound copies including 1 PDF copy on DVD or CD in each of the manuals.

.3 Provide two (2) additional PDF copies on DVD or CD.

.4 Binders: cloth, hard covered, expandable, loose leaf paper size 219 x 279 mm. Colour “black.” Provide four (4) copies.

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

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

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

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

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

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

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

1.3 CONTENTS - EACH VOLUME

.1 Table of Contents: provide title of project;

.1 Date of submission; names.

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

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

.2 For each product or system:

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

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

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

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

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

1.4 AS-BUILTS AND SAMPLES

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

.1 Contract Drawings.

.2 Specifications.

.3 Addenda.

.4 Change Orders and other modifications to Contract.

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

.6 Field test records.

.7 Inspection certificates.

.8 Manufacturer's certificates.

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

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

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

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

1.5 RECORDING ACTUAL SITE CONDITIONS

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

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

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

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

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

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

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

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

.7 Refer to Mechanical and Electrical Divisions for information specific to the mechanical and electrical close-out submittals.

1.6 EQUIPMENT AND SYSTEMS

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

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

.3 Include installed colour coded wiring diagrams.

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

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

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

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

.8 Include sequence of operation by controls manufacturer.

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

.10 Provide installed control diagrams by controls manufacturer.

.11 Provide Contractor's co-ordination drawings, with installed colour coded piping diagrams.

.12 Provide charts of valve tag numbers, with location and function of each valve, keyed to flow and control diagrams.

.13 Provide list of original manufacturer's spare parts, current prices, and recommended quantities to be maintained in storage.

.14 Include test and balancing reports as specified in Section 01 45 00 - Quality Control.

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

1.7 MATERIALS AND FINISHES

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

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

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

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

1.8 SPARE PARTS

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

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

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

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

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

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

1.9 MAINTENANCE MATERIALS

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

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

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

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

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

1.10 SPECIAL TOOLS

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

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

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

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

1.11 STORAGE, HANDLING AND PROTECTION

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

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

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

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

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

1.12 WARRANTIES AND BONDS

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

.2 Assemble approved information in binder and submit upon acceptance of work. Organize binder as follows:

.1 Separate each warranty or bond with index tab sheets keyed to Table of Contents listing.

.2 List subcontractor, supplier, and manufacturer, with name, address, and telephone number of responsible principal.

.3 Obtain warranties and bonds, executed in duplicate by subcontractors, suppliers, and manufacturers, within ten days after completion of applicable item of work.

.4 Verify that documents are in proper form, contain full information, and are notarized.

.5 Co-execute submittals when required.

.6 Retain warranties and bonds until time specified for submittal.

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

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

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

1.13 PRE-WARRANTY CONFERENCE

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

.2 Departmental Representative will establish communication procedures for:

.1 Notification of construction warranty defects.

.2 Determine priorities for type of defect.

.3 Determine reasonable time for response.

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

.4 Ensure contact is located within local service area of warranted construction, is continuously available, and is responsive to inquiries for warranty work action.

END OF SECTION

Part 1 General

1.1 SUMMARY

.1 Section Includes:

.1 This Section specifies roles and responsibilities of Training.

1.2 TRAINEES

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

.2 Trainees will be available for training for purposes of familiarization with systems.

1.3 INSTRUCTORS

.1 Consultant will provide:

.1 Descriptions of systems.

.2 Instruction on design philosophy, design criteria, and design intent.

.2 Contractor and certified factory-trained manufacturers' personnel: to provide instruction on the following:

.1 Start-Up, operation, shut-down of equipment, components and systems.

.2 Control features, reasons for, results of, implications on associated systems of, adjustment of set points of control and safety devices.

.3 Instructions on servicing, maintenance and adjustment of systems, equipment and components.

.3 Contractor and equipment manufacturer to provide instruction on:

.1 Start-up, operation, maintenance and shut-down of equipment they have certified installation, started up and carried out PV tests.

1.4 TRAINING OBJECTIVES

.1 Training to be detailed and duration to ensure:

.1 Safe, reliable, cost-effective, energy-efficient operation of systems in normal and emergency modes under all conditions.

.2 Effective on-going inspection, measurements of system performance.

.3 Proper preventive maintenance, diagnosis and trouble-shooting.

.4 Ability to update documentation.

.5 Ability to operate equipment and systems under emergency conditions until appropriate qualified assistance arrives.

1.5 TRAINING MATERIALS

.1 Instructors to be responsible for content and quality.

.2 Training materials to include:

.1 "As-Built" Contract Documents.

.2 Operating & Maintenance Manual.

.3 TAB and PV Reports.

.3 Departmental Representative will review training manuals.

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

.5 Supplement training materials:

.1 Transparencies for overhead projectors.

.2 Multimedia presentations.

.3 Manufacturer's training videos.

.4 Equipment models.

1.6 SCHEDULING

.1 Include in Commissioning Schedule time for training.

.2 Deliver training during regular working hours, training sessions to be for duration specified in relevant Specification Sections.

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

1.7 RESPONSIBILITIES

.1 Be responsible for:

.1 Implementation of training activities,

.2 Coordination among instructors,

.3 Quality of training, training materials,

.2 Departmental Representative will evaluate training and materials.

.3 Upon completion of training, provide written report, signed by Instructors, with complete list of attendees, and witnessed by Consultant and Cx Authority.

.4 Coordination with Departmental Representative.

1.8 TRAINING CONTENT

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

.2 Content includes:

.1 Review of facility and occupancy profile.

.2 Functional requirements.

.3 System philosophy, limitations of systems and emergency procedures.

.4 Review of system layout, equipment, components and controls.

.5 Equipment and system start-up, operation, monitoring, servicing, maintenance and shut-down procedures.

.6 System operating sequences, including step-by-step directions for starting up, shut-down, operation of valves, dampers, switches, adjustment of control settings and emergency procedures.

.7 Maintenance and servicing.

.8 Trouble-shooting diagnosis.

.9 Interaction among systems during integrated operation.

.10 Review of O&M documentation.

.3 Provide specialized training as specified in relevant Sections of the Specifications.

END OF SECTION

Part 1 General

1.1 SUMMARY

.1 Section Includes:

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

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

.3 Acronyms:

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

1.2 GENERAL

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

.1 Verify installed equipment, systems and integrated systems operate in accordance with contract documents and design criteria and intent.
.2 Ensure appropriate documentation is compiled into the O&M manual.
.3 Effectively train O&M staff.

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

.1 Systems to be operated at full capacity under various modes to determine if they function correctly and consistently at peak efficiency. Systems to be interactively with each other as intended in accordance with Contract Documents and design criteria.
.2 During these checks, adjustments to be made to enhance performance to meet environmental or user requirements.

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

1.3 COMMISSIONING OVERVIEW

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

.2 The parties responsible for Cx activities shall be identified in the Commissioning (Cx) Plan.

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

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

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

.6 Departmental Representative will issue Interim Acceptance Certificate when:

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

.2 Equipment, components and systems have been commissioned.

.3 O&M training has been completed.

1.4 NON-CONFORMANCE TO PERFORMANCE VERIFICATION REQUIREMENTS

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

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

1.5 PRE-CX REVIEW

.1 Before Construction:

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

.1 Adequacy of provisions for Cx.

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

.2 During Construction:

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

.3 Before start of Cx:

.1 Have Cx Plan up-to-date.

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

.3 Fully understand Cx requirements and procedures.

.4 Have Cx documentation shelf-ready.

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

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

.7 Have Cx schedules up-to-date.

.8 Ensure systems have been cleaned thoroughly.

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

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

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

1.6 CONFLICTS

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

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

1.7 SUBMITTALS

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

.1 Submit:

.1 Name of Contractor's Cx agent.

.2 Draft Cx documentation.

.3 Preliminary Cx schedule.

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

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

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

1.8 COMMISSIONING DOCUMENTATION

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

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

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

1.9 COMMISSIONING SCHEDULE

.1 Provide detailed Cx schedule as part of construction schedule in accordance with Section 01 32 16 - Construction Progress Schedules.

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

.1 Approval of Cx reports.

.2 Verification of reported results.

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

.4 Training.

1.10 COMMISSIONING MEETINGS

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

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

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

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

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

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

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

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

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

1.11 STARTING AND TESTING

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

1.12 WITNESSING OF STARTING AND TESTING

.1 Provide 14 days notice prior to commencement.

.2 Departmental Representative may witness start-up.

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

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

1.13 MANUFACTURER'S INVOLVEMENT

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

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

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

.2 Integrity of warranties:

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

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

.3 Qualifications of manufacturer's personnel:

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

.2 Ability to interpret test results accurately.

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

1.14 PROCEDURES

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

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

.1 Included in delivery and installation:

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

.2 Visual inspection of quality of installation.

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

.3 Operational testing: document equipment performance.

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

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

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

.4 Documents require tests on approved PV forms.

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

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

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

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

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

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

1.15 START-UP DOCUMENTATION

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

.2 Start-up documentation to include:

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

.2 Pre-start-up inspection reports.

.3 Signed installation/start-up check lists.

.4 Start-up reports,

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

1.16 OPERATION AND MAINTENANCE OF EQUIPMENT AND SYSTEMS

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

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

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

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

1.17 TEST RESULTS

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

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

1.18 START OF COMMISSIONING

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

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

1.19 INSTRUMENTS / EQUIPMENT

.1 Submit to Departmental Representative for review and approval:

.1 Complete list of instruments proposed to be used.

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

.2 Provide the following equipment as required:

.1 2-way radios.

.2 Ladders.

.3 Equipment as required to complete work.

1.20 COMMISSIONING PERFORMANCE VERIFICATION

.1 Carry out Cx:

.1 Under actual operating conditions, over entire operating range, in all modes.

.2 On independent systems and interacting systems.

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

.3 Follow equipment manufacturer's operating instructions.

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

1.21 WITNESSING COMMISSIONING

.1 Consultant and Cx Authority to witness activities and verify results.

1.22 AUTHORITIES HAVING JURISDICTION

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

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

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

1.23 COMMISSIONING CONSTRAINTS

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

1.24 EXTRAPOLATION OF RESULTS

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

1.25 EXTENT OF VERIFICATION

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

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

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

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

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

1.26 REPEAT VERIFICATIONS

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

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

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

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

1.27 SUNDRY CHECKS AND ADJUSTMENTS

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

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

1.28 DEFICIENCIES, FAULTS, DEFECTS

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

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

1.29 COMPLETION OF COMMISSIONING

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

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

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

1.30 ACTIVITIES UPON COMPLETION OF COMMISSIONING

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

1.31 TRAINING

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

1.32 MAINTENANCE MATERIALS, SPARE PARTS, SPECIAL TOOLS

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

1.33 OCCUPANCY

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

1.34 INSTALLED INSTRUMENTATION

.1 Use instruments installed under Contract for TAB and PV if:

.1 Accuracy complies with these specifications.

.2 Calibration certificates have been deposited with Departmental Representative.

.2 Calibrated EMCS sensors may be used to obtain performance data provided that sensor calibration has been completed and accepted.

1.35 PERFORMANCE VERIFICATION TOLERANCES

.1 Application tolerances:

.1 Specified range of acceptable deviations of measured values from specified values or specified design criteria. Unless noted otherwise in this contract Specifications, to be within +/- 10% of specified values.

.2 Instrument accuracy tolerances:

.1 To be of higher order of magnitude than equipment or system being tested.

.3 Measurement tolerances during verification:

.1 Unless noted otherwise in this contract Specifications actual values to be within +/- 2 % of recorded values.

1.36 OWNER'S PERFORMANCE TESTING

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

Part 2 Schedules

2.1 SCHEDULE OF ARCHITECTURAL SYSTEMS

.1 All door hardware and controls: door hardware and electronic controls function.

.2 Windows: motorized.

2.2 CX SCHEDULE FOR MECHANICAL SYSTEMS

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

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

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

.1 Training Plan.

.2 Cx Documentation Plan.

.3 Water/fire mains and related site fire hydrants:

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

.5 Wet pipe sprinkler systems:

.1 Test completed systems in accordance with NFPA 13.

.6 Plumbing systems:

.1 To be filled, then proceed with flushing, cleaning and disinfection processes.

.2 Test plumbing and piping systems installed under this project

.7 HVAC systems:

.1 Ductwork, piping and conduit systems that will be concealed to be tested and certified to specified standards before being concealed. This work is specified in relevant technical sections of Division 23.

.2 HVAC systems to be initially started up, "bumped" in a stand-alone mode and pre-start-up inspections completed.

.3 Start after dust-producing construction procedures have been completed and areas are dust-free.

.4 Start HVAC to replace temporary heating systems after Consultant's written approval.

.5 Operate HVAC to permit TAB and ensure full compliance with contract documents when weatherstripping, caulking and sealing of exterior envelope has been completed, and interior partitions and doors are installed and ceiling return plenums are in place.

.8 Hydronic systems:

.1 To be filled, pumps "bumped" in stand-alone mode and pre-start-up inspections completed. Then undertake cleaning and flushing processes.

.2 Commission after exterior envelope has been completed and exterior has been caulked, but only after relevant water treatment systems have been commissioned.

.3 Commission at same time as HVAC systems are being TAB'd.

.9 HVAC and related hydronic systems:

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

.10 Items which have a detrimental effect on operation and maintenance. To receive preliminary attention at this point. To be fully commissioned at same time as relevant equipment and systems.

.11 Vibration isolation and seismic control measures:

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

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

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

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

.13 EMCS:

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

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

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

.14 To reduce VOC concentrations to acceptable levels:

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

.15 Commission mechanical systems and associated equipment as follows:

.1 Plumbing systems:

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

.2 Installation and Operation of hot water generating equipment (DWH-1 and DWH-2).

.3 Installation and Operation of Domestic Booster Pumps (P-6a and P-6b)

.4 Installation and Operation of Domestic Recic pump (P-5)

.5 All piping installed to serve fixtures.

.2 HVAC and exhaust systems:

.1 HVAC systems (AHU-1 with CU-1, AHU-2 with CU-2, ERV-1, P-1 to P-4, Boiler B-1 to B-2, System Fill SF-1, AC-1 with CU-3)

.2 Exhaust systems (EF-1 to EF-8)

.3 Dedicated DX Systems (AC-1 with CU-3)

.4 Terminal Units (VAV-101 to VAV-111, Manifold MF-1 to MF-8, CUH-1 to CUH-4, UH-1 to UH-3)

.3 Fire and life safety systems:

.1 Wet pipe sprinkler systems.

.2 Fire Hydrant.

.3 Fire extinguishers.

.4 Fire Pump and Jockey Pump

.4 EMCS (Energy Management Control System:

.1 Entire EMCS system from graphic to device (point-to-point) performance verification.

.16 Product Information forms shall be completed and submitted with Shop Drawings. A sample of each type of form is provided with the specifications.

.17 Performance Verification forms (samples provided as noted) shall be finalized with contractor and completed by the contractor prior to performance review with Departmental Representative for the following mechanical systems:

.1 Air Handling Units (AHU-1 (PV sample provided), AHU-2 and ERV-1

.2 All Variable Air Volume Boxes (PV sample provided) – 30% to be reviewed with Cx Agent after commissioning is complete.

.3 Boilers B-1 and B-2 – 100% to be reviewed with Cx Agent after commissioning is complete.

.4 Pumps P1a and P1b, P-2a and P-2b, P-3 and P-4 (PV sample provided) – 100% to be reviewed with Cx Agent after commissioning is complete.

.5 Exhaust fans EF-1 to EF-8 (PV sample provided) – 100% to be reviewed with Cx Agent after commissioning is complete.

.6 Air Conditioning Units AC-1 and associated condensing units. – 100% to be reviewed with Cx Agent after commissioning is complete.

.7 System Fill Tanks– 100% to be reviewed with Cx Agent after commissioning is complete.

.8 In-floor manifolds and loops: 30% to be reviewed with Cx Agent after commissioning is complete.

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

.10 Domestic Booster Pumps P-6a and P-6b - 100% to be reviewed with Cx Agent after commissioning is complete.

.11 Domestic water Heaters DWH-1 and DWH-2 - 100% to be reviewed with Cx Agent after commissioning is complete.

.12 Cabinet Units heaters and Units heaters - 100% to be reviewed with Cx Agent after commissioning is complete

2.3 SCHEDULE OF ELECTRICAL SYSTEMS

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

.1 Low Voltage Lighting Control Devices (includes potential relocation for optimizing effectiveness of sensing zones)

.2 Low Voltage Switchboards (includes adjustments and confirmation of all trip settings from project's Over-Current Coordination study).

.3 Panelboards Breaker Type (includes proper operation of emergency transfer panel)

.4 Motor Starters

.5 Grounding (includes ground resistance test results)

.6 Car Parking Control System

.7 Lighting

.8 Emergency Lighting (includes aiming of lamps to optimize illumination onto egress paths).

.9 Exit Signs

.10 Fire Alarm System (includes integrated life safety testing and monitoring of alarm call outs)

.11 Communication Cable Inside Building (includes review of all testing printouts)

2.4 INTEGRATED LIFE SAFETY SYSTEMS

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

.1 Loss of power

.2 Fire alarm signal

.2 Electronic Hardware and Detention Hardware Systems: Test integration with fire alarm event.

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

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

.5 Fire alarm call out, horn strobes.

.6 Emergency lighting, exit signage.

END OF SECTION

Part 1 General

1.1 SUMMARY

.1 Section Includes:

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

.2 Product Information (PI) forms are appended to this Section.

.3 Example Performance Verification (PV) forms are appended to this Section.

1.2 INSTALLATION/START-UP CHECK LISTS

.1 Include the following data:

.1 Product manufacturer's installation instructions and recommended checks.

.2 Special procedures as specified in relevant technical sections.

.3 Items considered good installation and engineering industry practices deemed appropriate for proper and efficient operation.

.2 Equipment manufacturer's installation/start-up check lists are acceptable for use. As deemed necessary by Departmental Representative supplemental additional data lists may be required for specific project conditions.

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

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

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

1.3 PRODUCT INFORMATION (PI) REPORT FORMS

.1 Product Information (PI) forms compiles gathered data on items of equipment produced by equipment manufacturer, includes nameplate information, parts list, operating instructions, maintenance guidelines and pertinent technical data and recommended checks that is necessary to prepare for start-up and functional testing and used during operation and maintenance of equipment. This documentation is included in the Cx Manual at completion of work.

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

1.4 PERFORMANCE VERIFICATION (PV) FORMS

.1 PV forms to be used for checks, running dynamic tests and adjustments carried out on equipment and systems to ensure correct operation, efficiently and function independently and interactively with other systems as intended with project requirements.

.2 PV report forms include those developed by Contractor, and records the measured data and readings taken during functional testing and Performance Verification procedures.

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

1.5 COMMISSIONING FORMS

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

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

1.6 COMMISSIONING VERIFICATION PROCESS

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

.2 Strategy for Use:

.1 Consultant provides Contractor project-specific Commissioning forms with Specification data included.

.2 Contractor will provide required shop drawings information and verify correct installation and operation of items indicated on these forms.

.3 Confirm operation as per design criteria and intent.

.4 Identify variances between design and operation and reasons for variances.

.5 Verify operation in specified normal and emergency modes and under specified load conditions.

.6 Record analytical and substantiating data.

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

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

.9 Submit immediately after tests are performed.

.10 Reported results in true measured SI unit values.

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

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

END OF SECTION

Mechanical Component Form Index		
Section 1: Air Moving Equipment		
Form	Equipment	Reference
CFM1.1	Air Handling Unit AHU-1	Provided in Specifications
CFM1.2	Air Handling Unit AHU-2	Similar to CFM1.1
CFM1.3	Packaged Energy Recovery Unit ERV-1	Provided in Specifications
CFM1.4	Exhaust Fan EF-1	Provided in Specifications
CFM1.5	Exhaust Fan EF-2	Similar to CFM1.4
CFM1.6	Exhaust Fan EF-3	Similar to CFM1.4
CFM1.7	Exhaust Fan EF-4	Similar to CFM1.4
CFM1.8	Exhaust Fan EF-5	Similar to CFM1.4
CFM1.9	Exhaust Fan EF-6	Similar to CFM1.4
CFM1.10	Exhaust Fan EF-7	Similar to CFM1.4
CFM1.11	Exhaust Fan EF-8	Similar to CFM1.4
Section 2: Hydronic Equipment		
Form	Equipment	Reference
CFM2.1	Pump P-1a and P-1b	Provided in Specifications
CFM2.2	Pump P-2a and P-2b	Similar to CFM2.1
CFM2.3	Pump P-3	Similar to CFM2.1
CFM2.4	Pump P-4	Similar to CFM2.1
CFM2.5	Pump P-5	Similar to CFM2.1
CFM2.6	Pump P-6a and P-6b	Similar to CFM2.1
CFM2.7	Boilers	Not Provided
Section 3: Terminal Heating Units		
Form	Equipment	Reference
CFM3.1	Cabinet Unit Heater CUH-1	Provided in Specifications
CFM3.2	Cabinet Unit Heater CUH-2	Similar to CFM3.1
CFM3.3	Cabinet Unit Heater CUH-3	Similar to CFM3.1
CFM3.4	Cabinet Unit Heater CUH-4	Similar to CFM3.1
CFM3.5	Unit Heater UH-1	Similar to CFM3.1
CFM3.6	Unit Heater UH-2	Similar to CFM3.1
CFM3.7	Unit Heater UH-3	Similar to CFM3.1
CFM3.8	Radiant Panels	Provided in Specifications

Mechanical Component Form Index		
CFM3.9	Infloor Manifolds	Provided in Specifications
Section 4: New Terminal Boxes		
Form	Equipment	Reference
CFM4.1	VAV Box, VAV-101	Provided in Specifications
CFM4.2	VAV Box, VAV-102	Similar to CFM4.1
CFM4.3	VAV Box, VAV-103	Similar to CFM4.1
CFM4.4	VAV Box, VAV-104	Similar to CFM4.1
CFM4.5	VAV Box, VAV-105	Similar to CFM4.1
CFM4.6	VAV Box, VAV-106	Similar to CFM4.1
CFM4.7	VAV Box, VAV-107	Similar to CFM4.1
CFM4.8	VAV Box, VAV-108	Similar to CFM4.1
CFM4.9	VAV Box, VAV-109	Similar to CFM4.1
CFM4.10	VAV Box, VAV-110	Similar to CFM4.1
CFM4.11	VAV Box, VAV-111	Similar to CFM4.1
Section 5: Air Conditioning Equipment		
Form	Equipment	Reference
CFM5.1	Air Conditioning Unit CU-1	Provided in Specifications
CFM5.2	Air Conditioning Unit ACU-2	Similar to CFM5.1
CFM5.3	Package Cooling AC-1	Provided in Specifications
Section 6: Miscellaneous		
Form	Equipment	Reference
CFM6.1	Silencers	Provided in Specifications
CFM6.2	System Fill	Not Provided
CFM6.3	Expansion Tank ET-1	Not Provided
CFM6.4	Expansion Tank ET-2	Not Provided
Section 7: Plumbing		
Form	Equipment	Reference
CFM7.1	Domestic Water Heater	Not Provided
CFM7.2	Plumbing Fixtures	Not Provided

Project Name:	**Project #:**	**29/2013**
New Police Building - Maidstone Saskatchewan	**Component Form #:**	**CFM1.1**

Component Verification Form		*Section:*
System: **HVAC**	*Equipment:* **Central Air Handling Unit**	*Tag:* **AHU-1**

INSTALLED EQUIPMENT DATA:

Manufacturer	
Type	INDOOR AIR HANDLING UNIT
Model Number	
Serial Number	

LOCATION DATA:

Building	
Area Served	
Floor Located	2ND FLOOR
Room	201

PERFORMANCE DATA:

	Specified	Shop Drawings	Required Modification	Installed
Supply Fan:				
Fan Size & Type	9.5" FC Class II		-	Eng: ☐ Con: ☐
Air Flow	650 L/s (1,378 CFM)	(0 CFM)	-	Eng: ☐ Con: ☐
T.S.P.	844 Pa (3.39 in.w.c.)	(0.00 in.w.c.)	-	Eng: ☐ Con: ☐
E.S.P.	249 Pa (1.00 in.w.c.)	(0.00 in.w.c.)	-	Eng: ☐ Con: ☐
Fan RPM			-	Eng: ☐ Con: ☐
Fan Static Efficiency			-	Eng: ☐ Con: ☐
Motor Size	1.49 kW (2.00 hp)	(0.00 hp)	-	Eng: ☐ Con: ☐
Motor RPM	1750 RPM		-	Eng: ☐ Con: ☐
Motor Efficiency	Premium		-	Eng: ☐ Con: ☐
Voltage / Phase	208/3		-	Eng: ☐ Con: ☐
Return Fan:				
Fan Size & Type	9.5" FC Class II		-	
Air Flow	650 L/s (1,378 CFM)	(0 CFM)	-	Eng: ☐ Con: ☐
T.S.P.	436 Pa (1.75 in.w.c.)	(0.00 in.w.c.)	-	Eng: ☐ Con: ☐
E.S.P.	187 Pa (0.75 in.w.c.)	(0.00 in.w.c.)	-	Eng: ☐ Con: ☐
Fan RPM			-	Eng: ☐ Con: ☐
Fan Static Efficiency			-	Eng: ☐ Con: ☐
Motor Size	1.49 kW (2.00 hp)	(0.00 hp)	-	Eng: ☐ Con: ☐
Motor RPM	1750 RPM		-	Eng: ☐ Con: ☐
Motor Efficiency	Premium		-	Eng: ☐ Con: ☐
Voltage / Phase	208/3		-	Eng: ☐ Con: ☐
Heat Wheel:				
Air Flow	650 L/s (1,378 CFM)	(0 CFM)	-	Eng: ☐ Con: ☐
Sensible Effectiveness (balanced)	76.3%		-	Eng: ☐ Con: ☐
Latent Effectiveness (balanced)	72.0%		-	Eng: ☐ Con: ☐
Motor Size	0.25 kW (0.33 hp)	(0.00 hp)	-	Eng: ☐ Con: ☐
Motor RPM	1750 RPM		-	Eng: ☐ Con: ☐
Voltage / Phase	208/3		-	Eng: ☐ Con: ☐
Defrost Control	VFD Motor		-	Eng: ☐ Con: ☐
Heating Coil:				
Air Flow	650 L/s (1,378 CFM)	(0 CFM)	-	Eng: ☐ Con: ☐
E.A.T.	-40.00 C -(40.00 F)	(32.00 F)	-	Eng: ☐ Con: ☐
L.A.T	32.20 C (89.96 F)	(32.00 F)	-	Eng: ☐ Con: ☐
A.P.D.	35 Pa (0.14 in.w.c.)	(0.00 in.w.c.)	-	Eng: ☐ Con: ☐
Water Flow	13.20 L/s (209 GPM)	(0 GPM)	-	Eng: ☐ Con: ☐
Medium	30% Propylene Glycol		-	Eng: ☐ Con: ☐
E.W.T.	71.10 C (159.98 F)	(32.00 F)	-	Eng: ☐ Con: ☐
L.W.T.	54.40 C (129.92 F)	(32.00 F)	-	Eng: ☐ Con: ☐
W.P.D.	5.06 kPa (1.69 ft.w.c.)	(0.00 ft.w.c.)	-	Eng: ☐ Con: ☐
Energy Exchanged	53.60 kW (183 MBH)	(0 MBH)	-	Eng: ☐ Con: ☐

Project Name:	Project #:	29/2013
New Police Building - Maidstone Saskatchewan	Component Form #:	CFM1.1

Component Verification Form		*Section:*
System: **HVAC**	*Equipment:* **Central Air Handling Unit**	*Tag:* **AHU-1**

INSTALLED EQUIPMENT DATA:

Manufacturer	
Type	INDOOR AIR HANDLING UNIT
Model Number	
Serial Number	

LOCATION DATA:

Building	
Area Served	
Floor Located	2ND FLOOR
Room	201

PERFORMANCE DATA:

	Specified	Shop Drawings	Required Modification	Installed	
Cooling Coil:					
Air Flow	650 L/s (1,378 CFM)	(0 CFM)	-	Eng: ☐	Con: ☐
E.A.T. DB	29.40 C (84.92 F)	(32.00 F)	-	Eng: ☐	Con: ☐
E.A.T. WB	18.90 C (66.02 F)	(32.00 F)	-	Eng: ☐	Con: ☐
L.A.T. DB	12.20 C (53.96 F)	(32.00 F)	-	Eng: ☐	Con: ☐
A.P.D.	189 Pa (0.76 in.w.c.)	(0.00 in.w.c.)	-	Eng: ☐	Con: ☐
Suction Temperature	6.70 C (44.06 F)	(32.00 F)	-	Eng: ☐	Con: ☐
Total Energy Exch.	17.90 kW (61 MBH)	(0.0 MBH)	-	Eng: ☐	Con: ☐
Sensible Energy Exch.	13.40 kW (46 MBH)	(0.0 MBH)	-	Eng: ☐	Con: ☐
Refrigerant	R-410A (HFC)		-	Eng: ☐	Con: ☐
Compressors	2		-	Eng: ☐	Con: ☐
Lead Capacity Control	Variable Speed		-	Eng: ☐	Con: ☐
Lag Capacity Control	on/off		-	Eng: ☐	Con: ☐

Comments

SIGN-OFFS:

Contractor: _____ Date: _____

Engineer: _____ Date: _____

CxA: _____ Date: _____

Component Verification Form		*Section:*
System: **HVAC**	*Equipment:* **Central Air Handling Unit**	*Tag:* **AHU-1**

Project Name:	**Project #:**	**29/2013**
New Police Building - Maidstone Saskatchewan	**Component Form #:**	**CFM1.2**

Component Verification Form		*Section:*
System: **HVAC**	*Equipment:* **Indoor Air Handling Unit**	*Tag:* **AHU-2**

INSTALLED EQUIPMENT DATA:

Manufacturer	
Type	
Model Number	
Serial Number	

LOCATION DATA:

Building	
Area Served	
Floor Located	2ND FLOOR
Room	201

PERFORMANCE DATA:

	Specified	Shop Drawings	Required Modification	Installed
Supply Fan:				
Fan Size & Type	FC	-	-	Eng: ☐ Con: ☐
Air Flow	4,500 L/s (9,540 CFM)	(0 CFM)	-	Eng: ☐ Con: ☐
T.S.P.	1,033 Pa (4.15 in.w.c.)	(0.00 in.w.c.)	-	Eng: ☐ Con: ☐
E.S.P.	498 Pa (2.00 in.w.c.)	(0.00 in.w.c.)	-	Eng: ☐ Con: ☐
Fan Static Efficiency	65%	-	-	Eng: ☐ Con: ☐
Motor Size	11.19 kW (15.00 hp)	(0.00 hp)	-	Eng: ☐ Con: ☐
Motor Efficiency	Premium	-	-	Eng: ☐ Con: ☐
Voltage / Phase	208/3	-	-	Eng: ☐ Con: ☐
Return Fan:				
Fan Size & Type	FC	-	-	Eng: ☐ Con: ☐
Air Flow	4,500 L/s (9,540 CFM)	(0 CFM)	-	Eng: ☐ Con: ☐
T.S.P.	264 Pa (1.06 in.w.c.)	(0.00 in.w.c.)	-	Eng: ☐ Con: ☐
E.S.P.	249 Pa (1.00 in.w.c.)	(0.00 in.w.c.)	-	Eng: ☐ Con: ☐
Fan Static Efficiency	65%	-	-	Eng: ☐ Con: ☐
Motor Size	3.73 kW (5.00 hp)	(0.00 hp)	-	Eng: ☐ Con: ☐
Motor Efficiency	Premium	-	-	Eng: ☐ Con: ☐
Voltage / Phase	208/3	-	-	Eng: ☐ Con: ☐
Heating Coil:				
Air Flow	4,500 L/s (9,540 CFM)	(0 CFM)	-	Eng: ☐ Con: ☐
E.A.T.	4.20 C (39.56 F)	(32.00 F)	-	Eng: ☐ Con: ☐
L.A.T	15.70 C (60.26 F)	(32.00 F)	-	Eng: ☐ Con: ☐
A.P.D.	30 Pa (0.12 in.w.c.)	(0.00 in.w.c.)	-	Eng: ☐ Con: ☐
Water Flow	0.91 L/s (14 GPM)	(0 GPM)	-	Eng: ☐ Con: ☐
E.W.T.	71.10 C (159.98 F)	(32.00 F)	-	Eng: ☐ Con: ☐
L.W.T.	54.40 C (129.92 F)	(32.00 F)	-	Eng: ☐ Con: ☐
W.P.D.	3.88 kPa (1.30 ft.w.c.)	(0.00 ft.w.c.)	-	Eng: ☐ Con: ☐
Energy Exchanged	58.80 kW (201 MBH)	(0 MBH)	-	Eng: ☐ Con: ☐

Project Name:	**Project #:**	**29/2013**
New Police Building - Maidstone Saskatchewan	**Component Form #:**	**CFM1.2**

Component Verification Form		*Section:*
System: **HVAC**	*Equipment:* **Indoor Air Handling Unit**	*Tag:* **AHU-2**

INSTALLED EQUIPMENT DATA:

Manufacturer	
Type	
Model Number	
Serial Number	

LOCATION DATA:

Building	
Area Served	
Floor Located	2ND FLOOR
Room	201

PERFORMANCE DATA:

	Specified	Shop Drawings	Required Modification	Installed	
Cooling Coil:					
Air Flow	4,500 L/s (9,540 CFM)	(0 CFM)	-	Eng: ☐	Con: ☐
E.A.T. DB	29.40 C (84.92 F)	(32.00 F)	-	Eng: ☐	Con: ☐
E.A.T. WB	18.90 C (66.02 F)	(32.00 F)	-	Eng: ☐	Con: ☐
L.A.T. DB	12.20 C (53.96 F)	(32.00 F)	-	Eng: ☐	Con: ☐
A.P.D.	209 Pa (0.84 in.w.c.)	(0.00 in.w.c.)	-	Eng: ☐	Con: ☐
Suction Temperature	6.70 C (44.06 F)	(32.00 F)	-	Eng: ☐	Con: ☐
Total Energy Exch.	115.20 kW (393 MBH)	(0.0 MBH)	-	Eng: ☐	Con: ☐
Sensible Energy Exch.	89.10 kW (304 MBH)	(0.0 MBH)	-	Eng: ☐	Con: ☐
Refrigerant	R-410A (HFC)		-	Eng: ☐	Con: ☐
Compressors	2		-	Eng: ☐	Con: ☐
Lead Capacity Control	Variable Speed		-	Eng: ☐	Con: ☐
Lag Capacity Control	on/off		-	Eng: ☐	Con: ☐

Comments

SIGN-OFFS:

Contractor: _____ Date: _____

Engineer: _____ Date: _____

CxA: _____ Date: _____

Project Name:	**Project #:**	**29/2013**
New Police Building - Maidstone Saskatchewan	**Component Form #:**	**CFM1.3**

Component Verification Form		*Section:*
System: **HVAC**	*Equipment:* **Packaged Energy Recovery Unit**	*Tag:* **ERV-1**

INSTALLED EQUIPMENT DATA:

Manufacturer	
Type	Energy Recovery Unit
Model Number	
Serial Number	

LOCATION DATA:

Building	
Area Served	AHU-2
Floor Located	2ND FLOOR
Room	201

PERFORMANCE DATA:

	Specified	Shop Drawings	Required Modification	Installed
Supply Fan:				
Fan Size & Type	APF SW Class II		-	Eng: ☐ Con: ☐
Air Flow	1,400 L/s (2,968 CFM)	(0 CFM)	-	Eng: ☐ Con: ☐
T.S.P.	665 Pa (2.67 in.w.c.)	(0.00 in.w.c.)	-	Eng: ☐ Con: ☐
E.S.P.	249 Pa (1.00 in.w.c.)	(0.00 in.w.c.)	-	Eng: ☐ Con: ☐
Fan RPM			-	Eng: ☐ Con: ☐
Fan Static Efficiency			-	Eng: ☐ Con: ☐
Motor Size	3.73 kW (5.00 hp)	(0.00 hp)	-	Eng: ☐ Con: ☐
Motor RPM	1750 RPM		-	Eng: ☐ Con: ☐
Motor Efficiency	Premium		-	Eng: ☐ Con: ☐
Voltage / Phase	208/3		-	Eng: ☐ Con: ☐
Return Fan:				
Fan Size & Type	APF SW Class II		-	
Air Flow	1,400 L/s (2,968 CFM)	(0 CFM)	-	Eng: ☐ Con: ☐
T.S.P.	665 Pa (2.67 in.w.c.)	(0.00 in.w.c.)	-	Eng: ☐ Con: ☐
E.S.P.	249 Pa (1.00 in.w.c.)	(0.00 in.w.c.)	-	Eng: ☐ Con: ☐
Fan RPM			-	Eng: ☐ Con: ☐
Fan Static Efficiency			-	Eng: ☐ Con: ☐
Motor Size	3.73 kW (5.00 hp)	(0.00 hp)	-	Eng: ☐ Con: ☐
Motor RPM	1750 RPM		-	Eng: ☐ Con: ☐
Motor Efficiency	Premium		-	Eng: ☐ Con: ☐
Voltage / Phase	208/3		-	Eng: ☐ Con: ☐
Energy Recovery				
Air Flow	1,400 L/s (2,968 CFM)	(0 CFM)	-	Eng: ☐ Con: ☐
Sensible Effectiveness (summer balanced)	66.0%	-	-	Eng: ☐ Con: ☐
Latent Effectiveness (summer balanced)	0.0%	-	-	Eng: ☐ Con: ☐
Sensible Effectiveness (winter balanced)	67.6%	-	-	Eng: ☐ Con: ☐
Latent Effectiveness (winter balanced)	0.0%	-	-	Eng: ☐ Con: ☐
Summer Energy Exch.	3.90 kW (13 MBH)	(0 MBH)	-	Eng: ☐ Con: ☐
Winter Energy Exch.	71.90 kW (245 MBH)	(0 MBH)	-	Eng: ☐ Con: ☐
Defrost energy Exch.	24.20 kW (83 MBH)	(0 MBH)	-	Eng: ☐ Con: ☐
Defrost Control	Bypass Damper		-	Eng: ☐ Con: ☐

Project Name:	Project #:	29/2013
New Police Building - Maidstone Saskatchewan	Component Form #:	CFM1.3

Component Verification Form		*Section:*
System: **HVAC**	*Equipment:* **Packaged Energy Recovery Unit**	*Tag:* **ERV-1**

INSTALLED EQUIPMENT DATA:

Manufacturer	
Type	Energy Recovery Unit
Model Number	
Serial Number	

LOCATION DATA:

Building	
Area Served	AHU-2
Floor Located	2ND FLOOR
Room	201

PERFORMANCE DATA:

	Specified	Shop Drawings	Required Modification	Installed

Comments

SIGN-OFFS:

Contractor: _____ Date: _____

Engineer: _____ Date: _____

CxA: _____ Date: _____

Component Verification Form		*Section:*
System: **HVAC**	*Equipment:* **Central Air Handling Unit**	*Tag:* **AHU-1**

Project Name:	**Project #:**	**29/2013**
New Police Building - Maidstone Saskatchewan	**Component Form #:**	**CFM1.4**

Component Verification Form

Section:

System:	*Equipment:*	*Tag:*
HVAC	**EXHAUST FAN**	**EF-1**

INSTALLED EQUIPMENT DATA:

Manufacturer	
Type	
Model Number	
Serial Number	

LOCATION DATA:

Building	
Area Served	Room 157
Floor Located	Room 157
Room	Room 157

PERFORMANCE DATA:

	Specified	Shop Drawings	Required Modification	Installed
Fan:				
Fan Type	Centrifugal	BI	-	Eng: ☐ Con: ☐
Air Flow	228 L/s (483 CFM)	(0 CFM)	-	Eng: ☐ Con: ☐
E.S.P.	125 Pa (0.50 in.w.c.)	(0.00 in.w.c.)	-	Eng: ☐ Con: ☐
Sound	6.1 Sones		-	Eng: ☐ Con: ☐
Motor Size	0.19 kW (0.25 hp)	(0.00 hp)	-	Eng: ☐ Con: ☐
Motor Efficiency	Premium		-	Eng: ☐ Con: ☐
Voltage / Phase	120/1		-	Eng: ☐ Con: ☐
Motor Type	Standard		-	Eng: ☐ Con: ☐
Options:				
Insulation Lining	13mm		-	Eng: ☐ Con: ☐
Backdraft Damper	Yes		-	Eng: ☐ Con: ☐
Isolators	Spring		-	Eng: ☐ Con: ☐

Comments

SIGN-OFFS:

Contractor: _____ Date: _____

Engineer: _____ Date: _____

CxA: _____ Date: _____

Prepared By: **HDA Engineering Ltd.** Regina, Sk, (306) 525-9815

Project Name:	**Project #:**	**29/2013**
New Police Building - Maidstone Saskatchewan	**Component Form #:**	**CFM2.1**

Component Verification Form

Section:

System:	*Equipment:*	*Tag:*
HVAC	**EXHAUST FAN**	**P-1a/1b**

INSTALLED EQUIPMENT DATA:

Manufacturer	
Type	
Model Number	
Serial Number	

LOCATION DATA:

Building	
Area Served	Heating System
Floor Located	Main Floor
Room	Room 139

PERFORMANCE DATA:

	Specified	Shop Drawings	Required Modification	Installed	
Fan:					
Pump Size	2		-	Eng: ☐	Con: ☐
Flow	60.00 L/s (951 US gpm)	(0 US gpm)	-	Eng: ☐	Con: ☐
Fluid	Prop Glycol 30%		-	Eng: ☐	Con: ☐
Head	172.10 kPa (57.63 ft.w.c.)	(0.00 ft.w.c.)	-	Eng: ☐	Con: ☐
Pump Efficiency			-	Eng: ☐	Con: ☐
Motor Size	2.00 kW (2.68 hp)	(0.00 hp)	-	Eng: ☐	Con: ☐
Motor Efficiency	Premium		-	Eng: ☐	Con: ☐
Voltage / Phase	208/3		-	Eng: ☐	Con: ☐
Options:					
Motor	Inverter Duty		-	Eng: ☐	Con: ☐
Control	VFD		-	Eng: ☐	Con: ☐

Comments

SIGN-OFFS:

Contractor: _____ Date: _____

Engineer: _____ Date: _____

CxA: _____ Date: _____

Project Name:	Project #:	29/2013
New Police Building - Maidstone Saskatchewan	Component Form #:	CFM3.1

Component Verification Form

Section:

System:	*Equipment:*	*Tag:*
HVAC	UNIT HEATER	CUH-1

INSTALLED EQUIPMENT DATA:

Manufacturer	
Type	
Model Number	
Serial Number	

LOCATION DATA:

Building	
Area Served	Room 101
Floor Located	Main Floor
Room	Room 101

PERFORMANCE DATA:

	Specified	Shop Drawings	Required Modification	Installed
Supply Fan:				
Fan Size & Type	FC		-	Eng: ☐ Con: ☐
Air Flow	708 L/s (1,501 CFM)	(0 CFM)	-	Eng: ☐ Con: ☐
Motor Size	0.19 kW (0.25 hp)	(0.00 hp)	-	Eng: ☐ Con: ☐
Voltage / Phase	115/1	115/1	-	Eng: ☐ Con: ☐
Heating Coil:				
Air Flow	708 L/s (1,501 CFM)	(0 CFM)	-	Eng: ☐ Con: ☐
E.A.T.	15.60 C (60.08 F)	(32.00 F)	-	Eng: ☐ Con: ☐
Water Flow	0.24 L/s (3.80 GPM)	(0 GPM)	-	Eng: ☐ Con: ☐
Medium	30% Prop. Glycol		-	Eng: ☐ Con: ☐
E.W.T.	51.70 C (125.06 F)	(32.00 F)	-	Eng: ☐ Con: ☐
L.W.T.	40.60 C (105.08 F)	(32.00 F)	-	Eng: ☐ Con: ☐
W.P.D.	3.59 kPa (1.20 ft.w.c.)	(0.00 ft.w.c.)	-	Eng: ☐ Con: ☐
Energy Exchanged	10.90 kW (37 MBH)	(0 MBH)	-	Eng: ☐ Con: ☐
Options:				
Cabinet Arrangement	18		-	Eng: ☐ Con: ☐
Output is Derated	Yes		-	Eng: ☐ Con: ☐

Comments

SIGN-OFFS:

Contractor: _____ Date: _____

Engineer: _____ Date: _____

CxA: _____ Date: _____

Project Name: Maidstone Detachment	**Project #:** 29/2013
	Component Form #: CFM3.8

Component Verification Form

Section:

System:	*Equipment:*	*Tag:*
HVAC	**Radiant Panel**	**n/a**

INSTALLED EQUIPMENT DATA:

Manufacturer	TWA
Type	Hot Water Radiant Panels
Model Number	
Serial Number	

LOCATION DATA:

Building	
Area Served	Building
Floor Located	Main Floor
Room	Various

PERFORMANCE DATA:

	Specified	Shop Drawings	Required Modification	Installed
Type B Panel				
Panel Size	600 x 1200		Acceptable	Eng: ☐ Con: ☐
# of Passes	6		-	Eng: ☐ Con: ☐
Rated Energy Output	316 W/panel (329 Btuh/panel)	(0 Btuh/panel)	-	Eng: ☐ Con: ☐
Derated Output	288 W/panel (300 Btuh/panel)	(0 Btuh/panel)	-	Eng: ☐ Con: ☐
E.W.T.	71.10 C (159.98 F)	(32.00 F)	-	Eng: ☐ Con: ☐
L.W.T.	54.40 C (129.92 F)	(32.00 F)	-	Eng: ☐ Con: ☐

Comments

SIGN-OFFS:

Contractor: _____ Date: _____

Engineer: _____ Date: _____

CxA: _____ Date: _____

Prepared By: HDA Engineering Ltd. Regina, Sk, (306) 525-9815

Project Name:	**Project #:**	**29/2013**
New Police Building - Maidstone Saskatchewan	**Component Form #:**	**CFM3.9**

Component Verification Form

System:	*Equipment:*	*Section:* / *Tag:*
HVAC	**Radiant Panel**	**n/a**

INSTALLED EQUIPMENT DATA:

Manufacturer	TWA
Type	Hot Water Radiant Panels
Model Number	
Serial Number	

LOCATION DATA:

Building	
Area Served	Building
Floor Located	Main Floor
Room	Various

PERFORMANCE DATA:

			Specified		Shop Drawings		Required Modification	Installed	
Manifold	**Serving**	**Circuits**							
MF-1	102	1	0.032 L/s	(0.50 US gpm)		(0.00 US gpm)		Eng: ☐	Con: ☐
MF-1	103	1	0.047 L/s	(0.75 US gpm)		(0.00 US gpm)			
MF-1	104	2	0.109 L/s	(1.73 US gpm)		(0.00 US gpm)			
MF-1	110	1	0.031 L/s	(0.49 US gpm)		(0.00 US gpm)			
MF-1	111, 112	1	0.050 L/s	(0.80 US gpm)		(0.00 US gpm)			
MF-2	105	2	0.093 L/s	(1.47 US gpm)		(0.00 US gpm)			
MF-2	106	1	0.056 L/s	(0.89 US gpm)		(0.00 US gpm)			
MF-2	108, 109	1	0.032 L/s	(0.50 US gpm)		(0.00 US gpm)			
MF-3	113	4	0.325 L/s	(5.14 US gpm)		(0.00 US gpm)			
MF-3	114	1	0.042 L/s	(0.66 US gpm)		(0.00 US gpm)			
MF-3	115	1	0.065 L/s	(1.03 US gpm)		(0.00 US gpm)			
MF-4	113	4	0.220 L/s	(3.49 US gpm)		(0.00 US gpm)			
MF-4	125, 141	1	0.060 L/s	(0.95 US gpm)		(0.00 US gpm)			
MF-4	126	1	0.032 L/s	(0.50 US gpm)		(0.00 US gpm)			
MF-5	117	1	0.059 L/s	(0.94 US gpm)		(0.00 US gpm)			
MF-5	119, 120	1	0.032 L/s	(0.50 US gpm)		(0.00 US gpm)			
MF-5	122, 123	1	0.031 L/s	(0.50 US gpm)		(0.00 US gpm)			
MF-5	128	2	0.102 L/s	(1.62 US gpm)		(0.00 US gpm)			
MF-6	116	1	0.032 L/s	(0.50 US gpm)		(0.00 US gpm)			
MF-6	129	1	0.032 L/s	(0.50 US gpm)		(0.00 US gpm)			
MF-6	130	1	0.034 L/s	(0.54 US gpm)		(0.00 US gpm)			
MF-7	132	1	0.032 L/s	(0.50 US gpm)		(0.00 US gpm)			
MF-7	133	1	0.036 L/s	(0.58 US gpm)		(0.00 US gpm)	-	Eng: ☐	Con: ☐
MF-7	134	1	0.032 L/s	(0.50 US gpm)		(0.00 US gpm)	-	Eng: ☐	Con: ☐
MF-7	135	1	0.032 L/s	(0.50 US gpm)		(0.00 US gpm)	-	Eng: ☐	Con: ☐
MF-8	136	1	0.017 L/s	(0.28 US gpm)		(0.00 US gpm)			
MF-8	137	1	0.019 L/s	(0.30 US gpm)		(0.00 US gpm)			
MF-8	138	1	0.019 L/s	(0.30 US gpm)		(0.00 US gpm)			

Comments

SIGN-OFFS:

Contractor: _____ Date: _____

Engineer: _____ Date: _____

CxA: _____ Date: _____

Project Name:	Project #:	29/2013
New Police Building - Maidstone Saskatchewan	Component Form #:	CFM3.9

Component Verification Form		*Section:*
System: **HVAC**	*Equipment:* **Radiant Panel**	*Tag:* **n/a**

INSTALLED EQUIPMENT DATA:

Manufacturer	TWA
Type	Hot Water Radiant Panels
Model Number	
Serial Number	

LOCATION DATA:

Building	
Area Served	Building
Floor Located	Main Floor
Room	Various

PERFORMANCE DATA:

	Specified	Shop Drawings	Required Modification	Installed

Project Name:	Project #:	29/2013
New Police Building - Maidstone Saskatchewan	Component Form #:	CFM4.1

Component Verification Form

Section:

System:	*Equipment:*	*Tag:*
HVAC	Variable Volume Box	VAV-101

INSTALLED EQUIPMENT DATA:

Manufacturer	
Type	
Model Number	
Serial Number	

LOCATION DATA:

Building	
Area Served	Room 115
Floor Located	Main Floor
Room	Room 104

PERFORMANCE DATA:

	Specified	Shop Drawings	Required Modification	Installed
Supply Fan:				
Inlet Size	175 mm 7 in.	0 in.	-	Eng: ☐ Con: ☐
Maximum Airflow	209 L/s (443 CFM)	(0 CFM)	-	Eng: ☐ Con: ☐
Min. Occ. Airflow	105 L/s (223 CFM)	(0 CFM)	-	Eng: ☐ Con: ☐
Min. Unocc. Airflow	118 L/s (250 CFM)	(0 CFM)	-	Eng: ☐ Con: ☐

Comments

SIGN-OFFS:

Contractor: _____ Date: _____

Engineer: _____ Date: _____

CxA: _____ Date: _____

Prepared By: HDA Engineering Ltd. Regina, Sk, (306) 525-9815

Project Name:	**Project #:**	**29/2013**
New Police Building - Maidstone Saskatchewan	**Component Form #:**	**CFM5.1**

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

INSTALLED EQUIPMENT DATA:

Manufacturer	
Type	
Model Number	
Serial Number	

LOCATION DATA:

Building	
Area Served	AHU-1
Floor Located	ROOF
Room	ROOF

PERFORMANCE DATA:

	Specified	Shop Drawings	Required Modification	Installed
Main Unit				
Voltage / Phase	208/3	-	-	Eng: ☐ Con: ☐
Full Load Amps	28	-	-	Eng: ☐ Con: ☐
MAX Circuit Ampacity	31	-	-	Eng: ☐ Con: ☐
Overcurrent Prot.	40	-	-	Eng: ☐ Con: ☐
Refrigerant	HFC	-	-	Eng: ☐ Con: ☐
Compressors	2	-	-	Eng: ☐ Con: ☐
Load Mod. On Lead	Hot Gas Bypass	-	-	Eng: ☐ Con: ☐
Load Mod on Lag	On/Off	-	-	Eng: ☐ Con: ☐

Comments

SIGN-OFFS:

Contractor: _____ Date: _____

Engineer: _____ Date: _____

CxA: _____ Date: _____

Project Name:	**Project #:**	**29/2013**
New Police Building - Maidstone Saskatchewan	**Component Form #:**	**CFM5.3**

Component Verification Form

Section:

System:	*Equipment:*	*Tag:*
HVAC	**Packaged Cooling Equipment**	**AC-1**

INSTALLED EQUIPMENT DATA:

Manufacturer	
Type	
Model Number	
Serial Number	

LOCATION DATA:

Building	
Area Served	Room 140
Floor Located	Main Floor / Roof
Room	Room 140 / Roof

PERFORMANCE DATA:

	Specified	Shop Drawings	Required Modification	Installed
Indoor Unit				
Air Flow	333 L/s (706 CFM)	(0 CFM)	-	Eng: ☐ Con: ☐
Entering Air Dry Bulb	22.20 C (71.96 F)	(32.00 F)	-	Eng: ☐ Con: ☐
Entering Air Wet bulb	14.80 C (58.64 F)	(32.00 F)	-	Eng: ☐ Con: ☐
Total Cooling	3.52 kW (12 MBH)	(0 MBH)	-	Eng: ☐ Con: ☐
% Sensible	95%	-	-	Eng: ☐ Con: ☐
Voltage / Phase	208/1	-	-	Eng: ☐ Con: ☐
Input	2650 Watts	-	-	Eng: ☐ Con: ☐
Breaker	25A	-	-	Eng: ☐ Con: ☐
Refrigerant	HFC (R410A)	-	-	Eng: ☐ Con: ☐
Outdoor Unit CU-3				
Voltage / Phase	208/1	-	-	Eng: ☐ Con: ☐
Full Load Amps	18	-	-	Eng: ☐ Con: ☐
Overcurrent Prot.	30	-	-	Eng: ☐ Con: ☐
Refrigerant	HFC (R410A)	-	-	Eng: ☐ Con: ☐
Accessories				
Filter Width	100mm	-	-	Eng: ☐ Con: ☐
Filter Efficiency	Merv 8	-	-	Eng: ☐ Con: ☐
Condensate Lift Pump	Yes	-		Eng: ☐ Con: ☐
Warranty	6 yr compressor	-		Eng: ☐ Con: ☐

Comments

SIGN-OFFS:

Contractor: _____ Date: _____

Engineer: _____ Date: _____

CxA: _____ Date: _____

Prepared By: HDA Engineering Ltd. Regina, Sk, (306) 525-9815

Project Name:	Project #:	29/2013
New Police Building - Maidstone Saskatchewan	Component Form #:	CFM6.1

Component Verification Form

Section:

System:	Equipment:	Tag:
HVAC	Silencer	SIL-1

INSTALLED EQUIPMENT DATA:

Manufacturer	
Type	
Model Number	
Serial Number	

LOCATION DATA:

Building	
Area Served	Room 106
Floor Located	Main Floor
Room	

PERFORMANCE DATA:

	Specified	Shop Drawings	Required Modification	Installed
Supply Fan:				
Length	1200 mm 48 in.	0 in.	-	Eng: ☐ Con: ☐
Inlet Size	450x200 (18"x8")		-	Eng: ☐ Con: ☐
Airflow	94 L/s (199 CFM)	(0 CFM)	-	Eng: ☐ Con: ☐
Configuration	Z - configuration		-	Eng: ☐ Con: ☐
Attenuation - 63 Hz	8		-	Eng: ☐ Con: ☐
Attenuation - 125 Hz	16		-	Eng: ☐ Con: ☐
Attenuation - 250 Hz	29		-	Eng: ☐ Con: ☐
Attenuation - 500 Hz	34		-	Eng: ☐ Con: ☐
Attenuation - 1 kHz	41		-	Eng: ☐ Con: ☐
Attenuation - 2kHz	38		-	Eng: ☐ Con: ☐
Attenuation - 4kHz	35		-	Eng: ☐ Con: ☐
Attenuation - 8kHz	25		-	Eng: ☐ Con: ☐
Outer Casing	22 ga. Galvanized		-	Eng: ☐ Con: ☐
Inner Casing	22 ga. Perforated Galv.		-	Eng: ☐ Con: ☐
Media	fiberglass		-	Eng: ☐ Con: ☐
Media Liner	no		-	Eng: ☐ Con: ☐

Comments

SIGN-OFFS:

Contractor: _____ Date: _____

Engineer: _____ Date: _____

CxA: _____ Date: _____

Project Name:	Project #:	29/2013
New Police Building – Maidstone Saskatchewan	Performance Verification #:	PVM1.1

Performance Verification Test Form		*Section:*
System: **HVAC**	*Equipment:* **AHU-2 Central Air Handling**	*Room #:* **201**

1. TEST PURPOSE

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

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

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

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

2. Test PrerequisitesMechanical:

		C	E
.1	As-built drawings are complete and have been submitted ----------	☐	☐
.2	All component verifications are complete and reviewed ----------	☐	☐
.3	Testing, adjusting and balancing (TAB) is complete for all associated systems. ----------	☐	☐
.4	TAB report is complete and reviewed. ----------	☐	☐
.5	Heating is operational. ----------	☐	☐
.6	Cooling is operational. ----------	☐	☐
.7	Humidification is operational. ----------	☐	☐
.8	Energy recovery unit is operational. ----------	☐	☐
.9	Verify supply fan operation:		
	.1 Rotation ---------- ----------	☐	☐
	.2 Lubrication ---------- ----------		
	.3 Belt Alignment ---------- ----------		
.10	Verify return fan operation:		
	.1 Rotation ---------- ----------	☐	☐
	.2 Lubrication ---------- ----------	☐	☐
	.3 Belt Alignment ---------- ----------	☐	☐

.2 Controls:

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

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

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

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

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

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

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

Project Name: New Police Building – Maidstone Saskatchewan	Project #: 29/2013
	Performance Verification #: PVM1.1

Performance Verification Test Form		*Section:*
System: **HVAC**	*Equipment:* **AHU-2 Central Air Handling**	*Room #:* **201**

3. Operational Testing Procedures

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

.2 Occupied/Unoccupied Schedule

				C	E
.1	Weekday Schedule	ON _____	OFF _____	☐	☐
.2	Weekend Schedule	ON	OFF	☐	☐
.3	Holiday Schedule	ON	OFF	☐	☐

.3 Verification of field temperature devices.

.1	Return Air Temperature (prior to air handling unit):			
.1	Temperature indicated through BMS ---------- _____	--- ^{O}C	☐	☐
.2	Actual measured temperature----------	--- ^{O}C	☐	☐
.2	Exhaust Air Temperature (prior to ERV heat wheel):			
.1	Temperature indicated through BMS ----------	--- ^{O}C	☐	☐
.2	Actual measured temperature----------	--- ^{O}C	☐	☐
.3	Exhaust Air Temperature (after ERV heat wheel):			
.1	Temperature indicated through BMS ----------	--- ^{O}C	☐	☐
.2	Actual measured temperature----------	--- ^{O}C	☐	☐
.4	Outdoor Air Temperature (prior to ERV heat wheel):			
.1	Temperature indicated through BMS ----------	--- ^{O}C	☐	☐
.2	Actual measured temperature----------	--- ^{O}C	☐	☐
.5	Outdoor Air Temperature (prior to air handling unit):			
.1	Temperature indicated through BMS ----------	--- ^{O}C	☐	☐
.2	Actual measured temperature----------	--- ^{O}C	☐	☐
.6	Mixed Air Temperature at AHU:			
.1	Temperature indicated through BMS ----------	--- ^{O}C	☐	☐
.2	Actual measured temperature----------	--- ^{O}C	☐	☐
.7	Supply Air Temperature Discharge:			
.1	Temperature indicated through BMS ----------	--- ^{O}C	☐	☐
.2	Actual measured temperature----------	--- ^{O}C	☐	☐

.4 Air Flow Stations

.1	Supply Airflow			
.1	Airflow indicated at BMS ----------	---L/s	☐	☐
.2	Airflow shown on TAB report----------	---L/s	☐	☐
.2	Return Airflow			
.1	Airflow indicated at BMS ----------	---L/s	☐	☐
.2	Airflow shown on TAB report----------	---L/s	☐	☐

Project Name: New Police Building – Maidstone Saskatchewan	Project #: 29/2013
	Performance Verification #: PVM1.1

Performance Verification Test Form		*Section:*
System: **HVAC**	*Equipment:* **AHU-2 Central Air Handling**	*Room #:* **201**

.5 Coil and drain pan
- .1 Fill drain pan with water (during fan operation, with door closed)
  - .1 Water drains freely---------- ---------- ☐ ☐
  - .2 No leaks evident---------- ---------- ☐ ☐
  - .3 All water flows to drain---------- ---------- ☐ ☐

.6 System shut down (or unoccupied mode):
- .1 Set system to unoccupied mode ---------- ☐ ☐
- .2 AHU Supply Fan ramps down and "OFF"---------- ☐ ☐
- .3 AHU Return Fan ramps down and "OFF" ---------- ☐ ☐
- .4 ERV Supply Fan shuts down ---------- ☐ ☐
- .5 ERV Exhaust Fan shuts down ---------- ☐ ☐
- .6 Once fans are off AHU Mixed Air Dampers moves to "OPEN" ------ ☐ ☐
- .7 Once fans are off AHU Relief Damper moves to "CLOSED" -------- ☐ ☐
- .8 Once fans are off confirm AHU Economizer Dampers is "CLOSED" ☐ ☐
- .9 Heating Coil Valve "CLOSED" ---------- ☐ ☐
- .10 Cooling is "OFF" ---------- ☐ ☐
- .11 Coil Circ Pump (Current O/A temp above circulating setpoint) ------- ☐ ☐
  - .1 Temperature setpoint for circulating ---------- --- ^{O}C ☐ ☐
  - .2 Confirm Pump is off---------- ---------- ☐ ☐
  - .3 Adjust setpoint above O/A temperature --------- ---------- ☐ ☐
  - .4 Pump energizes and circulates---------- ---------- ☐ ☐
  - .5 Reset setpoint ---------- ---------- ☐ ☐
- .12 Coil Circ Pump (Current O/A temp below circulating setpoint) ------- ☐ ☐
  - .1 Temperature setpoint for circulating ---------- --- ^{O}C ☐ ☐
  - .2 Confirm Pump is on and circulating---------- ---------- ☐ ☐
  - .3 Adjust setpoint below O/A temperature --------- ---------- ☐ ☐
  - .4 Pump deenergizes---------- ---------- ☐ ☐
  - .5 Reset setpoint ---------- ---------- ☐ ☐

.7 System Start Up
- .1 Set system to unoccupied---------- ☐ ☐
  - .1 Confirm outside air damper is fully closed (ERV) ---------- ☐ ☐
  - .2 Confirm mixed air damper is fully open (AHU)---------- ☐ ☐
  - .3 Confirm exhaust air damper is fully closed (ERV)---------- ☐ ☐
  - .4 Confirm relief air damper is fully closed (AHU) ---------- ☐ ☐
  - .5 Confirm economizer O/A damper is fully closed (AHU) ---------- ☐ ☐
  - .6 All AHU Fans are Off (SF-2 and RF-2) --------- ---------- ☐ ☐
  - .7 ERV fans are Off (SF-3 and EF-9) ---------- ---------- ☐ ☐

Project Name: New Police Building – Maidstone Saskatchewan	Project #: 29/2013
	Performance Verification #: PVM1.1

Performance Verification Test Form		*Section:*
System: **HVAC**	*Equipment:* **AHU-2 Central Air Handling**	*Room #:* **201**

.2	Start-up system (Set to occupied)	☐	☐
.1	Verify ERV O/A damper opens and proves	☐	☐
.2	Verify ERV E/A damper opens and proves	☐	☐
.3	Verify AHU Economizer O/A damper remains closed	☐	☐
.4	Verify AHU Relief damper remains closed	☐	☐
.5	Verify ERV Exhaust fan starts	☐	☐
.6	Verify ERV Supply fan starts	☐	☐
.7	Verify AHU Supply fan starts and ramps to setpoint	☐	☐
.8	Verify AHU Return fan start and ramps to setpoint	☐	☐
.9	Verify mixed air and relief dampers modulate to occupied setpoint	☐	☐
.10	AHU controls heat/cool to meet discharge air temperature	☐	☐
.8	Static Pressure Control (space in cooling)		
.1	After system Start-up (performed above)	☐	☐
.1	Upon start-up, verify supply fans' volume control device operates in a smooth, steady manner to maintain duct static pressure at setpoint.	☐	☐
.2	Increase load conditions by raising discharge temperature setpoint to 21 deg.C.	☐	☐
.1	Verify fan volume increases as boxes open	☐	☐
.2	Verify duct static pressure remains in control	☐	☐
.3	Verify and record readings at static pressure sensing locations with certified manometer. Compare measurements with DDC readings.	☐	☐
.1	Measured Duct Static _____Pa	☐	☐
.2	BMS Duct Static Reading _____Pa	☐	☐
.3	Set discharge temperature setpoint to Auto		
.1	Verify fan volume decreases as terminal box dampers close.	☐	☐
.2	Verify duct static pressure remains in control	☐	☐
.4	Increase space temperature setpoints to 30 deg.C.		
.1	Verify VAV boxes close to minimum	☐	☐
.2	Verify duct static pressure remains in control	☐	☐
.3	Verify airflow decreases.	☐	☐
.5	Reset system to normal operation	☐	☐
.9	Discharge Air Control (OAT below free cooling – assumed to be 0 deg.C):		
.1	Turn off heat recovery wheel (fans to stay operating)	☐	☐
.2	Cooling is off	☐	☐
.3	Heating coil pump is off when heating valve is closed.	☐	☐
.4	Increase discharge air temperature setpoint	☐	☐
.5	Coil circulator energizes and BMS indicates correct status	☐	☐

Project Name: New Police Building – Maidstone Saskatchewan	Project #: 29/2013
	Performance Verification #: PVM1.1

Performance Verification Test Form		*Section:*
System: **HVAC**	*Equipment:* **AHU-2 Central Air Handling**	*Room #:* **201**

.6 Heating coil control valve controls smoothly and without hunting to maintain discharge air temperature setpoint ---------- ☐ ☐

.7 Economizer, heat wheel modulate smoothly to maintain mixed air setpoint ---------- ☐ ☐

.1 Verify discharge air temperature setpoint can be adjusted from workstation. ---------- ---------- ☐ ☐

.2 Reset discharge air temperature to Auto--------- ---------- ☐ ☐

.10 Discharge Air Control (OAT above 21 deg.C.):

.1 Set OAT to 25 Deg.C. if currently above 21 Deg.C. ---------- ☐ ☐

.2 Heating coil valve is closed ---------- ☐ ☐

.3 Coil circ pump is off. ---------- ☐ ☐

.4 Cooling coil control valve controls smoothly and without hunting to maintain a cold duct discharge air temperature setpoint ---------- ☐ ☐

.5 Remove OAT override. ---------- ☐ ☐

.11 Economizer Control :

.1 Set mixed air setpoint to a value that ensures mixing at time of test--- ☐ ☐

.1 Record setpoint override Value ---------- ---------- OC ☐ ☐

.2 Record OAT value at time of override---------- ---------- OC ☐ ☐

.2 Heat Wheel and by-pass dampers operate to transfer energy between relief and outdoor air ---------- ☐ ☐

.3 Economizer dampers modulate smoothly to maintain mixed air setpoint ---------- ☐ ☐

.4 Coil circ pump is off. ---------- ☐ ☐

.5 Set mixed air setpoint equal to outdoor air ---------- ☐ ☐

.6 Economizer modulates to free cooling, heat wheel stops ---------- ☐ ☐

.7 Remove temperature overrides, unit returns to normal operation ------ ☐ ☐

4. Failure Mode Testing Procedures

.1 Freeze Stat:

.1 Manipulate control to simulate freezestat.

.1 Freeze Setpoint (3 deg.C.)---------- ---------- ☐ ☐

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

.3 Return Fan Off---------- ---------- ☐ ☐

.4 ERV Fans Off---------- ---------- ☐ ☐

.5 Heating Valve at 100% ---------- ---------- ☐ ☐

.6 Coil Circ Pump On ---------- ---------- ☐ ☐

.7 Outdoor Air Damper at 0% ---------- ---------- ☐ ☐

.8 Relief Damper at 0% ---------- ---------- ☐ ☐

.9 Mixed Damper at 100%---------- ---------- ☐ ☐

.10 Cooling Valve at 0% ---------- ---------- ☐ ☐

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

.12 Alarm printout provided ---------- ---------- ☐ ☐

Project Name:	Project #:	29/2013
New Police Building – Maidstone Saskatchewan	Performance Verification #:	PVM1.1

Performance Verification Test Form		*Section:*
System: **HVAC**	*Equipment:* **AHU-2 Central Air Handling**	*Room #:* **201**

.2 Reset Freeze Alarm
- .1 Confirm system starts under control ☐ ☐
- .2 Banner shows return to normal ☐ ☐

.2 Supply Fan Failure:

.1 Switch Power Off at Disconnect
- .1 Critical Alarm ☐ ☐
- .2 Critical Alarm at printer and banner ☐ ☐
- .3 Heating Valve at 100% ☐ ☐
- .4 Coil Circ Pump Off ☐ ☐
- .5 Outdoor Air Damper at 0% ☐ ☐
- .6 Relief Damper at 0% ☐ ☐
- .7 Mixed Damper at 100% ☐ ☐
- .8 Cooling Valve at 0% ☐ ☐
- .9 Return fan stops ☐ ☐
- .10 ERV stops ☐ ☐

.2 Turn Power On
- .1 Fan system starts ☐ ☐
- .2 Banner show return to normal. ☐ ☐

.3 Return Fan Failure:

.1 Switch Power Off at Disconnect
- .1 Critical Alarm ☐ ☐
- .2 Critical Alarm at printer and banner ☐ ☐
- .3 Heating Valve at 100% ☐ ☐
- .4 Coil Circ Pump Off ☐ ☐
- .5 Outdoor Air Damper at 0% ☐ ☐
- .6 Relief Damper at 0% ☐ ☐
- .7 Mixed Damper at 100% ☐ ☐
- .8 Cooling Valve at 0% ☐ ☐
- .9 Supply fan stops ☐ ☐
- .10 ERV stops ☐ ☐

.2 Turn Power On
- .1 Fan system starts ☐ ☐
- .2 Banner show return to normal. ☐ ☐

.4 Heating Coil Circ Pump Failure

.1 Switch Power Off at Disconnect
- .1 Pump goes off ☐ ☐
- .2 No change in system operation ☐ ☐
- .3 Alarm message at Operator Work Station ☐ ☐
- .4 Alarm printout provided ☐ ☐

Project Name: New Police Building – Maidstone Saskatchewan	Project #: 29/2013
	Performance Verification #: PVM1.1

Performance Verification Test Form		*Section:*
System: **HVAC**	*Equipment:* **AHU-2 Central Air Handling**	*Room #:* **201**

.2 Turn Power On
- .1 Pump starts ☐ ☐
- .2 Banner show return to normal. ☐ ☐

.5 High Supply Static:

- .1 Supply air static high limit _____kPa
- .2 Set high limit below static
  - .1 Alarm at Operator Work Station ☐ ☐
  - .2 Alarm printout provided ☐ ☐
  - .3 Heating Valve remains operational ☐ ☐
  - .4 Coil Circ Pump remains operational ☐ ☐
  - .5 Outdoor Air Damper at 0% ☐ ☐
  - .6 Relief Damper at 0% ☐ ☐
  - .7 Mixed Damper at 100% ☐ ☐
  - .8 Cooling Valve at 0% ☐ ☐
  - .9 Supply fan stops ☐ ☐
  - .10 Return fan stops ☐ ☐
  - .11 HRV stops ☐ ☐
- .3 Reset static high limit
  - .1 Fan system remains off ☐ ☐
- .4 Command Fan system on
  - .1 Confirm system starts under control ☐ ☐
  - .2 Banner shows return to normal ☐ ☐

.6 High Relief Static:

- .1 Relief air static high limit _____kPa
- .2 Set high limit below static
  - .1 Alarm at Operator Work Station ☐ ☐
  - .2 Alarm printout provided ☐ ☐
  - .3 Heating Valve remains operational ☐ ☐
  - .4 Coil Circ Pump remains operational ☐ ☐
  - .5 Outdoor Air Damper at 0% ☐ ☐
  - .6 Relief Damper at 0% ☐ ☐
  - .7 Mixed Damper at 100% ☐ ☐
  - .8 Cooling Valve at 0% ☐ ☐
  - .9 Supply fan stops ☐ ☐
  - .10 Return fan stops ☐ ☐
  - .11 HRV stops ☐ ☐
- .3 Reset static high limit
  - .1 Fan system remains off ☐ ☐
- .4 Command Fan system on
  - .1 Confirm system starts under control ☐ ☐
  - .2 Banner shows return to normal ☐ ☐

Project Name:	Project #:	29/2013
New Police Building – Maidstone Saskatchewan	Performance Verification #:	PVM1.1

Performance Verification Test Form		*Section:*
System: **HVAC**	*Equipment:* **AHU-2 Central Air Handling**	*Room #:* **201**

.7 High Intake Static:

.1 Intake air static high limit _____kPa ----------

.2 Set high limit above static

.1	Alarm at Operator Work Station ---------- ----------	☐	☐
.2	Alarm printout provided ---------- ----------	☐	☐
.3	Heating Valve remains operational ---------- ----------	☐	☐
.4	Coil Circ Pump remains operational ---------- ----------	☐	☐
.5	Outdoor Air Damper at 0% ---------- ----------	☐	☐
.6	Relief Damper at 0% ---------- ----------	☐	☐
.7	Mixed Damper at 100%---------- ----------	☐	☐
.8	Cooling Valve at 0% ---------- ----------	☐	☐
.9	Supply fan stops ---------- ----------	☐	☐
.10	Return fan stops ---------- ----------	☐	☐
.11	HRV stops ---------- ----------	☐	☐

.3 Reset static high limit

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

.4 Command Fan system on

.1	Confirm system starts under control ---------- ----------	☐	☐
.2	Banner shows return to normal ---------- ----------	☐	☐

.8 Failure of ERV:

.1 Fail ERV

.1	Alarm at Operator Work Station ---------- ----------	☐	☐
.2	Alarm printout provided ---------- ----------	☐	☐
.3	Heating Valve remains operational ---------- ----------	☐	☐
.4	Coil Circ Pump remains operational ---------- ----------	☐	☐
.5	Outdoor Air Damper, Relief Air Damper and Mixing Damper modulate to maintain mixed air temeprature ----------		
.6	Cooling Valve remains operational---------- ----------	☐	☐
.7	Supply fan remains operational ---------- ----------	☐	☐
.8	Return fan remains operational---------- ----------	☐	☐

.2 Reset ERV

.1	Fan system reverts to normal control---------- ----------	☐	☐

.3 Command Fan system on

.1	Confirm system starts under control ---------- ----------	☐	☐
.2	Banner shows return to normal ---------- ----------	☐	☐

Project Name:	Project #:	29/2013
New Police Building – Maidstone Saskatchewan	Performance Verification #:	PVM1.1

Performance Verification Test Form		*Section:*
System: **HVAC**	*Equipment:* **AHU-2 Central Air Handling**	*Room #:* **201**

Comments

SIGN-OFFS

Contractor: _____ Date:_____

Engineer:_____ Date:_____

CxA:_____ Date:_____

Project Name:	Project #:	29/2013
New Police Building – Maidstone Saskatchewan	Performance Verification #:	PVM2.1

Performance Verification Test Form		*Section:*
System: **HVAC**	*Equipment:* **VAV-101 and Infloor Valve**	*Room #:* **Room**

1. TEST PURPOSE

.1 To test a sample of air terminal devices and ensure that they operate as intended during normal and abnormal operating conditions.

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

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

.4 To verify that the point-to-point commissioning carried out by the contractor was completed and successful based on a sampling of the boxes.

2. Functional Performance Tests

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

.2 Occupied/Unoccupied Schedule

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

.3 Calibration of field temperature devices.

			C	E
.1	Space Temperature:	----------		
.1	Temperature indicated through BMS ----------	---------- OC	☐	☐
.2	Actual measured temperature----------	---------- OC	☐	☐
.2	Discharge temperature:			
.1	Temperature indicated through BMS ----------	---------- OC	☐	☐
.2	Actual measured temperature----------	---------- OC	☐	☐

.4 Air Flows

			C	E
.1	Maximum Airflow			
.1	Maximum airflow indicated at BMS----------	----------L/s	☐	☐
.2	Maximum airflow shown on TAB report -------	----------L/s	☐	☐
.2	Minimum Airflow			
.1	Minimum airflow indicated at BMS ----------	----------L/s	☐	☐
.2	Minimum airflow shown on TAB report--------	----------L/s	☐	☐

.5 Cooling Mode Verification (start without mechanical cooling)

.1	Turn space temperature setpoint to actual space temperature			
.1	Box air flow goes to minimum ----------	----------	☐	☐
.2	Heating Valve is closed----------	----------	☐	☐
.3	Reheat Valve modulating to meet space requirement----------		☐	☐

Project Name: New Police Building – Maidstone Saskatchewan	Project #: 29/2013
	Performance Verification #: PVM2.1

Performance Verification Test Form		*Section:*
System: **HVAC**	*Equipment:* **VAV-101 and Infloor Valve**	*Room #:* **Room**

.2 Turn space temperature setpoint down to 15 deg.C.

.1	Reheat Valve modulates to maintain discharge air at setpoint -----	☐	☐
.2	Box valve modulates to full flow ---------- ----------	☐	☐
.3	Heating Valve is closed---------- ----------	☐	☐

.3 Enable mechanical cooling

.1	Reheat Valve closes ---------- ----------	☐	☐
.2	Box valve modulates to suit space temperature ----------	☐	☐
.3	Heating Valve is closed---------- ----------	☐	☐

.6 Heating Mode Verification

.1 Turn space temperature setpoint to actual space temperature

.1	Box air flow goes to minimum ---------- ----------	☐	☐
.2	Heating Valve is closed---------- ----------	☐	☐
.3	Reheat Valve modulating to meet space requirement----------	☐	☐

.2 Turn space temperature setpoint up to Maximum

.1	Box air flow stays at minimum---------- ----------	☐	☐
.2	Heating Valve for infloor opens---------- ----------	☐	☐
.3	Reheat Valve modulates to meet temperature discharge (below room temperature)---------- ----------	☐	☐

.3 Fail infloor valve (close)

.1	Box air flow stays at minimum---------- ----------	☐	☐
.2	Reheat Valve modulates to meet space temperature ----------	☐	☐

.4 Reset space setpoint

.1	Confirm ---------- ----------	☐	☐

Comments

SIGN-OFFS

Contractor: _____ Date:_____

Engineer:_____ Date:_____

CxA:_____ Date:_____

Project Name: Maidstone Detachment	Project #: 29/2013
	Performance Verification #: PVM6.2

Performance Verification Test Form		*Section:*
System: **HVAC**	*Equipment:* **Exhaust Fan EF-2 and EF-3**	*Room #:* **Room 148**

1. TEST PURPOSE

.1 To test installation of the exhaust fan to ensure that the system and all associated sub-systems operate as intended during normal and abnormal operating conditions.

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

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

2. Test Prerequisites

		C	E
.1	Mechanical:		
.1	As-built drawings are complete and have been submitted	☐	☐
.2	All component verifications are complete and reviewed	☐	☐
.3	Testing, adjusting and balancing (TAB) is complete for all associated systems.	☐	☐
.4	TAB report is complete and reviewed.	☐	☐
.2	Controls:		
.1	As-built points lists have been submitted and reviewed.	☐	☐
.2	All associated controls have been verified point to point including: inputs, outputs, valves, actuators, interlocks, time delays, failure modes, restart modes, schedules, reset schedules, graphics and trending.	☐	☐
.3	All sensors/devices have been calibrated.	☐	☐
.4	All sequences of operation at both extremes and at midpoints have been verified.	☐	☐
.5	All manual overrides and jumpers have been removed to allow for automatic operation.	☐	☐
.6	Trending within the BMS is operational.	☐	☐
.3	Equipment		
.1	Turn fan off manually	☐	☐
.2	Verify system is complete and clean	☐	☐
.3	Verify belt alignment	☐	☐
.4	Verify fan rotation	☐	☐
.5	Verify back draft damper installation	☐	☐
.6	Verify installation of access doors	☐	☐
.7	Set fan to Auto	☐	☐
.4	Gas Setpoints		
.1	Record CO lower limit setpoint PPM	☐	☐
.2	Record CO upper limit setpoint PPM	☐	☐
.3	Record CO high level alarm (10 min) PPM	☐	☐
.4	Record CO high level alarm (60 min) PPM	☐	☐
.5	Record NOx lower limit setpoint PPM	☐	☐
.6	Record NOx upper limit setpoint PPM	☐	☐
.7	Record NOx high level alarm (10 min) PPM	☐	☐

Project Name: Maidstone Detachment	Project #: 29/2013
	Performance Verification #: PVM6.2

Performance Verification Test Form		*Section:*
System: **HVAC**	*Equipment:* **Exhaust Fan EF-2 and EF-3**	*Room #:* **Room 148**

.8 Record NOx high level alarm (60 min) PPM ---------- ☐ ☐

3. Operational Testing

		C	E
.1	Operation of EF-2		
.1	Ensure fan is on	☐	☐
.2	Verify vibration isolators appear to be functioning	☐	☐
.3	Noise generated is within reason in space	☐	☐
.2	Operation of EF-3	C	E
.1	Ensure fan is on	☐	☐
.2	Verify vibration isolators appear to be functioning	☐	☐
.3	Noise generated is within reason in space	☐	☐

4. Functional Testing

.1	Schedule (ensure no gas detected in space)		
.1	System has a BMS occupied schedule set to 24 hour operation	☐	☐
.2	EF-2 is on	☐	☐
.3	Verify BMS shows fan motor status as “ON”	☐	☐
.4	Verify outside air damper is at open to minimum	☐	☐
.5	Verify BMS shows damper position	☐	☐
.6	EF-3 is off	☐	☐
.7	Verify BMS shows fan motor status as “OFF”	☐	☐
.8	Adjust schedule to unoccupied	☐	☐
.9	Verify Fan EF-2 denergizes	☐	☐
.10	Verify BMS shows fan motor status as “OFF”	☐	☐
.11	Verify outside air damper closes	☐	☐
.12	Verify BMS shows damper closed	☐	☐
.13	Reset Schedule	☐	☐
.14	Verify fan EF-2 re-energizes	☐	☐
.15	Verify BMS shows fan status as “ON”	☐	☐
.16	Verify outside air damper opens to minimum	☐	☐
.17	Verify BMS shows damper position	☐	☐
.2	Gas Detection (during occupied mode)		
.1	EF-2 is on	☐	☐
.2	Start vehicle in space (or apply test gas to sensors)	☐	☐
.3	Sensor detects gas	☐	☐
.4	When gas rises above upper limit, record gas level/type PPM -------	☐	☐
.5	EF-3 energizes	☐	☐
.6	Verify BMS shows fan motor status as “ON”	☐	☐
.7	Verify outside air damper fully opens	☐	☐
.8	Verify BMS shows damper fully open	☐	☐

Project Name: Maidstone Detachment	Project #: 29/2013
	Performance Verification #: PVM6.2

Performance Verification Test Form		*Section:*
System: **HVAC**	*Equipment:* **Exhaust Fan EF-2 and EF-3**	*Room #:* **Room 148**

.9 Remove CO source ---------- ☐ ☐
.10 When gas drops below low limit, record gas level/type PPM ------- ☐ ☐
.11 EF-3 turns off ---------- ☐ ☐
.12 Verify BMS shows fan motor status as "OFF" ---------- ☐ ☐
.13 Verify outside air damper closes to minimum position ---------- ☐ ☐
.14 Verify BMS shows damper position ---------- ☐ ☐

.3 Gas Detection (during unoccupied mode)
.1 EF-2 and EF-3 are off and damper is closed ---------- ☐ ☐
.2 Start vehicle in space (or apply test gas to sensors) ---------- ☐ ☐
.3 Sensor detects gas ---------- ☐ ☐
.4 EF-2 energizes ---------- ☐ ☐
.5 Verify BMS shows fan motor status as "ON" ---------- ☐ ☐
.6 Verify outside air damper opens to minimum ---------- ☐ ☐
.7 Verify BMS shows damper fully open ---------- ☐ ☐
.8 When gas rises above upper limit, record gas level/type PPM ------- ☐ ☐
.9 EF-3 energizes ---------- ☐ ☐
.10 Verify BMS shows fan motor status as "ON" ---------- ☐ ☐
.11 Verify outside air damper fully opens ---------- ☐ ☐
.12 Verify BMS shows damper fully open ---------- ☐ ☐
.13 Remove CO source ---------- ☐ ☐
.14 When gas drops below low limit, record gas level/type PPM ------- ☐ ☐
.15 EF-3 turns off ---------- ☐ ☐
.16 Verify BMS shows fan motor status as "OFF" ---------- ☐ ☐
.17 Verify outside air damper closes to minimum position ---------- ☐ ☐
.18 Verify BMS shows damper position ---------- ☐ ☐
.19 When gas drops to zero ---------- ☐ ☐
.20 EF-2 turns off ---------- ☐ ☐
.21 Verify BMS shows fan motor status as "OFF" ---------- ☐ ☐
.22 Verify outside air damper closes ---------- ☐ ☐
.23 Verify BMS shows damper position ---------- ☐ ☐

5. Failure Modes

.1 Motor Failure EF-2
.1 Verify EF-2 is on ---------- ☐ ☐
.2 Cut power to motor ---------- ☐ ☐
.3 Verify alarm registers at BMS ---------- ☐ ☐
.4 Verify EF-3 energizes ---------- ☐ ☐
.5 Verify dampers stays at minimum.
.6 Restore power to EF-2 ---------- ☐ ☐
.7 EF-2 resumes control ---------- ☐ ☐

Project Name: Maidstone Detachment	Project #: 29/2013
	Performance Verification #: PVM6.2

Performance Verification Test Form		*Section:*
System: **HVAC**	*Equipment:* **Exhaust Fan EF-2 and EF-3**	*Room #:* **Room 148**

.8 EF-3 deenergizes ☐ ☐
.9 Acknowledge Alarm ☐ ☐

.2 Motor Failure EF-3
.1 Cut power to motor (EF-3) ☐ ☐
.2 Verify EF-2 is on ☐ ☐
.3 Apply gas to trip high limit ☐ ☐
.4 Verify EMCS calls for EF-3 to energize ☐ ☐
.5 Verify alarm registers at BMS ☐ ☐
.6 Verify EF-2 remains operating ☐ ☐
.7 Verify damper stays at minimum.
.8 Restore power to EF-3 ☐ ☐
.9 EF-3 resumes control ☐ ☐
.10 Acknowledge Alarm ☐ ☐

Comments

SIGN-OFFS

Contractor: _____ Date:_____

Engineer: _____ Date:_____

CxA: _____ Date:_____

Ritenburg & Associates Ltd.
Consulting Electrical Engineers

Performance Checks
CDP PANELBOARDS

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

Activities, Checks and Tests by the Electrical Contractor

- ☐ Verify the products used meet the requirements of the electrical specifications and complies with the shop drawings.
- ☐ Perform the installation and performance tests according to the Canadian Electrical Code, manufacturer's recommendations and Specifications.
- ☐ Confirm that the panelboard has been securely fastened and mounted on unistrut and / or plywood backboards (where required by the specifications).
- ☐ Confirm that all feeder and branch circuit conductors are properly sized, terminated with the proper torque, identified as required by the Specifications. Ensure that the panelboard, panelboard feeders & branch wiring have been Megger tested. Panel phase and branch wiring colour & circuit number must correspond.
- ☐ Ensure that trip rating of each breaker have been engraved on handle.
- ☐ Mark all lugs and terminals that have been torqued with red lacquer or marker.
- ☐ Ensure that the branch circuits and their breakers are correctly matched.
- ☐ Ensure that the panelboards lamecoid tag conforms to the drawings & Specification.
- ☐ Ensure that all sections of the Contractor Start-up and Testing Sheet(s) are signed or initialed and dated.
- ☐ Complete record drawings.
- ☐ Conduct Owner training on the operation and maintenance of the panelboards.
- ☐ Ensure that all parts of this commissioning form and performance checks have been completed. Enter into the notes areas of any unfinished work or problems encountered during installation or commissioning.

Notes: _____

_____

_____

_____

Contractor: Signature: _____ Date: _____

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

Ritenburg & Associates Ltd.
Consulting Electrical Engineers

Performance Checks
Data/Voice System

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

Activities, Checks and Tests by the Electrical Contractor

- ☐ Verify the products used meet the requirements of the specifications and comply with the shop drawings.
- ☐ Perform the installation in accordance with the manufacturer's recommendations and in accordance with the specifications and drawings.
- ☐ Conduct testing of the cabling system in accordance the standards outlined in the specifications.
- ☐ Confirm termination of all vertical and horizontal copper cable.
- ☐ Confirm termination of all fibre cable.
- ☐ All fibre and copper cables are provided with service loops at the equipment racks and BIX blocks.
- ☐ In all wall or pac pole drops, a 300mm cable slack is provided before entering wall or pac pole suspended in the ceiling.
- ☐ Confirm identification of equipment and all tagging is completed in accordance with the specifications and Owner's requirements.
- ☐ Confirm management of all vertical and horizontal cables, including installation of waterfalls at equipment racks.
- ☐ Confirm velcor straps are used. Cable ties are unacceptable.
- ☐ Confirm grounding within the Data/Com Rooms in accordance with the requirements of the Canadian Electrical Code, specifications and drawings, including bonding of the equipment racks, conduit stubs and cable trays.
- ☐ Confirm clearances at the equipment racks.
- ☐ Each equipment racks is supplied with a floor mounting base, fibre and copper patch panels, cable managers, power bar, and shelves.
- ☐ Confirm equipment racks are secured to floor.
- ☐ Confirm power to server equipment is energized and polarity of all wiring devices is checked.
- ☐ Supply and turn-over to Owner the fibre and copper patch cords in the quantities, types and lengths noted in the specifications.
- ☐ Submit cable test reports, include copies or CD disk in the Operating and Maintenance Manual.
- ☐ Conduct Owner training on the layout and installation of this system.
- ☐ Ensure that all parts of this commissioning form and performance checks have been completed. Enter into the notes areas of any unfinished work or problems encountered during installation or commissioning.

Notes: _____

_____

Contractor: Signature: _____ Date: _____

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

Ritenburg & Associates Ltd.
Consulting Electrical Engineers

Performance Checks
DISCONNECT SWITCHES F/NF

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

Activities, Checks and Tests by the Electrical Contractor

- ☐ Verify the products used meet the requirements of the electrical specifications and complies with the shop drawings.
- ☐ Perform the installation and performance tests according to the Canadian Electrical Code, manufacturer's recommendations and Specifications.
- ☐ Confirm that the disconnect switches has been securely fastened.
- ☐ Confirm that all feeder and branch circuit conductors are properly sized, terminated with the proper torque, identified as required by the Specifications.
- ☐ Mark all lugs and terminals that have been torqued with red lacquer or marker.
- ☐ Ensure that the branch circuits and their fuses are correctly matched.
- ☐ Ensure that the disconnect switches lamecoid tags conforms to the drawings & Specification.
- ☐ Ensure that all sections of the Contractor Start-up and Testing Sheet(s) are signed or initialed and dated.
- ☐ Complete record drawings.
- ☐ Conduct Owner training on the operation and maintenance of the panelboards.
- ☐ Ensure that all parts of this commissioning form and performance checks have been completed. Enter into the notes areas of any unfinished work or problems encountered during installation or commissioning.

Notes: _____

_____

_____

_____

Contractor: Signature: _____ Date: _____

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

Ritenburg & Associates Ltd.
Consulting Electrical Engineers

Performance Checks
EXIT AND EMERGENCY LIGHTING

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

Activities, Checks and Tests by the Electrical Contractor

- ☐ Verify the products used meet the requirements of the electrical specifications and complies with the shop drawings (if provided).
- ☐ The installation is completed in accordance with the Canadian Electrical Code, specifications and manufacturer's recommendations.
- ☐ Confirm that all conductors for supply and control are properly sized, terminated with proper torque.
- ☐ Confirm exit lighting clearly indicate the means of egress and are visible in all public areas.
- ☐ Confirm exit light fixtures are connected to a dedicated emergency circuit as indicated on the floor plans.
- ☐ Ensure that exit light circuit breaker is locked in on position.
- ☐ Confirm complete illumination of the EXIT signs.
- ☐ Perform functional & other tests (as applicable) required by the Specifications, the Manufacturer or the Design Consultant.
- ☐ Conduct Owner training in regards to the operation and maintenance of the emergency exit lighting.
- ☐ Ensure that all parts of this commissioning form and performance checks have been completed. Enter into the notes areas of any unfinished work or problems encountered during installation or commissioning.

Notes: _____

_____

_____

_____

Contractor: Signature: _____ Date: _____

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

Ritenburg & Associates Ltd.
Consulting Electrical Engineers

Performance Checks
FIRE ALARM

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

Activities, Checks and Tests by the Electrical Contractor

- ☐ Verify the products used meet the requirements of the electrical specifications and complies with the shop drawings.
- ☐ Complete installation and wiring of all components of the fire alarm system in accordance with the manufacturer's recommendations, specifications, and in accordance with the National Standard of Canada/Underwriters' Laboratory of Canada Standards CAN/ULC-S524-M06 "Standard for the Installation of Fire Alarm Systems".
- ☐ Complete the inspection and testing of the fire alarm system in accordance with the National Standard of Canada/Underwriters' Laboratory of Canada Standards CAN/ULC-S536-04 "Standard for the Inspection and Testing of Fire Alarm Systems".
- ☐ Complete the verification of the fire alarm system in accordance with the National Standard of Canada/Underwriters' Laboratory of Canada Standards CAN/ULC-S537-04 "Standard for the Verification of Fire Alarm System Installations".
- ☐ Confirm fire alarm system connected to a dedicated circuit with breaker lock-on device on branch breaker.
- ☐ Fire alarm control panel is fed with mineral insulated cable, or is provided with 1-hour rating on feeder to the fire alarm panel.
- ☐ Initiate alarm from each breakglass station.
- ☐ Initiate an alarm from each smoke detector and heat detector by initiating an alarm using a magnet, artificial smoke, or by jumping out device in case of fixed temperature heat detectors. The method to activate a detector shall be confirmed by the manufacturer's verification agent.
- ☐ Initiate an alarm from the sprinkler system by testing flow within a floor control zone valve.
- ☐ Conduct an open circuit tests at various points on the Class B tolerant loops. Initiate an alarm from various points on the open circuit.
- ☐ Initiate an alarm to check supervisory and control functions at the fire alarm control and annunciator panel.
- ☐ Check correctness of identification of annunciator zones and device mapping at the annunciator.
- ☐ Initiate one test alarm to central supervisory station after notice of test is given.
- ☐ Check operation of all auxiliary contacts and devices, and verify that auxiliary control door holders, fan shut-down, elevator homing, etc, is fully operational.
- ☐ Perform functional and other tests (as applicable) as required by the Specifications, the Manufacturer or the Consultant.
- ☐ Check operation of fire alarm audible and visual signal appliances in public areas.
- ☐ Record sound levels for fire alarm signal devices within public areas.
- ☐ Confirm signal to the municipal fire department in accordance with the requirements of the 2010 National Building Code.
- ☐ Submit manufacturer's fire alarm certificate of verification and fire alarm test report.
- ☐ Confirm spared devices are provided to the owner as required by the Specifications.
- ☐ Complete record drawings.

- ☐ Conduct Owner training on the operation and maintenance of the fire alarm system.
- ☐ Ensure that all parts of this commissioning form and performance checks have been completed. Enter into notes areas of any unfinished areas or problems encountered during installation or commissioning.

Notes: _____

_____

_____

_____

Contractor: Signature: _____ Date: _____

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

Ritenburg & Associates Ltd.
Consulting Electrical Engineers

Performance Checks
GROUNDING

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

Activities, Checks and Tests by the Electrical Contractor

- ☐ Verify the products used meet the requirements of the electrical specifications and complies with the shop drawings (if provided).
- ☐ Perform tests that are required by the Canadian Electrical Code, ANSI/NETA standard's, manufacturer's recommendations and Specifications.
- ☐ All electrical equipment and wiring grounded in accordance with the Canadian Electrical Code, and local inspection authority's rules and regulations.
- ☐ The ground bus in each switchboard, transformer, motor control centre, etc., connected to the grounding network by two AWG #3/0 bare copper conductors.
- ☐ All motors with flexible connections have separate insulated ground wire run bridging the flexible connections with the ground wire run back to the nearest junction box or motor control centre.
- ☐ Exposed copper cleaned to a bright surface, and finished with two coats of clean, insulating varnish.
- ☐ Where bonds are covered with soil, the conductors are to be coated with anti-corrosion compound "Kopr-Shield" (Thomas & Betts Co.) before compression connector is applied. All bonding done with 'C' tap and lug compression connectors.
- ☐ All grounding connectors, conductor and terminations checked and approved by the Consultant prior to concealment by fill or architectural finishes.
- ☐ The main grounding electrode or system shall have a fall-of-potential test. Refer to IEEE Standard 81. Five ohms is the maximum allowable resistance between the main grounding electrode and ground.
- ☐ Determine resistance between main grounding system and all major electrical equipment frames, system neutral and any floating neutrals. Any resistance values greater than 0.5 ohm shall be examined.
- ☐ Ensure that all parts of this commissioning form and performance checks have been completed. Enter into the notes areas of any unfinished work or problems encountered during installation or commissioning.

Notes: _____

_____

_____

_____

Contractor: Signature: _____ Date: _____

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

Ritenburg & Associates Ltd.
Consulting Electrical Engineers

Performance Checks
LIGHTING

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

Activities, Checks and Tests by the Electrical Contractor

- ☐ Verify the products used meet the requirements of the electrical specifications and complies with the shop drawings.
- ☐ Perform the installation and performance tests according to the Canadian Electrical Code, specifications, and manufacturer's recommendations.
- ☐ Confirm that all circuit conductors for supply and control are properly sized, terminated with proper torque, identified as required by the Specifications.
- ☐ Confirm proper ballast and voltage ratings are installed within the fixtures.
- ☐ Confirm correct lamps are provided for the fixture in accordance with the specifications and manufacturer's requirements. Ensure lamp colour temperatures and colour rendering index (CRI) are in accordance with the requirements of the specifications.
- ☐ Confirm fixtures are clean, proper fit of lenses and fixture trims.
- ☐ Confirm installation of switches, occupancy sensors and photocells.
- ☐ Adjust coverage and time delay-off to all wall and ceiling occupancy sensors.
- ☐ Complete record drawings for layout of lighting, circuit identification and control.
- ☐ Conduct Owner training in regards to the operating and maintenance of lighting fixtures, including the type of lamps installed, lamp and ballast replacement, ballast warranties, and general maintenance of the fixtures.
- ☐ Ensure that all parts of this commissioning form and performance checks have been completed. Enter into the notes areas of any unfinished work or problems encountered during installation or commissioning.

Notes: _____

_____

_____

_____

Contractor: Signature: _____ Date: _____

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

Ritenburg & Associates Ltd.
Consulting Electrical Engineers

Performance Checks
LOW VOLTAGE LIGHTING

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

Activities, Checks and Tests by the Electrical Contractor

- ☐ Verify the products used meet the requirements of the electrical Specification and complies with the shop drawings.
- ☐ Perform the installation and performance tests according to the Canadian Electrical Code, ANSI/NETA standards, manufacturer's recommendations and Specification.
- ☐ Confirm that all line voltage and class II wiring for supply and control are properly sized, terminated, identified as required by the specifications.
- ☐ Day-light sensors installed for interior perimeter lighting.
- ☐ Exterior photo-sensors installed for exterior lighting.
- ☐ Low voltage power packs are installed and locations marked on as-built drawings.
- ☐ Verify and adjust photo control sensitivity for interior and exterior lighting.
- ☐ Occupancy sensors interconnected to switches as shown on drawings.
- ☐ Provide record of occupancy sensor and photocell programming.
- ☐ Aim and adjust photo controls to optimize function.
- ☐ Conduct Owner training in regards to the operation, programming and maintenance of the lighting control system.
- ☐ Complete record drawings.
- ☐ Ensure that all parts of this commissioning form and performance checks have been completed. Enter into the notes areas of any unfinished work or problems encountered during installation or commissioning.

Notes: _____

_____

_____

_____

Contractor: Signature: _____ Date: _____

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

Ritenburg & Associates Ltd.
Consulting Electrical Engineers

Performance Checks
OVERCURRENT PROTECTIVE DEVICES

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

Activities, Checks and Tests by the Electrical Contractor

- ☐ Verify the products used meet the requirements of the electrical Specification and complies with the shop drawings.
- ☐ Perform the installation and performance tests according to the Canadian Electrical Code, ANSI/NETA standards, manufacturer's recommendations and Specification.
- ☐ Confirm that the overcurrent protection device is correctly sized and has been securely fastened.
- ☐ Confirm that all supply and load feeders are properly sized, terminated with the proper torque, identified as required by the Specification. Ensure that the supply and load feeders have been Megger tested.
- ☐ Mark all lugs and terminals that have been torqued with red lacquer or marker.
- ☐ Ensure that all sections of the Contractor Start-up and Testing Sheet(s) are signed or initialed and dated.
- ☐ Complete record drawings
- ☐ Conduct Owner training on the operation and maintenance of the overcurrent protective equipment.
- ☐ Ensure that all parts of this commissioning form and performance checks have been completed. Enter into the notes areas of any unfinished work or problems encountered during installation or commissioning.

Notes: _____

_____

_____

_____

Contractor: Signature: _____ Date: _____

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

Ritenburg & Associates Ltd.
Consulting Electrical Engineers

Performance Checks
BREAKER PANELBOARDS

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

Activities, Checks and Tests by the Electrical Contractor

- ☐ Verify the products used meet the requirements of the electrical specifications and complies with the shop drawings.
- ☐ Perform the installation and performance tests according to the Canadian Electrical Code, manufacturer's recommendations and Specifications.
- ☐ Confirm that the panelboard has been securely fastened and mounted on unistrut and / or plywood backboards (where required by the specifications).
- ☐ Ensure panel interior is at the correct depth from the tub or wall face. Confirm that the nuts securing the interior to the tub bolts / tub are properly tightened.
- ☐ Confirm that all feeder and branch circuit conductors are properly sized, terminated with the proper torque, identified as required by the Specifications. Ensure that the panelboard, panelboard feeders & branch wiring have been Megger tested. Panel phase and branch wiring colour & circuit number must correspond.
- ☐ Mark all lugs and terminals that have been torqued with red lacquer or marker.
- ☐ Ensure that the branch circuits and their breakers are correctly matched.
- ☐ Ensure that the panelboards lamecoid tag conforms to the drawings & Specification.
- ☐ Insert final typewritten panel directory and provide breaker lock-on devices as per Specification.
- ☐ Operate the PTT test feature if GFCI breakers are in the panelboard.
- ☐ Ensure that all sections of the Contractor Start-up and Testing Sheet(s) are signed or initialed and dated.
- ☐ Complete record drawings.
- ☐ Conduct Owner training on the operation and maintenance of the panelboards.
- ☐ Ensure that all parts of this commissioning form and performance checks have been completed. Enter into the notes areas of any unfinished work or problems encountered during installation or commissioning.

Notes: _____

_____

_____

_____

Contractor: Signature: _____ Date: _____

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

Ritenburg & Associates Ltd.
Consulting Electrical Engineers

Performance Checks
WIRING DEVICES

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

Activities, Checks and Tests by the Electrical Contractor

- ☐ Verify the products used meet the requirements of the electrical specifications and complies with the shop drawings.
- ☐ Perform the installation and performance tests according to the Canadian Electrical Code, manufacturer's recommendations and Specifications.
- ☐ Test receptacles for polarity.
- ☐ Test GFCI Receptacles with an appropriate ground fault tester.
- ☐ Verify panel directories and circuit identification indicated on the record drawings are consistent and correct.
- ☐ Record drawings are completed, indicating actual location of devices and circuit identification.
- ☐ Ensure that all parts of this commissioning form and performance checks have been completed. Enter into the notes areas of any unfinished work or problems encountered during installation or commissioning.

Notes:

_____

_____

_____

Contractor: Signature: _____ Date: _____

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

Ritenburg & Associates Ltd.
Consulting Electrical Engineers

Owner:
Project Name: *Section:*
RAL File No:
Owner File No: *Item:* **BREAKER PANELBOARD**

LOCATION DATA:

Floor _____ Room _____ Panel ID _____

EQUIPMENT DATA:

Manufacturer	_____	Bus Amperage/Bracing	_____
Model Number	_____	c/w TVSS Unit	___ Yes ___ No
Volt/Phase/Wire	_____		
No. of Circuits	_____	Match Installed	___ Yes ___ No

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

Enclosure Details

Mounting	_____		
EEMAC Enclosure Type	_____		
Door Type	_____		
Drip Hood	___ Yes ___ No	Door Lock	___ Yes ___ No

Feeder Details

Wire Size	_____	Wire Insulation	_____
Ground Wire Type & Size	_____	Conduit Size	_____

Branch Breaker

Mounting	___ Bolt In ___ Plug In	Branch Lugs Torqued	___ Yes ___ No
Branch Wires Labelled	___ Yes ___ No	Neutral Wires Labelled	___ Yes ___ No
GFCI Breakers Labelled	___ Yes ___ No	GFCI Breakers Tested	___ Yes ___ No

Auxiliary Components

Main Breaker	_____ A	Interrupting Capacity	_____ KA
Main Lugs Torqued	___ Yes ___ No	Isolated Ground Bar	___ Yes ___ No
Bus Type	___ Copper ___ Aluminum		

Miscellaneous

Conduit Skirting	___ Yes ___ No	Lamecoid Accurate	___ Yes ___ No
Spare Conduits	___ Yes ___ No	Breaker Filler Pieces Installed	___ Yes ___ No
Exterior Clean	___ Yes ___ No	Circuit Directory Installed	___ Yes ___ No
Interior Clean	___ Yes ___ No	Top Connectors Sealed	___ Yes ___ No

OPERATION CHECKS: **DATE / MEASURED BY:** _____

Measured Values	**Amperage**	**Voltage**
	Line A _____ Amps	AB _____ Volts
	Line B _____ Amps	BC _____ Volts
	Line C _____ Amps	CA _____ Volts

SIGN-OFFS:

Contractor: Signature: _____ Date:_____

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

Ritenburg & Associates Ltd.
Consulting Electrical Engineers

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

Section:

Item: **CDP PANELBOARD**

LOCATION DATA:

Floor _____ Room _____ Panel ID _____

EQUIPMENT DATA:

Manufacturer	_____	Bus Amperage/Bracing		
Model Number	_____	c/w TVSS Unit	___ Yes	___ No
Volt/Phase/Wire	_____			
No. of Breakers	_____	Match Installed	___ Yes	___ No

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

Enclosure Details				
Mounting	___ Flush ___ Surface ___ Padmount			
3mm Sheet Steel	___ Yes ___ No	Phosphated	___ Yes	___ No
Door Type	_____	Painted & Touched-up	___ Yes	___ No
Drip Hood	___ Yes ___ No	Door Lock	___ Yes	___ No
Feeder Details				
Wire Size	_____	Wire Insulation	_____	
Ground Wire Type & Size	_____	Conduit Size	_____	
Branch Breaker				
Mounting	___ Bolt In ___ Plug In	Branch Lugs Torqued	___ Yes	___ No
Branch Wires Labelled	___ Yes ___ No	Neutral Wires Labelled	___ Yes	___ No
Auxiliary Components				
Bus Type	___ Copper ___ Aluminum			
Miscellaneous				
Conduit Skirting	___ Yes ___ No	Lamecoid Accurate	___ Yes	___ No
Spare Conduits	___ Yes ___ No	Breaker Filler Pieces Installed	___ Yes	___ No
Exterior Clean	___ Yes ___ No	Top Connectors Sealed	___ Yes	___ No
Interior Clean	___ Yes ___ No			

OPERATION CHECKS: **DATE / MEASURED BY:** _____

Measured Values	**Amperage**		**Voltage**	
	Line A	_____ Amps	AB	_____ Volts
	Line B	_____ Amps	BC	_____ Volts
	Line C	_____ Amps	CA	_____ Volts

SIGN-OFFS:

Contractor: Signature: _____ Date:_____

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

Ritenburg & Associates Ltd.
Consulting Electrical Engineers

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

Item: **EQUIPMENT RACK**

LOCATION DATA:

Floor _____ Room _____ Panel ID _____

EQUIPMENT RACK:

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

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

Components Installed

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

Cabling

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

Connectors:

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

OPERATION CHECKS:

Cable installation and testing:

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

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

SIGN-OFFS:

Contractor: Signature: _____ Date:_____

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

Ritenburg & Associates Ltd.
Consulting Electrical Engineers

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

Item: **DISCONNECT SWITCHES**

LOCATION DATA:

Floor _____ Room _____ Equipment: _____

EQUIPMENT DATA:

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

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

Elevator Main Disconnect Switch

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

Enclosure Details

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

Elevator Cab Light Main Disconnect Switch

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

Enclosure Details

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

SIGN-OFFS:

Contractor: Signature: _____ Date:_____

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

Ritenburg & Associates Ltd.
Consulting Electrical Engineers

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

Item: **EXIT LIGHT**

FIXTURE TYPE: _____ Number Installed: _____

EQUIPMENT DATA:

DATE / CHECKED BY: _____

Manufacturer _____

Catalogue Number _____

Fixture Type _____

Housing _____

Voltage _____

Lamp Wattage _____

Lamp Type _____

Lettering Type _____

Number of Faces _____

Circuit _____

Mounting

Nexus Compatible _____

Options _____

_____

Match Installed ___ Yes ___ No

_____

_____

SIGN-OFFS:

Contractor: Signature: _____ Date:_____

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

Ritenburg & Associates Ltd.
Consulting Electrical Engineers

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

EQUIPMENT DATA:

Manufacturer _____ Match Installed ___ Yes ___ No
System _____

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

System Devices	**Model Number**	**Match installed**
Manual Pull Stations		___ Yes ___ No
Smoke Detectors		___ Yes ___ No
Monitor Modules		___ Yes ___ No
Control Modules		___ Yes ___ No
Relay Modules		___ Yes ___ No
Fault Isolator Modules		___ Yes ___ No
Power Supply		___ Yes ___ No
Annunciator Panel		___ Yes ___ No
Wall Speakers & Speaker Strobes		___ Yes ___ No

SIGN-OFFS:

Contractor: Signature: _____ Date:_____

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

Ritenburg & Associates Ltd.
Consulting Electrical Engineers

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

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

Grounded Systems

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

Miscellaneous

Riser _____

Ground Bus _____

SIGN-OFFS:

Contractor: Signature: _____ Date:_____

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

Ritenburg & Associates Ltd.
Consulting Electrical Engineers

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

Item: **LIGHTING**

FIXTURE TYPE: _____ Number Installed: _____

EQUIPMENT DATA:

DATE / CHECKED BY: _____

Manufacturer _____

Catalogue Number _____

Voltage _____

Lamp Type _____

Lamp Wattage _____

Number of Lamps _____

Ballast Type _____

Size _____

Mounting _____

Diffuser _____

Options _____

_____

Match Installed ___ Yes ___ No

SIGN-OFFS:

Contractor: _____ Signature: _____ Date:_____

Cx Rep: _____ Signature: _____ Date:_____

Ritenburg & Associates Ltd.
Consulting Electrical Engineers

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

LOCATION DATA:

Floor: _____ Room: _____ ID: _____

EQUIPMENT DATA:

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

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

Components Installed

Intelligent Card	___ Yes	___ No	Data-Line	___ Yes	___ No
Photo Control Package	___ Yes	___ No	BMS Interface Module	___ Yes	___ No
Networking Modules	___ Yes	___ No	Photo-control Module	___ Yes	___ No
Power Supply Units	___ Yes	___ No	OCC Sensors	___ Yes	___ No
Digital Switches w/ Pilot Light	___ Yes	___ No	Photo Sensors (Indoor)	___ Yes	___ No
Relays w/ Pilot Light Switch	___ Yes	___ No	Photo Sensors (Outdoor)	___ Yes	___ No
Channel Bushbuttons	___ Yes	___ No			

Panel Installation

Power supply terminated	___ Yes	___ No	Operating manuals provided	___ Yes	___ No
Panel relays terminated	___ Yes	___ No			
Remote relays terminated	___ Yes	___ No			
Class 2 wiring terminated	___ Yes	___ No			
Lamecoid Identification	___ Yes	___ No			

OPERATION CHECKS:

Programming and Start-up

Start-up and programming verified by:
Company: _____ Name: _____ Date: _____

Control Devices:

LV Switching conforms to drawings	___ Yes	___ No
Indoor Photo Sensors Operational	___ Yes	___ No
Outdoor Photo Sensors Operational	___ Yes	___ No
Occupancy Sensors Operational	___ Yes	___ No

SIGN-OFFS:

Contractor: Signature: _____ Date:_____

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

Ritenburg & Associates Ltd.
Consulting Electrical Engineers

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

Item: **MOTOR STARTER**

LOCATION DATA:

Floor _____ Room _____ ID _____

EQUIPMENT DATA:

Manufacturer	_____	Thermal Protection	___ Yes ___ No
Model Number	_____	Panel/Cct Fed From	_____
Starter Volt/Phase/Wire	_____	Starter Size	_____
Starter Type	_____	Match Installed	___ Yes ___ No

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

Motor Protection Switch

Type	___ Fuse ___ Breaker	Pilot Lights Checked	___ Yes ___ No
Size	_____		

Overload Elements

Overload Correctly Sized	___ Yes ___ No	Amperage Range	_____ Amps

Motor Data

Service Factor	_____	Full Load Current	_____ Amps
Motor Volt/Phase/Wire	_____	Motor Horsepower	_____ HP
Motor Design Type	_____	Motor Code	_____
Motor Insulation	_____	Motor Locked Rotor Current	_____ Amps
Cable Distance to Drive	_____	Motor RPM	_____ RPM

Enclosure Details

Mounting	___ Flush ___ Surface		
EEMAC Enclosure Type	_____		
Door Type	_____		
Drip Hood	___ Yes ___ No	Door Lock	___ Yes ___ No

Miscellaneous

Exterior Clean	___ Yes ___ No	Top Connectors Water Tight	___ Yes ___ No
Interior Clean	___ Yes ___ No	Conduit Connectors Sealed	___ Yes ___ No
Indicating Lights Operate	___ Yes ___ No	Ground Wire Type & Size	___ Type ___ AWG
Hand/Off/Auto Switch	___ Yes ___ No	Phase Rotation Confirmed	___ Yes ___ No
Air Filters Present	___ Yes ___ No	Operation Manual Included	___ Yes ___ No
Air Filters Changed Pre-Startup	___ Yes ___ No	Record of VFD Settings	___ Yes ___ No

OPERATION CHECKS: **DATE / MEASURED BY:** _____

Starter Operation

Manual Operation Checked	___ Yes ___ No	Auto Operation Checked	___ Yes ___ No
Disconnect Function Checked	___ Yes ___ No	Fire Alarm Shutdown Checked	___ Yes ___ No
VFD Display Calibrated	___ Yes ___ No	Auto Restart Checked	___ Yes ___ No
Motor RPM Verified	___ Yes ___ No	Owner Training Completed	___ Yes ___ No

Measured Values	**Amperage**		**Voltage**		**Voltage**	
	Line A	_____ Amps	AB	_____ Volts	AN	_____ Volts
	Line B	_____ Amps	BC	_____ Volts	BN	_____ Volts
	Line C	_____ Amps	CA	_____ Volts	CN	_____ Volts

Motor Terminal Waveforms Taken	___ Yes ___ No	Skip Frequencies	_____
Acceleration Time	_____	Carries Frequency	_____
Deceleration Time	_____	Maximum Speed	_____
Output Pulse Risetime	_____	Minimum Speed	_____
Speed Control	☐-10VDC ☐4-20mA ☐ +/-10VDC	Speed Display	☐ % ☐ Hz

SIGN-OFFS:

Contractor: Signature: _____ Date: _____

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

Ritenburg & Associates Ltd.
Consulting Electrical Engineers

Owner:
Project Name:
Location:
Owner File No:

Item: **Wiring Devices**

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

Receptacles location and operation confirmation

Duplex Receptacles (5-15R)	_____ Yes	_____ No
Single Receptacles (5-15R)	_____ Yes	_____ No
T-Slot Receptacles (5-20R)	_____ Yes	_____ No
Tamper resistant safety Receptacles (5-15R)	_____ Yes	_____ No
GFCI (Safe-Lock - 5mA Ground Fault)	_____ Yes	_____ No

Switches location and operation confirmation

120V Switches (SPST, 15A)	_____ Yes	_____ No
120V Pilot Light Switches (SPST - 15A)	_____ Yes	_____ No
Fractional HP/KW Manual Starters	_____ Yes	_____ No
120V Illuminated Switches	_____ Yes	_____ No
120V Fluorescent Dimmer Switches	_____ Yes	_____ No

Comments:

SIGN-OFFS:

Contractor: Signature:_____ Date:_____

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

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
.5	Metal Fabrications	Section 05 50 00

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 (R2008) and CAN/CSA -A23.1-09 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 A23.1-09.

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. 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 (R2009) 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 Tubular column forms: round spirally wound laminated fibre forms, internally treated with release material.

.7 Dovetail anchor slots: minimum 0.6 mm galvanized steel with insulation filled slots.

.8 Pre-moulded joint fillers:
- .1 Bituminous impregnated fibreboard: ASTM D1751-73.
- .2 Vinyl Foam: to ASTM D1752-67 (1973) Type I, flexible grade.
- .3 Standard Cork: to ASTM D1752-67 (1973) 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.

.4 Camber slabs and beams:
10 mm per 3000 mm of span unless indicated on drawings.

.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.

.6 Install continuous vertical anchor slots where concrete walls or columns are masonry faced. Co-ordinate extent and locations of anchor slots with spacing of masonry ties as specified in Division 4.

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 Footings, walls and grade beams - 4 days.

.2	Columns	- 7 days.
.3	Beams, soffits and 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 A23.1-09.

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	Continuous Flight Auger Piles	Section 31 63 16
.2	Concrete Forming and Accessories	Section 03 10 00
.3	Cast-in-Place Concrete	Section 03 30 00
.4	Concrete Finishing	Section 03 35 00
.5	Concrete Unit Masonry	Section 04 22 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 A23.1-09 and welding of reinforcement with CSA W186-M1990 (R2007).

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 General Conditions.

.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 A23.3-04, 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 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, Grade 400.

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

.4 *Welded wire fabric:* to CSA G30.5-M1983. 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-A23.3-04. 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 (R2007).

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, except for columns, 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 Clear distance between bars in columns shall be not less than 1½ the nominal diameter of the bar or 40 mm or 1½ times the maximum size of the coarse aggregate.

.4 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.

.4 In beams, girders and columns not exposed to the ground or weather, not less than 40 mm to principal reinforcement, ties and stirrups.

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 specifically detailed otherwise, supply and install additional 10 M bars by 2400 long at 300 mm centres above all steel floor beams supporting open web steel floor joists. Bars to be centred above beam and placed with 25 mm cover to top of slab. Provide 1 - 15 M carrier bar below for chairing.

.8 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.

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

.10 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 (R2007). Have welding performed by workmen qualified under CSA W47.1-09. 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 and Pedestals
.2 Concrete Slabs
.3 Concrete Columns and Walls
.4 Miscellaneous Concrete
.5 Finishing of all Formed Concrete Surfaces.

1.3 RELATED WORK

.1	Continuous Flight Auger Piles	Section 31 63 16
.2	Concrete Forming and Accessories	Section 03 10 00
.3	Concrete Reinforcing	Section 03 20 00
.4	Concrete Finishing	Section 03 35 00
.5	Concrete Masonry Units	Section 04 22 00
.6	Structural Steel for Buildings	Section 05 12 23
.7	Steel Joist Framing	Section 05 21 00
.8	Steel Decking	Section 05 31 00
.9	Metal Fabrications	Section 05 50 00

1.4 QUALITY ASSURANCE

.1 Provide at least one person who shall be present at all times during execution of this portion of the Work and who shall be thoroughly trained and experienced in placing the types of concrete specified and who shall direct all work performed under this Section.

.2 For finishing of exposed surfaces of the concrete, use only thoroughly trained and experienced journeyman concrete finishers.

.3 Perform cast-in-place concrete work to requirements of CAN/CSA-A23.1-09 - "Concrete Materials and Methods of Concrete Construction".

1.5 PRODUCT HANDLING

.1 Use all means necessary to protect cast-in-place concrete materials before, during and after installation and to protect the installed work and materials of all other trades.

.2 In the event of damage, immediately make all repairs and replacements necessary to approval of the Consultant and at no additional cost to the Owner.

1.6 INSPECTION AND TESTING

.1 Inspection and testing will be performed by a firm approved by the Consultant and paid for by the Contractor. Unless approved otherwise, the testing agency must perform all aspects of testing including cylinder preparation.

.2 Provide free access to all portions of work and co-operate with appointed firm.

.3 Submit proposed mix design for each class of concrete to Consultant for approval two (2) weeks prior to commencement of work.

.4 Tests of cement and aggregates may be performed to ensure conformance with requirements stated herein.

.5 One concrete test, consisting of three test cylinders, will be taken for every 50 cubic meters or less of each class of concrete placed. One cylinder to be tested at seven (7) days, the remaining two cylinders to be tested at twenty-eight (28) days.

.6 One (1) additional test cylinder will be taken during cold weather concreting, and be cured on job site under same conditions of concrete it represents.

.7 One (1) slump test and one (1) air content test will be taken for each set of test cylinders taken.

.8 Testing of concrete will be performed in accordance with CAN/CSA-A23.2-09 "Method of Test for Concrete".

.9 Test results will be issued to the Contractor, Consultant and Owner. Test reports are to be numbered consecutively beginning with number one.

.10 Required retesting will be paid for by the Contractor.

.11 The Consultant may order additional testing any time even though the required tests indicate the strength requirements have been met. In this instance, the Owner will pay for those tests that meet the specified requirements and the Contractor will pay for those that do not.

.12 Non-destructive methods for testing concrete shall be according to CAN/CSA A23.2-09.

Part 2 Products

2.1 CONCRETE MATERIALS

.1 *Cement:* Normal - N and Sulphate Resistant - HS Portland Type, to CSA A3000-08 - "Portland Cements".

.2 *Fine and Coarse Aggregates:* conforming to CAN/CSA-A23.1-09 - "Concrete Material and Methods of Concrete Construction".

.3 *Fine and Coarse Aggregates:* conforming to CAN/CSA-A23.1-09 - "Concrete Materials and Methods of Concrete Construction". The fine and coarse aggregate for concrete floor slabs and finish toppings shall contain a maximum of 0.4% low density particles as determined by CSA Test A23.2-09 "Low Density Material in Aggregate". Test results shall be submitted to Consultant for review.

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

2.2 ADMIXTURES

.1 *Air Entrainment:* to ASTM C260-06 - "Air-Entraining Admixtures for Concrete".

.2 *Chemical:* to ASTM C494-08a - "Chemical Admixtures for Concrete"; water reducing, strength increasing type WN - normal setting.

.3 *Pozzolanic Mineral:* to CSA A3000-08 "Supplementary Cementing Materials and Their Use in Concrete Construction", fly ash permitted only as approved by Consultant.

2.3 ACCESSORIES

.1 *Vapour Barrier:* 6 mil polyethylene film, to CGSB 70-GP-1a, Type 1 - low permeance heavy duty.

.2 *Curing Compounds:* shall conform to the requirements of the latest issue of ASTM Standard C309.

.3 *Non-shrink Grout:* premixed compound consisting of non-metallic aggregate, cement, water reducing and plasticizing agents; capable of developing minimum compressive strength of 20 MPa at 3 days and 50 MPa at 28 days. CPD Non Shrink Grout by CPD Construction Products or approved equivalents.

.4 *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, Planitop X - Rapid Setting Mortar as manufactured by MAPEI Inc.

.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 *Epoxy Bonding Agent:* Approved mineral filled polymer/epoxy adhesive formulated to bond new concrete to cured concrete. Apply in strict conformance with manufacturer's written recommendations for proposed application. ST-432 by Sternson, SIKADUR HI-MOD by Sika, CONCRESIVE 1001-LPL by Adhesive Engineering Company or approved equal.

.13 *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 A23.1-09.

.2 All concrete shall have the following minimum properties.

Based on 2010 National Building Code

Location	Exposure Class	Comp. Strength (MPa) and Age	Aggregate	Air Entrainment	Slump
1. Piling	S-1	35 @ 56 d	40	3 – 6	80 ± 30
2. Grade Beams/Walls in Contact with Soil	S-1	35 @ 56 d	20	4 – 7	80 ± 30
3. Interior Walls, Structural Slabs, Beams	N	25 @ 28 d	20	0	80 ± 30
4. Slab on Deck	N	25 @ 28 d	20	0	80 ± 30

5. Interior Grade Supported Slab	N	25 @ 28 d	20	0	80 ± 30
6. Exterior Grade Supported Sidewalks/Landing Pads, 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 0.4.

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 A23.1-09.

.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.

.8 Concrete mix for exposed aggregate finish and sandblasted finish shall be designed as a low slump, gap-graded mix with a maximum amount of screened and washed crushed coarse aggregate.

Part 3 Execution

3.1 INSPECTION

.1 Prior to all work of this Section, carefully inspect the installed work of all other trades and verify that all such work is complete to the point where this installation may properly commence.

.2 Verify that all items to be embedded in concrete are in place.

.3 Verify that concrete may be placed to the lines and elevations indicated on the Drawings, with all required clearance from reinforcement.

3.2 DISCREPANCIES

.1 In the event of discrepancy, immediately notify the Consultant.

.2 Do not proceed with installation in areas of discrepancy until all such discrepancies have been fully resolved.

3.3 PREPARATION

.1 Remove all wood scraps and debris from the formed areas in which concrete will be placed.

.2 Thoroughly clean the forms to ensure proper placement and bonding of concrete.

.3 Thoroughly wet the forms, except in freezing weather, or oil them; remove all standing water.

.4 Thoroughly clean all transporting and handling equipment.

3.4 PLACING CONCRETE

.1 Place concrete in accordance with requirements of CAN/CSA A23.1-09 and as indicated on Drawings.

.2 Notify Consultant and Inspection and Testing Firm a minimum of twenty-four (24) hours prior to commencement of concreting operations.

.3 Ensure all anchors, seats, plates and other items to be cast into concrete are placed, held securely and will not cause undue hardship in placing concrete.

.4 Maintain accurate records of poured concrete items. Record date, location of pour, quantity, air temperature and test samples taken.

.5 Ensure reinforcement, inserts, embedded parts, formed joints and fitments are not disturbed during concrete placement.

.6 Prepare previously placed concrete by cleaning with steel brush.

.7 Pour concrete continuously between predetermined construction and control joints. All construction joints subject to approval of the Consultant.

.8 Approval to place concrete shall be contingent on the formwork and reinforcing steel placement and evidence that the Contractor can place the planned casting without stopping.

.9 Pour slabs on grade in checkerboard pattern or saw cut, as indicated on Drawings. Saw cut control joints within twenty-four (24) hours after finishing. Use 6 mm thick blades, cutting 20 mm into depth of slab thickness. Vacuum clean saw cut prior to installation of sealant.

.10 Excessive honeycomb or embedded debris in concrete is not acceptable. Remove and replace defective concrete. Excessive honeycomb is when eraser end of a pencil fits into cavity.

3.5 COLD WEATHER REQUIREMENTS

.1 When the air temperature is at or below 5^0 C. or when there is a probability of it falling to this limit during the placing or curing period, cold weather requirements shall be applicable.

.2 Provide heating equipment or heating plant on the job ready for use when concrete is being placed during cold weather. Such equipment shall be adequate for the purpose of maintaining the required temperature during the placing and curing of the concrete. The methods used for heating shall be approved by the Consultant. Equipment inducing carbon monoxide gas in the building shall not be accepted.

.3 Concrete shall not be placed on or against reinforcement, formwork, ground or any surface that is at a temperature less than 5^0 C.

.4 The temperature of the concrete at all surfaces shall be maintained at not less than 15^0 C for three (3) days, or at not less than 10^0 C for five days after placing. Means shall be provided to humidify the air within enclosures and to keep the concrete and formwork continuously moist if dry heat is used. The concrete shall be kept above freezing temperature for a period of seven (7) days, and shall be kept from alternate freezing and thawing for at least fourteen (14) days after placement.

.5 At the end of the specified protection period the temperature of the concrete shall be reduced gradually at a rate not exceeding that shown in CAN/CSA A23.1-09.

.6 Accelerator or so-called anti-freeze compounds shall ***not*** be permitted unless otherwise approved in writing by the Consultant.

.7 All protective coverings shall be kept clear of the concrete and form surfaces to permit free circulation of air and shall be maintained intact for at least twenty-four (24) hours after artificial heat is discontinued.

3.6 HOT WEATHER REQUIREMENTS

.1 When the air temperature exceeds 27^0, hot weather requirements shall be applicable.

.2 Time of initial mixing to complete discharge shall not exceed 1 hour and 15 minutes and concrete placed shall not exceed 27^0.

.3 Concrete forming surfaces and reinforcing steel shall be sprinkled with cool water just prior to placing concrete. Standing water or puddles shall be removed prior to concrete placement.

.4 Special wind protection will be required as directed by the Consultant.

.5 Columns, walls, beams and slabs shall be kept continuously damp for twenty-four (24) hours by normal curing procedures as outlined by this Specification. Slabs cured by the applications of sealing, shall have curing compound applied immediately after finishing of the slab but before evaporation of surface moisture.

.6 The use of water reducing agents shall be subject to the approval of the Consultant when hot weather conditions prevail.

3.7 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 In general the construction joints in floor and roof systems shall be located in the middle of the spans of slabs, beams and girders. Proper key and dowels or extensions of reinforcing shall be provided at all construction joints.

.4 Concrete placed in wall and column forms shall be struck off flush with the underside of the floor and roof systems.

.5 Vertical construction joints in foundation walls shall be properly keyed and dowelled and constructed with an approved water stop, properly anchored against displacement during the placement of the concrete and properly sealed at all of the intersections. Splices and intersections of water stop shall be jointed by heat fusion in accordance with approved manufacturer's instructions.

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 A23.2-09. The test results shall be indicative of the in-place concrete.

.3 Load testing of the structural elements in accordance with CAN3 A23.3-04.

.4 The changes in the mix proportions and the testing shall be at the Contractor's expense.

.5 Concrete failing to meet the strength requirements of this Specification shall be strengthened or replaced at the Contractor's expense and to the satisfaction of the Consultant.

3.9 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 FINISHING OF FORMED SURFACES

.1 All formed surfaces noted in Architect’s Room Finish Schedule as receiving a paint, vinyl or other applied finish shall be final finished to remove all protrusions, ridges and other irregularities. All voids and pinholes are to be filled. Finished surface is to be smooth, straight and true, ready to receive architectural finish as noted.

.2 On all other exposed formed concrete surfaces, except at unfinished areas: remove blemishes, formwork joint marks by rubbing with carborundum block and water. Leave finished surfaces smooth, unmarred. Complete rubbing within twenty-four (24) hours for stripping formwork.

3.11 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.

3.12 BASE PLATES GROUTING

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

3.13 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.

3.14 DOVETAIL ANCHOR SLOTS

.1 Cast in continuous dovetail anchor slots to receive dovetail anchors and masonry ties for lateral support of masonry.

.2 Refer to Specifications Division 4 for extent and spacing of masonry ties. Anchor slots to be located to coincide with spacing of masonry ties as specified in Division 4.

3.15 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
.2	Expansion and Control Joints	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 *Penetrating Epoxy Sealer:* Acceptable products "905 Penetrating Epoxy" by Cementation Company (Canada) Ltd., or Cappar's Niklepoxy Penetrant Sealer".

.4 *Coloured Dry Shake Hardener and Sealer:* Hardener to be prepackaged, factory-mixed product containing crushed, washed and graded non-metallic aggregate, Portland cement, colouring pigments and other proprietary components. Sealer to be liquid curing and sealing compound recommended for use on color hardened floors. Sealer to be supplied in colour that is recommended for, and compatible with, colour or dry shake hardener.

Acceptable Products:

Hardener	Sealer	Manufacturer
ColourPlete	FlorSeal Colour	Sternson
Colocron	Master Kure	Master Builder
Surflex	EuroCure Colour	Elsro
Colour Blend	Colour Blend	W. R. Meadows

.5 *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.

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

.7 *Epoxy Bonding Agent:* Approved mineral filled polymer/epoxy adhesive formulated to bond new concrete to cured concrete. Apply in strict conformance with manufacturer's written recommendations for proposed application. ST-432 by Sternson, SIKADUR HI-MOD by Sika, CONCRESIVE 1001-LPL by Adhesive Engineering Company or approved equal.

Part 3 Execution

3.1 FLOOR FINISHING

.1 Finish concrete floor surfaces in accordance with CAN/CSA A23.1-09.

.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 Apply Plain or Coloured Dry Shake Hardener and Sealer to concrete floors noted in Architect's Room Finish Schedule as receiving hardener. Colour selecting by Consultant. Apply dry shake in two passes at the rate of 5.0 kg/m2 (100 lb/100 Ft^2) or as recommended by manufacturer for Normal Traffic Conditions. After application of shake hardener is complete, apply minimum one coat of sealer. Application of both the dry shake hardener and sealer is to be strictly in accordance with manufacturer's recommendations.

.4 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 A23.1-09, Table 22 Class A straight edge method to produce floor surface of pleasing characteristics.

.5 All concrete slabs noted in Architect's Room Finish Schedule as receiving thin-set quarry tile finish are to be final finished with a swirl trowel finish plus fine hair brooming to give a surface finish to achieve a “flat” floor in accordance with CAN/CSA A23.1-09, Clause 7.5.6.1 maintaining surface flatness with maximum variation of 5 mm in 3 M and absolute maximum of ± 6 mm.

.6 All concrete slabs noted in Architect's Room Finish Schedule as receiving application of Penetrating Epoxy Sealer are to be final finished with a swirl trowel finish suitable for the application of penetrating type epoxy sealer. Slab is to be finished to a hard, smooth surface free from blemishes. Final finish to achieve a “flat” floor in accordance with CAN/CSA A23.1, Clause 7.5.6.1 to produce floor surface of pleasing appearance, easily cleaned and maintained with high wear-resistance qualities. Maintain surface flatness with maximum variation of 5 mm in 3 M and absolute maximum of ± 6 mm. Co-ordinate suitable curing method for slabs where penetrating type of sealer is used. Supplier's representative must be on site prior to application to advise on finishing procedures and application rate. Apply sealer at rate recommended for medium traffic in a minimum of two passes.

.7 Apply concrete Surface Sealer on floor surfaces noted in Architect's Room Finish Schedule as exposed concrete. Apply strictly in accordance with manufacturer's recommendations.

.8 In areas with floor drains, maintain floor level at walls and pitch surfaces uniformly to drain at 5 mm/M nominal unless indicated otherwise on Drawings.

3.2 CURING AND PROTECTION

.1 All equipment needed for the curing and protection of the concrete shall be on hand and ready for use before actual placing is started.

.2 All exposed non-formed surfaces shall be kept continuously moist for a minimum of seven consecutive days after placement of the concrete. The water for curing shall be clean and free from any materials that will cause staining or discolouration of the concrete. A liquid, membrane forming, curing compound shall be used under circumstances where the application of moisture is impracticable and where such compounds will not jeopardize the appearance of the concrete nor the bonding of future floor finishes.

.3 Special curing techniques shall be employed when the concrete is subject to drying conditions such as high temperatures, low relative humidity and high winds. Concrete wall and column forms shall be kept continuously moist.

.4 Freshly placed concrete shall be protected from the effects of direct sunshine, drying winds, cold, excessive heat and running water by the use of adequate tarpaulins or other suitable material to cover completely or enclose all freshly finished surfaces until the end of the curing period specified.

END OF SECTION

Part 1 General

1.1 RELATED SECTIONS

.1 Section 03 30 00 – Cast-In-Place Concrete

.2 Section 03 35 00 – Concrete Finishing

1.2 SUBMITTALS

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

.2 Product Data: Submit manufacturer’s technical literature for each product indicated, specified, or required. Include manufacturer's technical data, application instructions, and recommendations.

.3 Maintenance Manuals:

.1 Conform to Section 01 78 00 - Closeout Submittals.

.2 Include instructions for maintenance of installed work, including methods and frequency recommended for maintaining optimum condition under anticipated use.

.3 Include precautions against cleaning products and methods which may be detrimental to finishes and performance.

1.3 DELIVERY, STORAGE, AND HANDLING

.1 Deliver, handle, store and protect materials in accordance with Section 01 61 00 - Common Product Requirements.

.2 Deliver and store materials in original wrappings and containers with manufacturer's seals and labels, intact. Protect from freezing, moisture, water and contact with ground or floor.

1.4 QUALITY ASSURANCE

.1 Experience: Company experienced in performing specified work similar in design, products, and extent to scope of this Project; with a record of successful in-service performance; and with sufficient production capability, facilities, and personnel to produce specified work.

.2 Supervision: Maintain competent supervisor who is at Project during times specified work is in progress.

.3 Manufacturer Qualification: Approved by manufacturer to apply liquid applied products.

.4 Pre-Installation of Concrete Conference: Prior to placing concrete for areas scheduled for polishing, conduct meeting. Meeting attendees to include Architect, Contractor, Concrete supplier, concrete finisher, concrete polisher and technical representative of liquid applied products.

.5 Coefficient of Friction: Achieve following coefficient of friction by field quality control testing in accordance to the following standards:

.1 ANSI B101.3 Dynamic Coefficient of Friction - Achieve a minimum of .35 for level floor surfaces.

.6 Field Mock-up: Before performing work of this Section, provide following field mock-up to verify selections made under submittals and to demonstrate aesthetic effects of polishing. Approval does not constitute approval of deviations from Contract Documents, unless Architect specifically approves deviations in writing.

.1 Provide 5 square meter mock-up.

.2 Concrete shall be same mix design as scheduled for Project.

.3 Placement and finishing work shall be performed by same personnel as will finish concrete for Project.

.4 Mock-up shall be representative of work to be expected.

.5 Perform grinding, honing, and polishing work as scheduled for Project using same personnel as will perform work for Project.

.6 Approval is for following aesthetic qualities:

.1 Compliance with approved submittals.

.7 Compliance with specified aggregate exposure.

.8 Compliance with specified finished gloss level.

.9 Compliance with Specified colour.

.10 Approved field mock-ups mock-up may remain as part of finished work as a standard for judging completed work.

1.5 SITE CONDITIONS

.1 Damage and Stain Prevention: Prevent damage and staining of concrete surfaces to be polished.

.2 Prohibit use of markers, spray paint, and soapstone.

.3 Prohibit improper application of liquid membrane film forming curing compounds.

.4 Prohibit pipe-cutting operations over concrete surfaces.

.5 Prohibit storage of any items over concrete surfaces for not less than 28 days after concrete placement.

.6 Prohibit ferrous metals storage over concrete surfaces.

.7 Protect from petroleum, oil, hydraulic fluid, or other liquid dripping from equipment working over concrete surfaces.

.8 Protect from acids and acidic detergents contacting concrete surfaces.

.9 Protect from painting activities over concrete surfaces.

Part 2 PRODUCTS

2.1 LIQUID APPLIED PRODUCTS

.1 Liquid Densifier: An Aqueous solution of Silicon Dioxide dissolved in one of the following Hydroxides that penetrates into the concrete surface and reacts with the Calcium Hydroxide to provide a permanent chemical reaction that hardens and densifies the wear surface of the cementitious portion of the concrete. All of the following have the same chemistry varying only by the alkali used for solubility of the Silicon Dioxide.

- .1 Sodium Silicate
- .2 Potassium Silicate
- .3 Lithium Silicate
- .4 Alkalis solution of Colloidal Silicates or Silica

2.2 DYE

.1 Non-film forming soluble colorant dissolved in a carrier designed to penetrate and alter coloration and appearance of a concrete floor surface without a chemical reaction.

.2 Colours to be selected by Consultant from standard range.

2.3 SEALER

.1 Impregnating Stain Protection: Non film forming stain and food resistant penetrating sealer designed to be applied to densified and polished concrete which meets the requirements of OSHA for slip resistance as tested by ASTM D 2047 and stain resistance of ASTM D 1308.

2.4 ACCESSORIES

.1 Repair Material: The material must have sufficient bonding capabilities to adhere after the polishing to the concrete surface and provide abrasion resistance equal to or greater than the surrounding concrete substrate.

.2 Grout Material: A thin mortar used for filling spaces. Acceptable products shall be:

- .1 Epoxy, urethane, poluyrea, or polyaspartic resins.
- .2 Latex or acrylic binders mixed with cement dust from previous grinding steps.
- .3 Silicate binders mixed with cement dust from previous grinding steps.

.3 Protective Cover: Non-woven, puncture and tear resistant, polypropylene fibers laminated with a multi-ply, textured membrane, not less than 18 mils in thickness.

2.5 POLISHING EQUIPMENT

.1 Multiple head, counter rotating, walk behind or ride on machine, of various size and weights, with diamond tooling affixed to the head for the purpose of grinding concrete.

.2 If dry grinding, honing, or polishing, use dust extraction equipment with flow rate suitable for dust generated, with squeegee attachments.

.3 If wet grinding, honing, or polishing, use slurry extraction equipment suitable for slurry removal and containment prior to proper disposal.

.4 Edge Grinding and Polishing Equipment: Hand-held or walk-behind machines which produces same results, without noticeable differences, as field grinding and polishing equipment.

.5 Burnishing Equipment: High speed walk-behind or ride-on machines capable of generating 1000 to 2000 revolutions per minute and with sufficient head pressure of not less than 20 pounds to raise floor temperature by 20 degrees F.

.6 Diamond Tooling: Abrasive tools that contain industrial grade diamonds within a bonded matrix (such as metallic, resinous, ceramic, etc) that are attached to rotating heads to refine the concrete substrate. Select tool and abrasives are required to achieve specified appearance and gloss level and as recommend by manufacturer.

.1 Bonded Abrasive: Abrasive medium held within a bonding that erodes away to expose new abrasive medium as it is used.

.2 Metal Bond Tooling: Diamond tooling containing industrial grade diamonds with a metallic bonded matrix attached to rotating heads to refine the concrete substrate.

.3 Resin Bond Tooling: Diamond tooling containing industrial grade diamonds within a resinous bonded matrix (poly-phenolic, ester-phenolic, thermoplastic-phenolic) attached to rotating heads to refine the concrete substrate.

.4 Hybrid Tooling: Diamond tooling combines metal bond and resin bond having the characteristics of both types of tooling. These types of tools are used as either transitional tooling from metal bond tools to resin bond tools or as a first cut tool on smooth concrete surfaces.

.5 Transitional Tooling: Diamond tooling is used to refine the scratch pattern of metal bond tooling prior to the application of resin bond tooling in an effort to extend the life of resin bond tooling and to create a better foundation for the polishing process.

.6 Abrasive Pad: An abrasive pad, resembling a typical floor maintenance burnishing pad, has the capability of refining the concrete surface on a microscopic level that may or may not contain industrial grade diamonds. These pads are typically used for the maintenance and/or restoration of previously installed polished concrete flooring.

Part 3 Execution

3.1 EXAMINATION

.1 Examine substrates to be polished for compliance with requirements and other conditions affecting performance.

.2 Concrete curing methods according to applicable Division 03 Section on cast-in-place concrete.

.3 Proceed only when unsatisfactory conditions have been corrected in a manner complying with Contract Documents.

.4 Starting work within a particular area will be construed as acceptance of surface conditions.

3.2 PREPARATION

.1 Prepare and clean concrete surfaces.

.2 Provide sound concrete surfaces free of laitance, glaze, efflorescence, curing compounds, form-release agents, dust, dirt, grease, oil, paint splatter, and other contaminants incompatible with liquid applied products and polishing.

3.3 TESTING

.1 Alkalinity:

.1 Test Method: Measure pH according to method indicated in ASTM F 710.

.2 Acceptable Results: pH between 8 and 10.

.2 Moisture Vapor Transmission Rate:

.1 Test Method: Perform anhydrous calcium chloride test according to ASTM F 1869.

.2 Acceptable Results: Not more than 5 pounds per 1000 square feet in 24 hours.

.3 Relative Humidity:

.1 Test Method: Perform relative humidity test using in situ probes according to ASTM F 2170.

.2 Acceptable Results: Not more than 75 percent

3.4 COLOURING CONCRETE FLOORS

.1 Apply solution by methods and techniques required by manufacturer to produce finish matching approved field mock-ups.

.2 Maintain wet edge, working newly applied solution into edges of adjacent wet edges of previously treated surfaces.

.3 Maintain consistent saturation throughout application.

.4 Avoid splashing, dripping, or puddling of solution on adjacent substrates.

.5 When color matches approved mock-ups, neutralize as required by manufacturer.

3.5 GRINDING AND POLISHING

.1 Perform all polishing procedures to ensure a consistent appearance from wall to wall.

.2 Initial Grinding:

.1 Use grinding equipment with metal or semi-metal bonded tooling.

.2 Begin grinding in one direction using sufficient size equipment and diamond tooling to meet specified aggregate exposure class.

.3 Make sequential passes with each pass perpendicular to previous pass using finer grit tool with each pass, up to 100 grit metal bonded tooling.

.4 Achieve maximum refinement with each pass before proceeding to finer grit tools.

.5 Clean floor thoroughly after each pass using dust extraction equipment properly fitted with squeegee attachment or walk behind auto scrubber suitable to remove all visible loose debris and dust.

.6 Continue grinding until aggregate exposure matches approved field mock-ups

.3 Treating Surface Imperfections:

.1 Mix patching compound or grout material with dust created by grinding operations, manufacturer's tint, or sand to match color of adjacent concrete surfaces.

.2 Fill surface imperfections including, but not limited to, holes, surface damage, small and micro cracks, air holes, pop-outs, and voids with grout to eliminate micro pitting in finished work.

.3 Work compound and treatment until color differences between concrete surface and filled surface imperfections are not reasonably noticeable when viewed from 10 feet away under lighting conditions that will be present after construction.

.4 Liquid Densifier Application

.1 Apply undiluted to point of rejection, remove excess liquid, and allow curing according to manufacturers instructions.

.5 Grout Grinding:

.1 Use grinding equipment and appropriate grit and bond diamond tooling.

.2 Apply grout, forced into the pore structure of the concrete substrate, to fill surface imperfections.

.3 Clean floor thoroughly after each pass using dust extraction equipment properly fitted with squeegee attachment or walk behind auto scrubber suitable to remove all visible loose debris and dust.

.6 Honing:

.1 Use grinding equipment with hybrid or resin bonded tooling.

.2 Hone concrete in one direction starting with a 100 grit tooling and make as many sequential passes as required to remove scratches, each pass perpendicular to previous pass, up to 400 grit tooling reaching maximum refinement with each pass before proceeding to finer grit tooling.

.3 Clean floor thoroughly after each pass using dust extraction equipment properly fitted with squeegee attachment or walk behind auto scrubber suitable to remove all visible loose debris and dust.

.7 Polishing:

.1 Use polishing equipment with resin-bonded tooling.

.2 Begin polishing in one direction starting with 800 grit tooling.

.3 Make sequential passes with each pass perpendicular to previous pass using finer grit tooling with each pass until the specified level of gloss has been achieved.

.4 Achieve maximum refinement with each pass before proceeding to finer grit pads.

.5 Clean floor thoroughly after each pass using dust extraction equipment properly fitted with squeegee attachment or walk behind auto scrubber suitable to remove all visible loose debris and dust.

.6 Stain Protection: Uniformly apply and remove excessive liquid according to manufacturer's instructions. Final film thickness should be less than .05 mils after cure.

.7 Final Polish: Using burnishing equipment and finest grit abrasive pads, burnish to uniform reflective sheen matching approved field mock-up.

.8 Final Polished Concrete Floor Finish

.1 Aggregate Exposure Class C – Medium Aggregate Finish: Remove not more than 1/8 inch of concrete surface by grinding and polishing resulting in majority of exposure displaying medium aggregate with no, or small amount of, large aggregate at random locations.

.9 Finished Gloss Level

.1 Finished Gloss Level 3 – High Gloss Appearance:

.1 Procedure: Not less than 4 steps with full refinement of each diamond tool with one application of densifier.

.2 Gloss Measurement: Determine the specular gloss by incorporating the following:

.3 Reflective Clarity Reading: Not less than 65 according to ASTM D5767 prior to the application of sealers.

.4 Reflective Sheen Reading: Not less than 35 according to ASTM D523 prior to the application of sealers.

3.1 CLEANING

.1 Perform cleaning as soon as possible after installation to remove construction and accumulated environmental dirt.

.2 Protect finished floor surface.

END OF SECTION

Part 1 General

1.1 RELATED SECTIONS

.1 Section 03 30 00 - Cast-in-Place Concrete.

.2 Section 04 05 12 - Mortar and Masonry Grout.

.3 Section 04 05 19 - Masonry Anchorage and Reinforcing.

.4 Section 04 05 23 - Masonry Accessories.

.5 Section 04 21 13 – Brick Masonry

.6 Section 04 22 00 - Concrete Unit Masonry.

.7 Section 05 50 00 - Metal Fabrications.

.8 Section 07 92 00 - Joint Sealing.

1.2 REFERENCES

.1 Canadian Standards Association (CSA International).

.1 CSA-A165 Series-94(R2000), Standards on Concrete Masonry Units.

.2 CSA A179-94(R1999), Mortar and Grout for Unit Masonry.

.3 CSA-A371-94 (R1999), Masonry Construction for Buildings.

1.3 DELIVERY, STORAGE, AND HANDLING

.1 Deliver, store, handle and protect materials in accordance with Section 01 61 00 - Common Product Requirements .

.2 Deliver materials to job site in dry condition.

.3 Storage and Protection.

.1 Keep materials dry until use except where wetting of bricks is specified .

.2 Store under waterproof cover on pallets or plank platforms held off ground by means of plank or timber skids.

1.4 SITE CONDITIONS

.1 Site Environmental Requirements.

.1 Cold weather requirements.

.1 Supplement Clause 5.15.2 of CSA-A371 with following requirements.

.1 Maintain temperature of mortar between 5 degrees C and 50 degrees C until batch is used or becomes stable.

.2 Maintain ambient temperature between 5 degrees C and 50 degrees C and protect site from windchill.

.2 Hot weather requirements.

.1 Protect freshly laid masonry from drying too rapidly, by means of waterproof, non-staining coverings.

.2 Keep masonry dry using waterproof, non-staining coverings that extend over walls and down sides sufficient to protect walls from wind driven rain, until masonry work is completed and protected by flashings or other permanent construction.

Part 2 Products

2.1 MATERIALS

.1 Masonry materials are specified in Related Sections.

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 PREPARATION

.1 Provide temporary bracing of masonry work during and after erection until permanent lateral support is in place.

3.3 INSTALLATION

.1 Do masonry work in accordance with CSA-A371 except where specified otherwise.

.2 Build masonry plumb, level, and true to line, with vertical joints in alignment.

.3 Layout coursing and bond to achieve correct coursing heights, and continuity of bond above and below openings, with minimum of cutting.

3.4 CONSTRUCTION

.1 Exposed masonry.

.1 Remove chipped, cracked, and otherwise damaged units, in accordance with CSA A-165, Clause 82.1 in exposed masonry and replace with undamaged units.

.2 Jointing.

.1 Allow joints to set just enough to remove excess water, then tool with round jointer to provide smooth, joints true to line, compressed, uniformly concave joints where concave joints are indicated.

.2 Allow joints to set just enough to remove excess water, then rake joints uniformly to 6 mm depth and compress with square tool to provide smooth, compressed, raked joints of uniform depth where raked joints are indicated.

.3 Strike flush joints concealed in walls and joints in walls to receive plaster, tile, insulation, or other applied material except paint or similar thin finish coating.

.3 Cutting.

.1 Cut out for electrical switches, outlet boxes, and other recessed or built-in objects.

.2 Make cuts straight, clean, and free from uneven edges.

.4 Building-In.

.1 Build in items required to be built into masonry.

.2 Prevent displacement of built-in items during construction. Check plumb, location and alignment frequently, as work progresses.

.3 Brace door jambs to maintain plumb. Fill spaces between jambs and masonry with mortar.

.5 Support of loads.

.1 Use grout to CSA A179 where grout is used in lieu of solid units.

.2 Install building paper below voids to be filled with concrete grout; keep paper 25 mm back from faces of units.

.6 Provision for movement.

.1 Leave 5 mm space below shelf angles.

.2 Leave 6 mm space between top of non-load bearing walls on structural slabs and partitions and structural elements. Do not use wedges.

.3 Leave 12 mm space between top of non-load bearing walls on structural slabs and partitions and structural elements Do not use wedges.

.4 Built masonry to tie in with stabilizers, with provision for vertical movement.

.7 Loose steel lintels.

.1 Install loose steel lintels. Centre over opening width.

.8 Control joints.

.1 Construct continuous vertical control joints at maximum 10m spacing in continuous long straight walls and in locations indicated on drawings. Confirm locations with Consultant.

3.5 SITE TOLERANCES

.1 Tolerances in notes to Clause 5.3 of CSA-A371 apply.

3.6 CLEANING

.1 Perform cleaning after installation to remove construction and accumulated environmental dirt.

.2 Upon completion of installation, remove surplus materials, rubbish, tools and equipment barriers.

3.7 PROTECTION

.1 Protect masonry and other work from marking and other damage. Protect completed work from mortar droppings. Use non-staining coverings.

END OF SECTION

Part 1 General

1.1 RELATED SECTIONS

.1 Section 04 05 00 - Common Work Results for Masonry.

1.2 REFERENCES

.1 Canadian Standards Association (CSA International).

.1 CSA A179-94(R1999), Mortar and Grout for Unit Masonry.

1.3 SUBMITTALS

.1 Product Data.

.1 Submit manufacturer's printed product literature, specifications and data sheet in accordance with Section 01 33 00 - Submittal Procedures .

.2 Submit two copies of WHMIS MSDS - Material Safety Data Sheets in accordance with Section 01 33 00 - Submittal Procedures . Indicate VOC's mortar, grout, parging, colour additives and admixtures.

.2 Samples.

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

.2 Submit two 100 mm size samples of mortar.

.3 Manufacturer's Instructions.

.1 Submit manufacturer's installation instructions.

.1 Maintenance Manuals:

.1 Conform to Section 01 78 00 - Closeout Submittals

Part 2 Products

2.1 MATERIALS

.1 Use same brands of materials and source of aggregate for entire project.

.2 Mortar and grout : CSA A179.

.3 Use aggregate passing 1.18 mm sieve where 6 mm thick joints are indicated.

.4 Mortar for exterior masonry above grade:

.1 Non-Loadbearing: type S.

.5 Mortar for interior masonry.

.1 Loadbearing: type S, 12.5 mPa.

.6 Following applies regardless of mortar types and uses specified above:

.1 Mortar for grouted reinforced masonry: type S based on Property specifications.

.7 White mortar: to produce mortar type specified.

.8 Non-Staining mortar: use non-staining masonry cement for cementitious portion of specified mortar type.

.9 Grout: to CSA A179, Table 3.

.10 Parging mortar: type S to CSA A179.

2.2 MIXES

.1 Coloured mortars: incorporate colour and admixtures into mixes in accordance with manufacturer's instructions.

.1 Use clean mixer for coloured mortar.

.2 Pointing mortar: prehydrate pointing mortar by mixing ingredients dry, then mix again adding just enough water to produce damp unworkable mix that will retain its form when pressed into ball. Allow to stand for not less than 1 hour nor more than 2 hours then remix with sufficient water to produce mortar of proper consistency for pointing.

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 CONSTRUCTION

.1 Do masonry mortar and grout work in accordance with CSA A179 except where specified otherwise.

3.3 CLEANING

.1 Upon completion of installation, remove surplus materials, rubbish, tools and equipment barriers.

3.4 SCHEDULE

.1 Use white mortar for interior block partition walls.

.2 Use grey mortar for exterior masonry walls.

END OF SECTION

Part 1 General

1.1 RELATED SECTIONS

.1 Section 04 05 00 - Common Work Results for Masonry.

.2 Section 04 05 12 – Masonry Mortar and Grout

.3 Section 04 21 13 – Brick Masonry

.4 Section 04 22 00 – Concrete Masonry Units

.5 Section 05 50 00 – Metal Fabrications

1.2 REFERENCES

.1 Canadian Standards Association (CSA International).

.1 CSA-A370-94(R1999), Connectors for Masonry.
.2 CSA-A371-94(R1999), Masonry Construction for Buildings.
.3 CSA-S304.1-94(R2001), Masonry Design for Buildings.
.4 CSA A179-94, Mortar and Grout For Unit Masonry.

1.3 SUBMITTALS

.1 Shop Drawings:

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

.1 For masonry anchorage system indicate component profiles, sizes, connection attachments, anchorage, size and type of fasteners, and accessories.

.2 Manufacturer's Instructions:

.1 Submit manufacturer's installation instructions.

Part 2 Products

2.1 MATERIALS

.1 Bar reinforcement: to CSA-A371 and CAN/CSA G30.18.

.2 Wire reinforcement: to CSA-A371 and CSA G30.14, ladder or truss type.

.3 Connectors: to CSA-A370 and CSA-S304.

.4 Steel stud with protected gypsum board to brick veneer connector.

.1 Fero “Surface mounted, Slotted L-Plate Rap-Tie” system. All metal components hot dipped galvanized after fabrication. Provide V-tie long enough to extend to centre line of brick veneer wall. Include polyethylene insulation support.

.2 Approved alternate.

.5 Concrete block to brick veneer connector.

.1 Fero “Slotted Block Tie Type I” system. All metal components hot dipped galvanized after fabrication. Provide V-tie long enough to extend to the centre line of brick veneer wall. Include polyethylene insulation support.

.2 Approved alternate.

.6 Corrosion protection: to CSA-S304, galvanized to CSA-S304 and CSA-A370.

2.2 FABRICATION

.1 Fabricate reinforcing in accordance with CAN/CSA-A23.1.

.2 Fabricate connectors in accordance with CSA-A370.

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 GENERAL

.1 Supply and install masonry connectors and reinforcement in accordance with CSA-A370, CSA-A371, CAN/CSA-A23.1 and CSA-S304.1 unless indicated otherwise.

.1 All masonry connectors and ties installed on exterior side of air/vapour barrier shall be hot dipped galvanized after fabrication.

.2 Provide additional reinforcement to masonry as indicated in Structural drawings.

3.3 BONDING AND TYING

.1 Tie masonry veneer to backing in accordance with NBC, CSA-S304.1, CSA-A371 and as indicated.

3.4 REINFORCED LINTELS AND BOND BEAMS

.1 Reinforce masonry lintels and bond beams as indicated in Structural drawings

.2 Place and grout reinforcement in accordance with CSA-S304.1, CSA-A371, and CSA-A179.

3.5 GROUTING

.1 Grout masonry in accordance with CSA-S304.1, CSA-A371 and CSA-A179 and as indicated.

3.6 ANCHORS

.1 Supply and install metal anchors as indicated.

3.1 BRICK MASONRY VENEER ANCHORS

.1 Install brick masonry veneer tie system as per manufacturers recommendations.

.1 Install ties at vertical and horizontal spacing recommended by manufacturer, including special situations such as around openings and at the tops and bottoms of walls.

.2 Install masonry ties at no less than 300 mm above the bottom of brick veneer wall, no less than 300 mm from top of brick veneer wall and not more than 300 mm from openings.

3.2 HORIZONTAL LATERAL SUPPORT ANCHORAGE

.1 Provide lateral support and anchorage in accordance with CSA-S304.1 and as indicated in drawings.

.2 Interior walls

.1 Provide reinforcing as noted in Structural drawings.

3.3 HORIZONTAL JOINT REINFORCEMENT

.1 Interior walls

.1 Lateral reinforcing wire ladder or truss to be installed at every second block course.

3.4 VERTICAL LATERAL SUPPORT ANCHORAGE

.1 Provide vertical lateral support and anchorage in accordance with CSA A370 and as indicated.

.2 Provide 15M vertical reinforcing bars spaced at a minimum of 1200 mm apart for full height of wall, grout fill reinforced cores.

3.5 MOVEMENT JOINTS

.1 Reinforcement will not be continuous across movement joints unless otherwise indicated.

3.6 FIELD BENDING

.1 Do not field bend reinforcement and connectors except where indicated or authorized by Consultant .

.2 Connector materials shall not be knurled or bent after hot-dip galvanizing where these operations would damage the zinc coating or impair the corrosion protection of the connector.

.3 When field bending is authorized, bend without heat, applying a slow and steady pressure.

.4 Replace bars and connectors which develop cracks or splits.

3.7 FIELD TOUCH-UP

.1 Touch up damaged and cut ends of epoxy coated or galvanized reinforcement steel and connectors with compatible finish to provide continuous coating.

3.8 CLEANING

.1 Upon completion of installation, remove surplus materials, rubbish, tools and equipment barriers.

END OF SECTION

Part 1 General

1.1 RELATED SECTIONS

.1 Section 04 05 00 - Common Work Results for Masonry.

.2 Section 04 05 12 - Masonry Mortar and Grout.

.3 Section 04 05 19 - Masonry Anchorage and Reinforcing.

.4 Section 04 21 13 – Brick Masonry

.5 Section 04 22 00 - Concrete Unit Masonry

1.2 REFERENCES

.1 American Society for Testing and Materials International, (ASTM).

.1 ASTM D2240-02b, Standard Test Method for Rubber Property - Durometer Hardness.

.2 Canadian Standards Association (CSA International).

.1 CSA-A371-94(R1999), Masonry Construction for Buildings.

1.3 SUBMITTALS

.1 Product Data:

.1 Submit manufacturer's printed product literature, specifications and data sheet in accordance with Section 01 33 00 - Submittal Procedures .

.2 Manufacturer's Instructions:

.1 Submit manufacturer's installation instructions.

Part 2 Products

2.1 MATERIALS

.1 Control joint filler: purpose-made elastomer durometer hardness to ASTM D2240 of size and shape indicated.

.2 Masonry Flashing Membrane: Self-Adhesive SBS rubberized asphalt laminated to high-density polyethylene film, minimum nominal total thickness of 1.0 mm.

.3 Lap adhesive: recommended by masonry flashing manufacturer.

.4 Weep hole vents: purpose-made PVC, colour black

.5 Cavity Drainage Protection

.1 Polyester/polyethylene mesh trapezoidal shape to maintain cavity airflow and drainage while suspending mortar droppings at unequal heights.

.1 Manufacturer: “Mortar Net” or equivalent.

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 Install continuous control joint fillers in control joints as indicated.

.2 Install weep holes in vertical joints immediately over flashings, in masonry veneer wall construction, at maximum horizontal spacing of 600 mm on centre.

.3 Install cavity protection drainage mat at steel angle support at grade beam, steel support angles and in locations indicated on drawings.

.4 Install weep hole vent at all weep hole locations.

3.3 CONSTRUCTION

.1 Build in flashings in masonry in accordance with CSA-A371.

.1 Install flashings under exterior masonry bearing on foundation walls, slabs, shelf angles, and steel angles over openings. Install flashings under weep hole courses and as indicated.

.2 In cavity walls and veneered walls, carry flashings from front edge of masonry, under outer wythe, then up backing not less than 200 mm or as indicated in drawings.

.3 Lap joints 150 mm and seal with adhesive.

3.4 CLEANING

.1 Upon completion of installation, remove surplus materials, rubbish, tools and equipment barriers.

END OF SECTION

Part 1 General

1.1 RELATED SECTIONS

.1 Section 04 05 12 - Mortar and Masonry Grout.

.2 Section 04 05 19 - Masonry Anchorage and Reinforcing.

.3 Section 04 05 23 - Masonry Accessories.

1.2 REFERENCES

.1 Brick Industry Association (BIA).

.1 Technical Note No. 20-2000, Cleaning Brick Masonry.

.2 Canadian Standards Association (CSA International).

.1 CAN/CSA A82.1-M87(R1999), Burned Clay Brick (Solid Masonry Units Made From Clay or Shale).

.2 CSA A82.3-M1978(R1998), Calcium Silicate (Sand-Lime) Building Brick.

.3 CAN3-A82.8-M78(R1999), Hollow Clay Brick.

.4 CSA-A165 Series-94(R2000), CSA Standards on Concrete Masonry Units.

1.3 ACTION AND INFORMATIONAL SUBMITTALS

.1 Product Data.

.2 Submit manufacturer's printed product literature, specifications and data sheet in accordance with Section 01 00 05 – General Requirements.

.3 Manufacturer's Instructions.

.1 Submit manufacturer's installation instructions.

.4 Samples:

.1 Submit six full size bricks to Department Representative prior to mock-up.

.5 Mock-ups: construct mock-ups in accordance with Section 01 45 00 - Quality Control and to requirements supplemented as follows:

.1 Provide mock-up for evaluation of surface finishes and workmanship.

.2 Co-ordinate type and location of mock-ups with project requirements.

.3 Mock-up will be approximately 5 m2 and include an edge detail at a change in materials (brick/phenolic panels) as well as a wall opening.

.4 Do not proceed with remaining work until workmanship, colour, and finish are approved by Departmental Representative.

.5 When accepted, mock-up will demonstrate minimum standard of quality required for this work.

.1 Approved mock-up may remain as part of finished work.

1.4 QUALITY ASSURANCE

.1 Installer Qualifications: Company specializing in installing work similar in material, design, and extent to that indicated for this Project, and with a minimum of five years documented experience.

.2 Pre-Installation Meetings: conduct pre-installation meeting to verify project requirements, manufacturer's installation instructions and manufacturer's warranty requirements. Comply with Section 01 00 05 – General Requirements.

Part 2 Products

2.1 MANUFACTURED UNITS

.1 Face brick.

.1 Burned clay brick: to CAN/CSA A82.1.

.1 Type: FBX .

.2 Grade: SW.

.3 Size: 92 x 57 x 194mm.

.4 Acceptable Manufacturer:

.1 Sioux City Brick “Cranberry Velour” or approved alternate.

2.2 ACCESSORIES

.1 Control joint filler: purpose-made elastomer durometer hardness to ASTM D2240 of size and shape indicated.

.2 Weep hole vents: purpose-made PVC or polypropylene fibre filter; colour: white..

.3 Weep hole protection mat: 90% open weave, high-density polyethylene, nylon or recycled polyester mat; product width to suit cavity space.

.1 Acceptable Material: Mortar Net

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 Bond: 1/2 Running.

.2 Coursing height: 200 mm for three bricks and three joints.

.3 Jointing: concave.

.4 Mixing and blending: mix units within each pallet and with other pallets to ensure uniform blend of colour and texture.

.5 Maintain masonry courses to uniform width. Make vertical and horizontal joints equal and of uniform thickness.

.6 Clean unglazed clay masonry as work progresses.

.7 Install continuous control joint fillers in control joints at locations indicated on drawings.

.8 Install weep hole vents in vertical joints at maximum horizontal spacing of 600 mm on centre.

.9 Install continuous length of cavity protection drainage mat in all locations where weep holes are located and as indicated in drawings.

.10 Install brick control joints in locations at minimum 10 meters or as indicated on drawings.

3.3 CLEANING

.1 Perform cleaning as soon as possible after installation to remove construction and accumulated environmental dirt.

.2 Clean brick using cleaning agent and method approved for use with specified brick. Perform cleaning in accordance with manufacturer’s instructions working from the top of the wall to the bottom.

.3 Test cleaning agent and procedures by cleaning a small, designated sample area.

.4 Upon completion of installation, remove surplus materials, rubbish, tools and equipment barriers.

END OF SECTION

Part 1 General

1.1 RELATED SECTIONS

.1 Section 04 05 00 - Common Work Results for Masonry.

.2 Section 04 05 12 - Mortar and Masonry Grout.

.3 Section 04 05 19 - Masonry Anchorage and Reinforcing.

.4 Section 04 05 23 - Masonry Accessories.

1.2 REFERENCES

.1 Canadian Standards Association (CSA International)

- .1 CAN3 A165 SERIES-94(R2000), CSA Standards on Concrete Masonry Units covers: A165.1, A165.2, A165.3.
- .2 CSA A371-04 Masonry Construction For Buildings

Part 2 Products

2.1 MATERIALS

.1 Load bearing concrete block units to CAN3-A165 Series (CAN3-A165.1)

- .1 Classification: H/15/A/M
- .2 Dimensions Nominal: 200mm wide x 200 mm high x 400 mm long.
- .3 Plain face.
- .4 Special shapes: provide bull-nosed units for exposed corners. Provide purpose-made shapes for lintels and bond beams. Provide additional special shapes as indicated.

Part 3 Execution

3.1 INSTALLATION

.1 Interior concrete block units.

- .1 Bond: running.
- .2 Coursing height: 200 mm for one block and one joint.
- .3 Jointing: concave where exposed or where paint or other finish coating is specified.
- .4 Jointing: concave where exposed or where paint or other finish coating is specified.

.2 Concrete block lintels.

- .1 Refer to structural drawings for reinforcing in loadbearing concrete block walls.

.2 Install reinforced concrete block lintels over openings in masonry where steel or reinforced concrete lintels are not indicated.

.3 End bearing: not less than 200 mm as indicated on drawings.

3.2 CLEANING

.1 Allow mortar droppings on masonry to partially dry then remove by means of trowel, followed by rubbing lightly with small piece of block and finally by brushing.

3.3 SCHEDULE

.1 Refer to drawings for location of concrete block units.

END OF SECTION

Part 1 General

1.1 RELATED REQUIREMENTS

.1 Section 04 05 00 – Common Work Results for Masonry

.2 Section 04 22 00 – Concrete Unit Masonry.

1.2 REFERENCES

.1 CSA Group

.1 CAN/CSA-A179-04(R2009), Mortar and Grout for Unit Masonry.

.2 CAN/CSA-A371-04(R2009), Masonry Construction for Buildings.

.3 CAN/CSA-A3000-08, Cementitious Materials Compendium (Consists of A3001, A3002, A3003, A3004 and A3005).

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 unit masonry and include product characteristics, performance criteria, physical size, finish and limitations.

1.4 DELIVERY, STORAGE AND HANDLING

.1 Deliver, store and handle materials in accordance with Section 01 61 00 - Common Product Requirements with manufacturer's written instructions.

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

.3 Storage and Handling Requirements:

.1 Store materials in dry location and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.

.2 Store and protect glass unit masonry from nicks, scratches, and blemishes.

.3 Replace defective or damaged materials with new.

1.5 SITE CONDITIONS

.1 Ambient Conditions: assemble and erect components when temperature is above 4 degrees C.

.2 Field Measurements:

.1 Make field measurements necessary to ensure proper fit of all members.

Part 2 Products

2.1 SYSTEM DESCRIPTION

.1 Glass block panels not to be designed to support structural loads.

.2 Provide for expansion and movement at jambs and heads of panels. Do not bridge expansion spaces with mortar.

.3 Do not cut glass blocks.

2.2 MANUFACTURED UNITS

.1 Solid glass block.

.1 Pattern and design: transparent.

.2 Surfaces: smooth.

.3 Colour: clear glass and sandblasted finish as noted in drawings.

.4 Nominal sizes:

.1 200 x 200 x 76 mm thick.

.5 Impact strength: 9-11 Nm, 6.8 kg mass per unit.

.6 Acceptable product: Pittsburgh Corning “Vistabrik”.

2.3 ACCESSORIES

.1 Mortar: Exterior wythe of glass block: type M based on mortar proportion by volume.

.2 Sealant: non-staining, waterproof mastic, silicone, urethane and Section 07 92 00 Joint Sealants. Apply sealant 24 hours after glass unit masonry installation.

.3 Sealant primer: non-staining type recommended by sealant manufacturer.

.4 Fasteners: steel, 6 mm minimum diameter, galvanized to ASTM A153/A153M, and as follows:

.1 To metal: self-drilling, self-tapping screws.

.2 To concrete and masonry: self-drilling, compression type insert, or self-tapping type screws for pre-drilled holes.

.3 To wood: wood screws.

.5 Spacers: plastic, concealed type, allowing pointing mortar and placing reinforcing and panel anchors without obstruction, of size to provide horizontal and vertical joint width indicated, capable of supporting glass units until mortar set, incorporated into structural design of glass unit masonry.

2.4 SOURCE QUALITY CONTROL

.1 Ensure glass block, components and materials are from single manufacturer.

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 glass unit masonry installation in accordance with manufacturer's written instructions.

.2 Beginning of installation means acceptance of conditions.

3.2 PREPARATION

.1 Ensure structure or substrate is adequate to support glass block.

.2 Surface Preparation: prepare surface in accordance with manufacturer's written recommendations and co-ordinate with Section 01 71 00 - Examination and Preparation.

.3 Clean glass units of foreign substances.

.4 Install sandblasted face of glass blocks in orientation noted in drawings.

.5 Establish and protect lines, levels, and coursing.

.6 Protect elements surrounding work of this Section from damage and disfiguration.

3.3 INSTALLATION

.1 Erect glass units and accessories in accordance with manufacturer's instructions.

.2 Set glass units with full bond mortar joints. Furrowing not permitted. Remove excess mortar.

.3 Do not install glass unit when ambient temperature is below 4 degrees C. Maintain ambient temperature above 4 degrees C for 48 hours after installation.

.4 Place units to maintain uniform joint width of 6 mm.

.5 Install unit masonry to avoid contact of glass units with metal accessories or frames.

.6 Shore assembly until mortar will maintain panel in position without movement.

.7 Joint reinforcement:

.1 Install reinforcement in accordance with NBC and Section 04 05 19 - Masonry Anchorage and Reinforcing, and as follows.

.2 Place security bars between wythes prior to installation of glass blocks.

3.4 CONSTRUCTION

.1 Mortar Placement:

.1 Place pointing mortar in accordance with Section 04 05 12 - Masonry Mortar and Grout.

.2 Set glass with full bond mortar joints. Furrowing not permitted. Remove excess mortar.

.3 Place units to maintain uniform joint width of 6 mm.

.2 Jointing:

.1 Tool joints to concave profile, exposing shoulders of glass units.

.2 Rake out mortar joints to depth equal to joint width and not less than 13 mm, to receive pointing mortar.

.3 Rake out mortar joints to half of joint width but not less than 5 mm depth, to receive joint sealant.

.3 Application of pointing mortar.

.1 Neatly tool surface to a concave profile. Expose shoulders of glass units.

.2 Remove excess mortar while it is still plastic using a clean, wet sponge or a scrub brush with stiff bristles.

.3 Vacuum clean mortar joints.

3.5 TOLERANCES

.1 Tolerance for glass block unit construction in accordance with Section 04 05 00 - Common Work Results for Masonry, supplemented as follows.

.1 Variation from specified joint width: plus 2 mm and minimum 0 mm.

.2 Maximum variation from plane of unit to adjacent unit: 1 mm.

.3 Maximum variation from flat plane: 3 mm in 3 m, non-cumulative.

3.6 CLEANING

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

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

3.7 PROTECTION

.1 Brace and protect glass block unit construction in accordance with Section 04 05 00 - Common Work Results for Masonry.

.2 Make good damage to adjacent materials caused by glass block installation.

3.8 SCHEDULES

.1 Hollow glass block: locate as indicated.

END OF SECTION

Part 1 General

1.1 GENERAL CONDITIONS

.1 The General Conditions of the Contract, Supplementary General Conditions and General Requirements are hereby made part of this Section.

1.2 WORK INCLUDED

.1 Structural steel framing members, structural steel support members, struts, complete with required bracing, welds, washers, nuts, shims, anchor plates and bolts.

.2 Baseplates, connectors and bearing plates.

.3 Field and shop welded composite beam studs shall be supplied and installed under this section.

.4 Erection.

1.3 RELATED WORK

.1	Cast-in-Place Concrete	Section 03 30 00
.2	Concrete Unit Masonry	Section 04 22 00
.3	Steel Joist Framing	Section 05 21 00
.4	Steel Decking	Section 05 31 00
.5	Wood Decking	Section 06 15 16
.6	Painting and Finishing	Section 09 90 00

1.4 QUALITY ASSURANCE

.1 Structural steel fabricator to be certified as minimum Division 2 Company under CSA W47.1-09 - "Certification of Companies for Fusion Welding of Steel Structures" or CSA Standard W55.3-08 "Resistance Welding Qualification Code for Fabricators of Structural Members" or both, as applicable.

.2 Design to strictly adhere to all codes and standards as enumerated under Section 1.5 Reference Standards.

.3 In the event of conflict between pertinent codes, standards and/or regulations, most stringent shall govern.

.4 Composite steel studs attached to structural steel beams or girders and installed in either the fabricator's plant or in the field shall be supplied and installed by the Structural Steel Subcontractor who shall be a company certified as a Division 2 fabricator by the Canadian Welding Bureau under CSA Standard W47.1 "Certification of Companies for Fusion Welding of Steel Structures". This certification to be in effect prior to date of tender closing. This condition is a mandatory condition of the Contract Documents and shall not be waived regardless of Saskatchewan Bid Depository Rules or practices.

1.5 REFERENCE STANDARDS

.1 CSA Standard CAN/CSA-S16-01 - "Limit States Design of Structural Steel Buildings".

.2 CSA G40.21-04 (R2009) - "Structural Quality Steel".

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

.4 CSA Standard W59-03 (R2008) - 'Welded Steel Construction".

.5 CSA Standard W47.1-09 - "Certification of Companies for Fusion Welding of Steel Structures".

.6 ASTM Standard A53 - "Welded and Seamless Steel Pipe".

1.6 SHOP DRAWINGS

.1 Submit shop drawings in accordance with General Conditions.

.2 Clearly indicate sizes, spacing and locations of structural members, connections, attachments, anchorages, framed openings and size and type of fasteners and welds.

.3 Indicate all shop and erection details including cuts, copes, connections, holes, threaded fasteners and welds.

.4 Show all welds, both shop and field, by the currently recommended symbols of the Canadian Welding Bureau.

.5 Provide drawings stamped and signed by a Professional Engineer registered in the Province of Saskatchewan.

.6 Review of shop drawings for size and arrangement of principal and auxiliary members only. Such review will not relieve the Contractor of responsibility for general and detail dimension and fit, or any errors or omissions.

1.7 INSPECTION AND TESTING

.1 Materials and workmanship subject to inspection on behalf of Owner.

.2 Report failure of material to fit together properly to Consultant. No corrective measures permitted unless approved by Consultant in writing.

Part 2 Products

2.1 MATERIALS/COMPONENTS

.1 *Standard Rolled Sections:* new material conforming to CSA G40.21-04 (R2009)M, 350W, weldable grade.

.2 *Hollow Structural Sections:* new material conforming to CSA G40.21-04 (R2009), 350 MPa, weldable grade.

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

.4 *Base and Cap Plates:* new material conforming to CSA G40.21-04 (R2009), Grade 300W.

.5 *Beam End Plates, Ledger Angles and Miscellaneous Steel:* new material conforming to CSA G40.21-04 (R2009), Grade 300W.

.6 *Anchor Bolts:* new material conforming to CSA G40.21-04 (R2009), Grade 260W.

.7 *Bolts, Nuts and Washers:* high strength type recommended for structural steel joints, conforming to requirements of ASTM A325M-83c.

.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 - 58T 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 S16-01. Welding to conform to CSA W59-03 (R2008) "Welded Steel Construction". Verify all dimensions prior to fabrication.

.2 No cutting of openings in structural members except as shown on structural drawings. Reinforce openings to maintain required design strength.

.3 Accurately cut and mill column ends to assure full contact of bearing surfaces.

.4 Camber horizontal members as specified on drawings. Mill camber up where not specifically detailed.

.5 All bolted connections to be "bearing" type connections except where subject to stress reversal which are to be "slip resistant" type connections.

.6 All connections showing combined axial load (tension or compression) across the joint to be designed for loads shown. Such connection to be bolted through columns only.

.7 All beams to be connected for the greater of the following conditions.

- .1 Loads shown on drawings.
- .2 50% of the total uniformly distributed load resistance of the member.
- .3 Half depth of the connected member using M20 bolts (minimum two bolts) in double shear.

.8 Shop installed shear studs to be installed in strict conformance with requirements of CSA Standard W59. Refer to Part 3 Execution for additional requirements.

.9 Masonry Ledgers

.1 All masonry ledgers supplied by structural steel shall be fabricated with connections to provide for full site adjustment.

.10 Tolerances

.1 All masonry ledgers exposed to view are to be fabricated straight with no discernible kinks, bends or sweep. Maintain straightness to within tolerance of 1 in 500 with maximum deviation of ± 3mm.

.2 Tolerances of all other structural steel shall be maintained strictly in accordance with CAN/CSA S16-01.

.11 All exposed steel and all related bridging and bracing shall be fabricated with clean, neat fitting welded connections.

2.3 PAINTING

.1 All steel in contact with concrete and all faying surfaces of high strength bolted slip-resistant connections shall not be primed.

.2 Top flange of steel beams that have shop or field installed shear studs shall not be painted.

.3 All exposed interior steel ledgers, lintels and glulam connections shall be prepared and painted as follows:

(I) Clean steel to SSPC Standard SP3 "Power Tool Cleaned". Apply one coat of General Paint 06-134 Q.D. Shop Primer.

(II) Apply one coat of General Paint 17-Line Q.D. Industrial Enamel. Color section by Consultant.

.4 All exposed steel and all related bridging and bracing shall be prepared and painted as follows:

(I) Clean steel to SSPC Standard SP3 "Power Tool Cleaned". Apply one coat of specified shop primer.

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

.6 Hot dipped galvanizing zinc coating. 600 grams/m^2 to CAN/CSA G164-M92.

Part 3 Execution

3.1 ERECTION

.1 Erect structural steel in accordance with building design drawings and all requirements on CAN/CSA S16-01.

.2 Make adequate provision for all erection loads and for sufficient temporary bracing to maintain structure safe, plumb and in true alignment until completion of erection. Leave such bracing in place as long as required for safety and integrity of the structure.

.3 As erection progresses, securely bolt work to take care of full design loads and to provide structural integrity as required.

.4 Use high tensile bolts for field connections unless otherwise noted on building design drawings.

.5 Set all baseplates which are shop welded to columns to proper elevation on steel shims. Maximum tolerance from stated elevations to be ± 2mm.

.6 Masonry Ledgers

.1 All masonry ledgers shall be erected with provision for full site adjustment. Position ledgers accurately to correct elevations and plan location and field weld in place prior to laying up masonry.

7. Tolerances

.1 All masonry ledgers are to be erected straight, level and plumb with no discernible kinks, bends or sweep. All masonry support members are to be erected such that the masonry can be laid up in its correct location, fully supported, straight and plumb.

.2 All masonry support members exposed to view are to be erected to comply with the following tolerances:

.1 Straight to within tolerance of 1 in 500 with maximum deviation of ±3 mm from established location.

.2 Level to within tolerance of 1 in 1000 with maximum deviation of ±3 mm from established location.

.3 Plumb to within tolerance of 1 in 500 with maximum deviation of ±3 mm .

.4 Adjoining ends of these members shall be aligned vertically within 2 mm.

.5 The location of these members vertically and horizontally shall be within 10 mm of the location established on the drawings.

.6 Splices between ledgers shall have the toe of the exposed flanges flush. The ledgers are to be fully welded together at all splice locations and all exposed portions are to be continuous with all welds ground smooth and flush.

.7 Exposed portions of all ledgers are to be finished smooth ready for finish painting. All irregularities and surface defects are to be removed.

.3 Tolerance of all other structural steel shall be maintained strictly in accordance with CAN/CSA S16-01.

.8 After erection, prime all welds, abrasions, bolted connections and all other surfaces not shop primed, except surfaces to be in contact with concrete.

.9 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 the Section.

1.2 WORK INCLUDED

.1 Open web steel joists, with required anchorages, bridging, bracing and bearing plates.

1.3 RELATED WORK

.1	Cast-in-Place Concrete	Section 03 30 00
.2	Concrete Unit Masonry	Section 04 22 00
.3	Structural Steel for Buildings	Section 05 12 23
.4	Steel Decking	Section 05 31 00
.5	Wood Decking	Section 06 15 16
.6	Metal Fabrications	Section 05 50 00

1.4 QUALITY ASSURANCE

.1 Steel joist fabricator to be certified as a Division 1 or 2 Company under CSA W47.1-09 - "Certification of Companies for Fusion Welding of Steel Structure".

1.5 DESIGN OF STEEL JOISTS

.1 Unless detailed otherwise all floor joists to be designed to support all applicable dead loads, partition loads, and all live loads for designated occupancies in accordance with current NBC. Unless noted otherwise, all joists to be designed for maximum liveload deflection of L/360.

.2 Unless specifically detailed otherwise, provide additional steel floor joists below all concrete masonry partition walls running parallel to direction of joists. Design joists to support tributary floor loads plus applicable wall loads. Design floor joists for applicable point load from concrete masonry running perpendicular to joists.

.3 In the event of conflict between pertinent codes, standards and/or regulations, most stringent shall govern.

1.6 REFERENCE STANDARDS

.1 CAN/CSA G40.21-04 (R2009) - "Structural Quality Steel".
.2 CAN/CSA S16-01 - "Steel Structures for Buildings".
.3 CSA Standard W59-03 (R2008) - "Welded Steel Construction".
.4 CSA Standard W55.3-08 - "Resistance Welding Qualification Code".

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

1.7 SHOP DRAWINGS

.1 Submit shop drawings in accordance with General Conditions.

.2 Clearly indicate material specification and profile of web and chord sections, location and spacing of joists, end connections, size and location of bridging.

.3 Indicate load capacity for all simply supported joists in kN/metre. Clearly note that magnitude and locations of all point loads for which joists have been designed. Indicate shear capacity of all joists subject to built up or point loading resulting in unequal shears at joist ends.

.4 Consider cantilever joists, continuous joists or joists having special support conditions as "Special Joists". Design these joists as per Clause 16.5.2 CAN3 S16-01 - "Loading for Open-Web Special Steel Joists". Indicate design loading on shop drawings.

.5 Prepare shop drawings under the direction of a Professional Engineer registered in the Province of Saskatchewan.

.6 Review of shop drawings for size and arrangement of principal and auxiliary members only. Such review will not relieve the Contractor of responsibility for general and detail dimension and fit, or any errors or omissions.

.7 Submit shop drawings stamped and signed by qualified professional engineer registered in Province of Saskatchewan, Canada.

Part 2 Products

2.1 MATERIALS/COMPONENTS

.1 *Joist Members:* of type W - Weldable steel, conforming to requirements of CSA G40.21-04 (R2009); with minimum yield strength of 300 Mpa.

.2 *Bridging and Bearing Plates/Angles:* of type W - Weldable steel conforming to requirements of CSA G40.21-04 (R2009); with minimum yield strength of 260 MPa.

.3 *Anchor Bolts for Required Nuts and Washers:* high strength type recommended for structural steel joints conforming to requirements of ASTM A325 M-83C.

.4 *Paint for primer* shall be grey (unless approved otherwise) and meet requirements of one of the following:

.1 CGSB 1-GP-40d, Primer, Structural Steel, oil alkyd type.
.2 CISC/CPMA Standard 1-73a, quick drying one-coat paint for use on structural steel.

2.2 FABRICATION

.1 Fabricate steel joists in accordance with building design drawings and all requirements of CAN/CSA S16-01. Verify all drawing dimensions and conditions prior to commencing fabrication.

.2 Fabricate joists to adhere to Clause 16.10 CAN/CSA S16-01 "Manufacturing Tolerances".

.3 Provide top and bottom chord extensions where indicated.

.4 Camber joists to accommodate for dead load deflection.

.5 Surface Preparation: shall conform to SSPC-SP2 "Hand Tool Cleaning".

.6 Apply 1 coat of specified shop primer.

Part 3 Execution

3.1 Erection

.1 Erect joists in accordance with drawings and within tolerances specified by Clause 16.12.2 CAN3 S16-01 - "Erection Tolerances".

.2 Allow minimum 100 mm bearing when supported by masonry. Allow minimum 65 mm bearing when supported by structural steel.

.3 Extend joist legs to within 6 mm of centre line of beams when bearing on both sides and minimum 25 mm past centre line when baring on one side only.

.4 During erection, provide all temporary bracing required as a result of induced loads and stresses.

.5 Co-ordinate the proper placement of anchor bolts in concrete and masonry construction as required for the support of bearing plates/angles.

.6 Field weld joist seat to bearing plates/angles after alignment and angles.

.7 Strut bottom chord where noted on drawings.

.8 Do not permit erection of decking until joists are sufficiently braced.

.9 Obtain Consultant's written permission prior to field cutting or altering of joists or bridging.

.10 After erection, prime all welds, abrasions and surfaces not shop primed. Use a primer consistent with that used to provide shop coat.

END OF SECTION

Part 1 General

1.1 GENERAL CONDITIONS

.1 The General Conditions of the Contract, Supplementary General Conditions and General Requirements are hereby made part of this Section.

1.2 WORK INCLUDED

.1 Steel roof and floor deck, complete with cover plates, cell closures and flashings.

.2 All closure angles, channels, plates, as well as supplementary deck support or anchorage where required to provide continuous deck membrane.

.3 Contractor to study Contract Drawings and Specifications with regard to the work shown and required under this Section to ensure its completeness. Supplementary items necessary to complete the work although not specifically shown or specified shall be supplied and installed.

.4 Steel roof deck designed as a structural diaphragm. Contractor to ensure all side lap fastening and welding is as per the Drawings and Specifications.

.5 Field and shop welded composite beam studs are to be supplied and installed by the structural steel subcontractor.

1.3 RELATED WORK

.1	Cast-in-Place Concrete	Section 03 30 00
.2	Structural Steel for Buildings	Section 05 12 23
.3	Steel Joist Framing	Section 05 21 00
.4	Metal Fabrications	Section 05 50 00
.5	Painting and Finishing	Section 09 90 00

1.4 REFERENCE STANDARDS

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

.2 CAN/CSA S136-07 - "Cold Formed Steel Structural Members".

.3 ASTM A446 - "Steel Sheet, Zinc Coated (Galvanized) by the Hot Dip Process, Physical (Structural Quality)".

.4 Welding to CSA W59-03 (R2008) except where specified elsewhere.

1.5 SHOP DRAWINGS

.1 Submit shop drawings in accordance with General Conditions.

.2 Clearly indicate decking plan, deck profile, dimensions, anchorage, supports, projects, openings and reinforcement, applicable details and accessories.

.3 Clearly indicate position of temporary shoring of decking if required by design criteria.

.4 Review of shop drawings will not relieve Contractor of responsibility for general and detail dimensions and fit, or any errors or omissions.

.5 Prepare shop drawings under the direction of a professional engineer registered in the Province of Saskatchewan, Canada.

.6 Submit shop drawings stamped and signed by qualified professional engineer registered in Province of Saskatchewan, Canada.

Part 2 Products

2.1 MATERIALS/COMPONENTS

.1 *Sheet Steel:* Grade A or Grade B structural quality, conforming to ASTM A446.

2.2 DECKING/RELATED ACCESSORIES

.1 *Roof Decking:* RD938 Roof Deck - 38 mm deep by 914 mm wide sheets by 0.76 mm core thickness, as manufactured by VicWest or approved equivalent. Galvanized to Z275 (G90) standard or ZF075 (A25) wiped coat.

.2 *Floor Decking:* HB938 Hi-Bond Steel Floor Deck - 38 mm deep by 914 mm wide sheets by 0.76 mm core thickness as manufactured by VicWest or approved equivalent. Galvanized to ZF075 (Wipe Coat) Standard.

.3 Any substitution of specified material to be approved in writing by the Consultant.

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

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

.6 *Closures to external walls:* neoprene as recommended by manufacturer.

2.3 FABRICATION

.1 Fabricate metal decking in accordance with Drawings and as recommended by the Canadian Sheet Steel Building Institute (CSSBI) Standards. Fabricate to accommodate maximum deflections of 1/360 span.

.2 Supply steel fillers between decking and supporting members where required.

.3 Deck units to be 3 span continuous where possible; under no circumstances should deck be less than 2 span continuous except where detailed.

Part 3 Execution

3.1 INSTALLATION

.1 Erect metal decking in accordance with drawings and as recommended by the CSSBI. Properly align and level on structural supports.

.2 Allow minimum 40 mm bearing when supported by structural steel and minimum 100 mm bearing when supported by masonry or concrete.

.3 Mechanical fasten male/female side laps at maximum 300 mm.

.4 Fasten deck to ALL supporting steel with 20 mm fusion welds at maximum 300 mm on centre. Secure "V" rib pans to structure with plug welds through 19 mm diameter steel washers at 300 mm on centre.

.5 Reinforce openings 150 mm to 450 mm in size with L51 x 51 x 4.8 steel angles or as indicated on the Drawings. Place angles perpendicular to flutes, extended minimum two flutes each side of openings and weld to deck.

.6 Reinforce openings over 450 mm in accordance with details indicated on Drawings.

.7 Install minimum 150 mm cover plates where deck changes direction. Spot weld in place at maximum 300 mm on centre.

.8 Install strip closures at slab edges to match thickness of slab, as required to contain poured concrete. Ensure closures are of sufficient strength to remain in place without distortion.

.9 Install acoustical closures in locations above walls and partitions in areas where partitions butt to decking.

.10 Immediately after installation, touch up welds, burned areas and damaged spots with prime paint. Use type of primer recommended for galvanized surfaces.

END OF SECTION

Part 1 General

1.1 REFERENCES

.1 American Society for Testing and Materials International, (ASTM)

- .1 ASTM A53/A53M-12, Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated Welded and Steamless.
- .2 ASTM A276-13a, Standard Specification for Stainless Steel Bars and Shapes.
- .3 ASTM A307-12, Standard Specification for Carbon Steel Bolts and Studs, 60,000 PSI Tensile Strength.

.2 Canadian General Standards Board (CGSB)

- .1 CAN/CGSB-1.40-97, Anti-corrosive Structural Steel Alkyd Primer.
- .2 CAN/CGSB-1.181-99, Ready-Mixed, Organic Zinc-Rich Coating.

.3 Canadian Standards Association (CSA International)

- .1 CSA-G40.20/G40.21-13, General Requirements for Rolled or Welded Structural Quality Steel.
- .2 CAN/CSA-G164-M92(R2003), Hot Dip Galvanizing of Irregularly Shaped Articles.
- .3 CAN/CSA-S16.1-01, Limit States Design of Steel Structures.
- .4 CSA W48-06(R2011), Filler Metals and Allied Materials for Metal Arc Welding (Developed in co-operation with the Canadian Welding Bureau).
- .5 CSA W59-13, Welded Steel Construction (Metal Arc Welding).

1.2 SUBMITTALS

.1 Product Data:

- .1 Submit manufacturer's printed product literature, specifications and data sheet in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Submit two copies of WHMIS MSDS - Material Safety Data Sheets in accordance with Section 01 33 00 - Submittal Procedures. Indicate VOC's:
  - .1 For finishes, coatings, primers and paints.

.2 Shop Drawings

- .1 Submit shop drawings in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Indicate materials, core thicknesses, finishes, connections, joints, method of anchorage, number of anchors, supports, reinforcement, details, and accessories.

1.3 QUALITY ASSURANCE

.1 Test Reports: Certified test reports showing compliance with specified performance characteristics and physical properties.

.2 Certificates: Product certificates signed by manufacturer certifying materials comply with specified performance characteristics and criteria and physical requirements.

.3 Pre-installation Meetings: Conduct pre-installation meeting to verify project requirements, manufacturer's installation instructions and manufacturer's warranty requirements.

1.4 DELIVERY, STORAGE, AND HANDLING

.1 Packing, Shipping, Handling and Unloading:

.1 Deliver, store, handle and protect materials in accordance with Section 01 61 00 - Common Product Requirements.

.2 Storage and Protection:

.1 Cover exposed stainless steel surfaces with pressure sensitive heavy protection paper or apply strippable plastic coating, before shipping to job site.

.2 Leave protective covering in place until final cleaning of building. Provide instructions for removal of protective covering.

Part 2 Products

2.1 MATERIALS

.1 Steel sections and plates: to CAN/CSA-G40.20/G40.21, Grade 300W or 350W.

.2 Steel pipe: to ASTM A53/A53M extra strong, galvanized finish.

.3 Welding materials: to CSA W59.

.4 Welding electrodes: to CSA W48 Series.

.5 Bolts and anchor bolts: to ASTM A307.

.6 Stainless steel: to ASTM A276, Type 302 commercial grade.

.7 Steel Mesh: rolled flattened steel mesh, galvanized finish.

.8 Grout: non-shrink, non-metallic, flowable, 15 MPa at 24 hours.

2.2 FABRICATION

.1 Fabricate work square, true, straight and accurate to required size, with joints closely fitted and properly secured.

.2 Use self-tapping shake-proof flat headed screws on items requiring assembly by screws or as indicated.

.3 Where possible, fit and shop assemble work, ready for erection.

.4 Ensure exposed welds are continuous for length of each joint. File or grind exposed welds smooth and flush.

2.3 FINISHES

.1 Galvanizing: hot dipped galvanizing with zinc coating 600 g/m^2 to CAN/CSA-G164.

.2 Chromium plating: chrome on steel with plating sequence of 0.009 mm thickness of copper, 0.010 mm thickness of nickel and 0.0025 mm thickness of chromium.

.3 Shop coat primer: to CAN/CGSB-1.40.

.4 Zinc primer: zinc rich, ready mix to CAN/CGSB-1.181.

2.4 ISOLATION COATING

.1 Isolate aluminum from following components, by means of bituminous paint:

.1 Dissimilar metals except stainless steel, zinc, or white bronze of small area.

.2 Concrete, mortar and masonry.

.3 Wood.

2.5 SHOP PAINTING

.1 Apply one shop coat of primer to metal items, with exception of galvanized or concrete encased items.

.2 Use primer unadulterated, as prepared by manufacturer. Paint on dry surfaces, free from rust, scale, grease. Do not paint when temperature is lower than 7 degrees C.

.3 Clean surfaces to be field welded; do not paint.

2.6 ANGLE LINTELS

.1 Steel angles: prime painted, sizes indicated for openings. Provide 150 mm minimum bearing at ends.

.2 Weld or bolt back-to-back angles to profiles as indicated.

.3 Finish: shop painted.

2.7 PIPE RAILINGS

.1 Steel pipe: 38 mm nominal outside diameter, formed to shapes and sizes as indicated.

.2 Galvanize exterior pipe railings after fabrication.

2.8 RAIN CHAINS

.1 Rain chain: stainless steel, marine grade 316L, welded links, polished finish complete with stainless steel attachment hardware.

.1 Links minimum 7mm thick, 25mm wide and 45mm long.

.2 Rain chain support: stainless steel pipe to fit over internal rainwater leader and stainless steel threaded support rods and hardware.

2.9 CORNER GUARDS

.1 Stainless steel angle: 89 x 89 x 2 mm thick x 2440 mm high, with 8 anchors each guard.

.2 Satin finish for all applications.

2.10 COUNTER SUPPORT ARM

.1 Steel plate, 6mm thick, shop primed.

2.11 BENCH SUPPORT ARM

.1 Steel plate, 6mm thick, shop primed.

2.12 STEEL MESH

.1 Rolled flattened steel mesh, galvanized.

2.13 Rain Water Leader (RWL)

.1 Hollow structural steel: 152mm x 102mm x 4.8mm.

.2 Shop painted: SSPC SP-6 commercial blast, apply MPI 5.1M paint system (epoxy primer and two coats W.B. light industrial paint coating). Premium grade, Gloss level 5

2.14 SHIP LADDER

.1 Refer to drawings.

2.15 ROOF RESTRAINT

.1 Refer to drawings.

Part 3 Execution

3.1 ERECTION

.1 Do welding work in accordance with CSA W59 unless specified otherwise.

.2 Erect metalwork square, plumb, straight, and true, accurately fitted, with tight joints and intersections.

.3 Provide suitable means of anchorage acceptable to Departmental Representative such as dowels, anchor clips, bar anchors, expansion bolts and shields, and toggles.

.4 Exposed fastening devices to match finish and be compatible with material through which they pass.

.5 Provide components for building by other sections in accordance with shop drawings and schedule.

.6 Make field connections with bolts to CAN/CSA-S16.1, or weld.

.7 Hand items over for casting into concrete or building into masonry to appropriate trades together with setting templates.

.8 Touch-up rivets, field welds, bolts and burnt or scratched surfaces after completion of erection with primer.

.9 Touch-up galvanized surfaces with zinc rich primer and zinc finish coating where burned by field welding.

3.2 ANGLE LINTELS

.1 Install lintels as indicated in drawings

3.3 PIPE RAILINGS

.1 Install pipe railings as indicated in drawings

3.4 RAIN CHAINS

.1 Install rain chain and rain chain support as indicated in drawings.

.2 Fasten rain chain to concrete base with stainless steel U-bolt.

3.5 CORNER GUARDS

.1 Install corner guards as indicated in drawings.

3.6 COUNTER SUPPORT ARM

.1 Install counter support arm as indicated in drawings.

.2 Continuously weld all connections, grind smooth.

.3 Apply primer to exposed metal.

3.7 BENCH SUPPORT ARM

.1 Fabricate and install support arm as indicated in drawings.

.2 Continuously weld all connections, grind smooth.

.3 Apply primer to exposed metal, finish paint support arm.

3.8 STEEL MESH

.1 Refer to Wall Types in drawings.

3.9 Rain Water Leader (RWL)

.1 Fabricate rain water leader as indicated.

.2 Shop paint rain water leader.

.3 Install rain water leader as indicated.

3.10 SHIP LADDER

.1 Refer to drawings.

3.11 ROOF RESTRAINT

.1 Refer to drawings.

3.12 CHANNEL FRAMES

.1 Install steel channel frames to openings as indicated.

3.13 CLEANING

.1 Perform cleaning after installation to remove construction and accumulated environmental dirt.

.2 Upon completion of installation, remove surplus materials, rubbish, tools and equipment barriers.

END OF SECTION

Part 1 General

1.1 RELATED SECTIONS

.1 Section 06 20 00 – Finish Carpentry

.2 Section 06 40 00 – Architectural Woodwork

.3 Section 08 71 00 – Door Hardware

.4 Section 09 21 16 – Gypsum Board Assemblies

.5 Section 10 28 10 – Toilet and Bath Accessories

1.2 REFERENCES

.1 American Society for Testing and Materials International (ASTM)

- .1 ASTM C36/C36M-03e1, Standard Specification for Gypsum Wallboard.

.2 Canadian General Standards Board (CGSB)

- .1 CAN/CGSB-51.32-M77, Sheathing, Membrane, Breather Type.
- .2 CAN/CGSB-51.34-M86, Vapour Barrier, Polyethylene Sheet for Use in Building Construction.
- .3 CAN/CGSB-71.26-M88, Adhesive for Field-Gluing Plywood to Lumber Framing for Floor Systems.

.3 Canadian Standards Association (CSA International)

- .1 CSA B111-1974(R2003), Wire Nails, Spikes and Staples.
- .2 CAN/CSA-G164-M92(R2003), Hot Dip Galvanizing of Irregularly Shaped Articles.
- .3 CSA O112 Series-M1977(R2006), CSA Standards for Wood Adhesives.
- .4 CSA O141-05(R2009), Softwood Lumber.
- .5 CSA O151-09, Canadian Softwood Plywood.
- .6 CAN/CSA-O325.0-92(R2003), Construction Sheathing.

.4 National Lumber Grades Authority (NLGA)

- .1 Standard Grading Rules for Canadian Lumber 2010.

1.3 SUBMITTALS

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

1.4 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.

1.5 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 FRAMING AND STRUCTURAL MATERIALS

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

.1 CSA O141.

.2 NLGA Standard Grading Rules for Canadian Lumber.

.2 Structural Composite Lumber (SCL) in accordance with ASTM D5456.

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

.4 Furring, blocking, nailing strips, grounds, rough bucks:

.1 Board sizes: "Standard" or better grade.

.2 Dimension sizes: "Standard" light framing or better grade.

.3 Post and timbers sizes: "Standard" or better grade.

.5 Use pressure (preservative) treated lumber material for wood nailers at roof.

2.2 PANEL MATERIALS

.1 Plywood, OSB and wood based composite panels: to CAN/CSA-O325.0.

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

2.3 ACCESSORIES

.1 Sealants: in accordance with Section 07 92 10 - Joint Sealing.

.1 Maximum allowable VOC limit 250 g/L.

.2 Subflooring adhesive: to CGSB-71.26, cartridge loaded.

.1 Maximum allowable VOC limit 30 g/L.

.3 General purpose adhesive: to CSA O112 Series.

.1 Maximum allowable VOC limit 140 g/L.

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

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

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

2.4 FASTENER FINISHES

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

Part 3 Execution

3.1 PREPARATION

.1 Store wood products in a dry location, off the ground.

3.2 INSTALLATION

.1 Comply with requirements of NBC 2005 Part 9 supplemented by following paragraphs.

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

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

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

.5 Select exposed framing for appearance. Install lumber and panel materials so that grade-marks and other defacing marks are concealed or are removed by sanding where materials are left exposed.

.6 Install wall sheathing in accordance with manufacturer's printed instructions.

.7 Install furring and blocking as required to space-out and support casework, cabinets, wall and ceiling finishes, facings, electrical equipment mounting boards, and other work as required. Refer to Section 09 91 23 – Interior Painting

.8 Install solid wood blocking 38mm x 152 mm in joist cavities at locations where wall mounted door stop is attached to steel stud wall assemblies.

.9 Install rough bucks, nailers and linings to rough openings as required to provide backing for frames and other work.

.10 Use dust collectors and high quality respirator masks when cutting or sanding wood panels.

3.3 ERECTION

.1 Frame, anchor, fasten, tie and brace members to provide necessary strength and rigidity.

.2 Countersink bolts where necessary to provide clearance for other work.

.3 Use nailing disks for soft sheathing as recommended by sheathing manufacturer.

3.4 SCHEDULES

.1 Refer to drawings for various items requiring furring, blocking, nailing strips, grounds and rough bucks.

.2 Provide backing in walls for all millwork, shelving and wall mounted items requiring solid blocking.

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 Supply and erect wood roof decking where shown on drawings.

1.3 RELATED WORK

.1	Structural Steel for Buildings	Section 05 12 23
.2	Steel Joist Framing	Section 05 20 00
.3	Carpentry	Section 06 10 00
.4	Finishing of Wood Decking	Section 09 90 00

1.4 REFERENCE STANDARDS

.1 CSA Standard O86-09 - Engineering Design in Wood.
.2 CSA Standard B111-1974 - Wire Nails, Spikes and Staples.
.3 CSA Standard O80 Series 08 (R2012)- Wood Preservation and Supplements.
.4 CSA Standard O141-05 (R2009) - Softwood Lumber.

1.5 PROTECTION

.1 Where decking to be exposed as a finish, handle with care during shipping and installation to maintain undamaged and unmarked exposed face. Damaged members will be rejected.

1.6 DELIVERY AND HANDLING

.1 Store wood decking well blocked off ground and separated with strippings, so air may circulate around sides of members. Cover top and sides with opaque moisture resistant membrane.

Part 2 Products

2.1 MATERIALS

.1 *Wood decking:* to be Cedar of Species Group E, select grade in accordance with the National Lumber Grades Authority - "Standard Grading Rules". Nominally 150 wide x 75 thick, double tongue and grooved with pre-drilled lateral holes 6 mm diameter at 760 mm on centre for lateral anchorage, maximum moisture content 15%.

.2 *Nails and Spikes:* conforming to requirements to CSA B111; size and type to suit application. Plain finish for interior application, galvanized for exterior use.

Part 3 Execution

3.1 PLACEMENT

.1 Placement of wood decking not to proceed until work upon which this is dependent has been inspected and approved. Advise Consultant of proposed schedule for placing deck such that wood decking and prior work may be inspected before erection commences.

.2 Place wood decking where indicated on drawings, perpendicular to support members. Lay decking with tongues in an upward position in controlled random pattern in accordance with CSA Standard O86.

.3 Secure each plank to each support with one 125 toe nail and one 150 face nail. Laterally spike planks together using one 250 spike in each pre-drilled hole.

.4 Where planks are unable to be laterally spiked due to perimeter parapet wall, connect planks together by 100 mm wide x 18 ga. galvanized metal straps face nailed to the top face of the decking at 750 mm on centre. Extend straps back to include at least the last plank which as been laterally spiked.

END OF SECTION

Part 1 General

1.1 REFERENCES

.1 American National Standards Institute (ANSI)

.1 ANSI/HPVA HP-1-2009, Standard for Hardwood and Decorative Plywood.

.2 ANSI/NPA A208.1-2009, Particleboard.

.2 Architectural Woodwork Manufacturers Association of Canada (AWMAC) and Architectural Woodwork Institute (AWI)

.1 Architectural Woodwork Quality Standards Illustrated, 1st edition, 2009.

.3 Canadian General Standards Board (CGSB)

.1 CAN/CGSB-71.20-M88, Adhesive, Contact, Brushable.

.4 Canadian Standards Association (CSA International)

.1 CSA B111-74(R2003), Wire Nails, Spikes and Staples.

.2 CSA O112.4 Series-M1977(R2006), Standards for Wood Adhesives.

.3 CSA O121-08(R2013), Douglas Fir Plywood.

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

.5 National Electrical Manufacturers Association (NEMA)

.1 ANSI/NEMA LD-3-2005, High-Pressure Decorative Laminates (HPDL).

.6 National Hardwood Lumber Association (NHLA)

.1 Rules for the Measurement and Inspection of Hardwood and Cypress 2011.

.7 National Lumber Grades Authority (NLGA)

.1 Standard Grading Rules for Canadian Lumber 2010.

1.2 PERFORMANCE REQUIREMENTS

.1 Perform architectural casework work in accordance with the recommendations of the "Architectural Woodwork Quality Standards Illustrated" of the Architectural Woodwork Institute and Architectural Woodwork Manufacturers Association of Canada (AWMAC), 2009 Edition, together with authorized additions and amendments, Custom Grade.

.2 Where modifications to the AWMAC Quality Standards are included in this project specification, then such modifications shall govern in case of conflict.

.3 Materials and installation shall be in metric measurement as specified.

1.3 SUBMITTALS

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

.2 Provide shop drawings in accordance with Section 01 33 00 - Submittal Procedures.

.1 Indicate details of construction, profiles, jointing, fastening and other related details.

.1 Scales: profiles full size, details half full size.

.2 Indicate materials, thicknesses, finishes and hardware.

.3 Indicate locations of service outlets in casework, typical and special installation conditions, and connections, attachments, anchorage and location of exposed fastenings.

.3 Provide samples in accordance with Section 01 33 00 - Submittal Procedures.

.1 Provide duplicate samples: sample size 300 x 300 mm or 600 mm long unless specified otherwise.

.2 Provide two (2) samples of each wood species for review.

.3 Provide duplicate colour samples of laminated plastic for colour selection.

.4 Provide duplicate samples of laminated plastic joints, edging, cutouts and postformed profiles.

.4 Quality assurance submittals:

.1 Manufacturer's Instructions: manufacturer's installation instructions.

1.4 QUALITY ASSURANCE

.1 Lumber by grade stamp of an agency certified by Canadian Lumber Standards Accreditation Board.

.2 Plywood, particleboard, OSB and wood based composite panels in accordance with CSA and ANSI standards.

.3 Delivery, Storage, and Handling:

.1 Deliver, handle, store and protect materials of this section in accordance with Section 01 61 00 - Common Product Requirements.

.1 Protect millwork against dampness and damage during and after delivery.

.2 Store millwork in ventilated areas, protected from extreme changes of temperature or humidity.

.4 Waste Management and Disposal:

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

Part 2 Products

2.1 MATERIALS

.1 Softwood lumber: unless specified otherwise, S4S, moisture content 19% or less in accordance with following standards:

.1 CSA O141.

.2 NLGA Standard Grading Rules for Canadian Lumber.

.3 AWMAC custom grade, moisture content as specified.

.2 Hardwood lumber: moisture content 6% or less in accordance with following standards:

.1 National Hardwood Lumber Association (NHLA).

.2 AWMAC custom grade, moisture content as specified.

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

.1 Urea-formaldehyde free.

.4 Hardwood plywood: to ANSI/HPVA HP-1.

.1 Urea-formaldehyde free.

.5 Engineered Combination core – 5 ply veneer: to ANSI A208-1

.1 Urea-formaldehyde free.

.6 Laminated plastic for flatwork: to NEMA LD3, Grade VGL, Type HD, 1.6 mm thick; based on solid, woodgrain, printed pattern, and metallic, colour range with satin, matt, textured, and embossed finish.

.7 Laminated plastic backing sheet: Grade BK, Type HD not less than 0.5 mm thick or same thickness and colour as face laminate.

.8 Thermofused Melamine: to NEMA LD3 Grade VGL.

.1 High wear resistant thermofused melamine: equal or exceed 400 cycles (Minimum standard for HPL abrasion test).

.9 Nails and staples: to CSA B111.

.10 Wood screws: plain, type and size to suit application.

.11 Splines: wood and metal.

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

.13 Laminated plastic adhesive:

.1 Adhesive: contact adhesive to CAN/CGSB-71.20.

.1 Maximum VOC limit 250 g/l.

.2 Adhesives urea-formaldehyde free.

2.2 HARDWOOD TRIM

.1 Hardwood: Solid maple, clear finish. Refer to section 09 91 23 – Interior Painting

2.3 MANUFACTURED UNITS

.1 Casework:

.1 Fabricate caseworks to AWMAC custom quality grade.

.2 Furring, blocking, nailing strips, grounds and rough bucks

.1 S2S is acceptable for concealed products.

.2 Board sizes: "standard" or better grade.

.3 Dimension sizes: "standard" light framing or better grade.

.4 Urea-formaldehyde free.

.3 Case bodies (ends, divisions and bottoms).

.1 Particleboard, grade, square edge, 19mm thick. Laminated with high pressure laminate on exposed ends and thermofused melamine on concealed interios.

.4 Backs:

.1 Particleboard core, square edge, 12.7mm thick, laminated with thermofused melamine.

.5 Shelving:

.1 Particleboard, laminated with thermofused melamine, 19 mm thick.

.2 Edge banding: provide matching colour PVC, 3 mm thickness.

.2 Drawers:

.1 Fabricate drawers to AWMAC custom grade supplemented as follows:

.2 Sides and Backs.

.1 Thermofused melamine: 15 mm thick.

.3 Bottoms:

.1 Thermofused melamine: 15 mm thick.

.4 Fronts:

.1 Particleboard, 19 mm thick, laminated with high-pressure plastic laminate.

.1 Exposed finish: high-pressure plastic laminate

.2 Semi-exposed surface: plastic laminate.

.3 Edges: banded with 3 mm PVC edge, colour to match exposed faces.

.3 Casework Doors:

.1 Fabricate doors to AWMAC custom grade supplemented as follows:

.2 Particleboard, 19 mm thick, laminated with high-pressure plastic laminate.

.1 Exposed finish: high-pressure plastic laminate

.2 Semi-exposed surface: plastic laminate.

.3 Edges: banded with 3 mm PVC edge, colour to match exposed faces.

.4 Countertops

.1 High-pressure plastic laminate: edged with 3 mm PVC edge unless indicated otherwise on details. Backsplash and sidesplash to match countertop unless indicated otherwise on drawings.

.2 Quartz Countertop: 2cm thick countertop with 4cm thick edge material by maximum practical length. Backsplash and sidesplash to match countertop unless indicated otherwise on drawings.

.3 Solid wood nosing: Maple, semi-transparent stain with water-borne varnish, Semi-gloss finish.

.1 Finish: MPI INT6.3W Premium Grade (stain with 3 coats of varnish)

2.4 FABRICATION

.1 Assemble cabinets in flush overlay style.

.2 Set nails and countersink screws apply plain wood filler to indentations, sand smooth and leave ready to receive finish.

.3 Shop install cabinet hardware for doors, shelves and drawers. Recess shelf standards unless noted otherwise.

.4 Shelving to cabinetwork to be adjustable unless otherwise noted.

.5 Provide cutouts for plumbing fixtures, inserts, appliances, outlet boxes and other fixtures.

.6 Shop assemble work for delivery to site in size easily handled and to ensure passage through building openings.

.7 Obtain governing dimensions before fabricating items which are to accommodate or abut appliances, equipment and other materials.

.8 Ensure adjacent parts of continuous laminate work match in colour and pattern.

.9 Veneer laminated plastic to core material in accordance with adhesive manufacturer's instructions. Ensure core and laminate profiles coincide to provide continuous support and bond over entire surface. Use continuous lengths up to 2400 mm. Keep joints 600 mm from sink cutouts.

.10 Use straight self-edging laminate strip for flatwork to cover exposed edge of core material. Chamfer exposed edges uniformly at approximately 20 degrees. Do not mitre laminate edges.

.11 Apply laminate backing sheet to reverse side of core of plastic laminate work.

2.5 HARDWARE

.1 Hinges: European concealed hinges, 110 degree opening. Only screw fastened hardware will be accepted, no friction fit hardware will be accepted.Use plastic insertion dowels to receive screws of hinge baseplates.

.1 Acceptable manufacturers: Hettich, Blum, Hafele or Richelieu.

.2 Drawer slides: full extension, bearing type, secured to sides of drawers and to gable, 45kg static load capacity, integral stop, self-closing

.1 Acceptable product: Accuride 3832, or Knape & Vogt 8400.

.3 Shelf standards: Safety shelf support pin for 5mm diameter holes, steel pin with mounded on clear plastic.

.4 Pulls: Recessed metal pull.

.1 Acceptable product: Richelieu 616743128174, or Hettich Zinc Modern 043 981.

.5 Cabinet locks: Cam type cylinder lock. Satin nickel finish. Install where shown on details. Key locks that are in the same room alike.

.6 Clear plastic silencers to be installed on all cabinet doors.

Part 3 Execution

3.1 INSTALLATION

.1 Do architectural woodwork to Quality Standards of the Architectural Woodwork Manufacturers Association of Canada (AWMAC), except where specified otherwise.

.2 Install prefinished millwork at locations shown on drawings. Position accurately, level, plumb straight.

.3 Fasten and anchor millwork securely. Provide heavy duty fixture attachments for wall mounted cabinets.

.4 Use draw bolts in countertop joints.

.5 Scribe and cut as required to fit abutting walls and to fit properly into recesses and to accommodate piping, columns, fixtures, outlets or other projecting, intersecting or penetrating objects.

.6 At junction of plastic laminate counter back splash and adjacent wall finish, apply small bead of sealant.

.7 Apply water resistant building paper over wood framing members in contact with masonry or cementitious construction.

.8 Fit hardware accurately and securely in accordance with manufacturer's written instructions.

.9 Site apply laminated plastic to units as indicated. Adhere laminated plastic over entire surface. Make corners with hairline joints. Use full sized laminate sheets. Make joints only where indicated or approved. Slightly bevel arises.

.10 For site application, offset joints in plastic laminate facing from joints in core.

.11 Install wood window sills as noted in drawing.

.12 Coordinate installation of continuous wood blocking behind adjustable shelving units. Attach standards to studs at a maximum spacing of 400mm on centre. Adjustable shelf shall extend a maximum of 100mm beyond the final standard, install standard as required.

3.2 CLEANING

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

.2 Clean millwork and cabinet work, inside cupboards and drawers and outside surfaces.

.3 Remove excess glue from surfaces.

3.3 PROTECTION

.1 Protect millwork and cabinet work from damage until final inspection.

END OF SECTION

Part 1 General

1.1 RELATED SECTIONS

.1 Section 04 21 13 – Brick Masonry

.2 Section 07 27 00 - Air and Vapour Barrier.

.3 Section 07 42 33 – Phenolic Wall Panels

.4 Refer to Section 07 52 00 – Modified Bituminous Roofing

.5 Refer to Section 07 61 00 – Sheet Metal Roofing.

1.2 REFERENCES

.1 Underwriters Laboratories of Canada (ULC)

.1 ASTM C612-[04], Standard Specification for Mineral Fibre Block and Board Thermal Insulation.

.2 CAN/ULC-S701-05, Standard for Thermal Insulation, Polystyrene, Boards and Pipe Coverings.

.3 CAN/ULC-S702- 97, Thermal Insulation, Mineral Fibre, for Buildings.

.4 CAN/ULC-S704-03, Standard for Thermal Insulation Polyurethane and Polyisocyanurate, Boards, Faced.

1.3 SUBMITTALS

.1 Product Data:

.1 Submit manufacturer's printed product literature, specifications and data sheet in accordance with Section 01 33 00 - Submittal Procedures.

.2 Submit two copies of WHMIS MSDS - Material Safety Data Sheets in accordance with Section 01300 Submittals. Indicate VOC's insulation products and adhesives.

.2 Manufacturer's Instructions:

.1 Submit manufacturer's installation instructions.

.3 Shop Drawings

.1 Provide layout for tapered roof insulation.

1.4 ENVIRONMENTAL PERFORMANCE REQUIREMENTS

.1 Mineral fibre insulation must be formaldehyde free.

Part 2 Products

2.1 INSULATION

.1 Extruded polystyrene (XPS): to CAN/ULC-S701.

- .1 Type: 4.
- .2 Thickness: as indicated in drawings.
- .3 Edges: shiplapped.

.2 Rigid Cellular Polyisocyanurate:

- .1 Refer to Section 07 52 00 – Modified Bituminous Roofing
- .2 Refer to Section 07 61 00 – Sheet Metal Roofing.
- .3 Faced: to CAN/ULC C-S704-11.
  - .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.
- .4 RSI (R-Value): as indicated on drawings.

.3 Mineral Fibre Board Insulation: to CAN/ULC-S702- 97.

- .1 Purpose made, dual density fibre board for use in cavity and rainscreen applications.
- .2 R-Value: RSI 0.76/ 25.4mm (R4.3/inch)
- .3 Exterior cavity wall as noted on drawings.
  - .1 Type 1.
  - .2 Density: Outer layer 100 kg/m³, Inner layer approximately 55 kg/m³.
  - .3 Thickness as indicated.
  - .4 Approved product:
    - .1 Roxul – “Cavityrock DD”
    - .2 Approved equivalent

2.2 PREMANUFACTURED TAPERED SUMP PANEL

.1 Rigid cellular Polyisocyanurate, panels tapered to centre, size 2440 x 2440 mm, 172 KPa (25 PSI).

- .1 Minimum thickness at roof drain: 25mm.
- .2 Perimeter thickness: 50mm (approximately 2% slope to drain)

2.3 ADHESIVE

.1 Adhesive (for polystyrene): to CGSB 71-GP-24.

.2 Compatible with roofing membrane and polystyrene insulation

2.4 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 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 WORKMANSHIP

.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 CAN4-S604 type A chimneys and CAN/CGA-B149.1 and CAN/CGA-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 Consultant.

3.3 EXAMINATION

.1 Examine substrates and immediately inform Consultant in writing of defects.

.2 Prior to commencement of work ensure:

.1 Substrates are firm, straight, smooth, dry, free of snow, ice or frost, and clean of dust and debris.

3.4 PREMANUFACTURED TAPERED SUMP PANEL

.1 Install premanufactured tapered sump panels at each roof drain location.

.2 Adhere tapered sump panel to roof deck according to manufacturer’s written instructions.

3.5 RIGID INSULATION INSTALLATION

.1 Apply adhesive to insulation board in accordance with manufacturer's recommendations.

.2 In addition to adhesive, install insulation boards with insulation clips and disk, 2 per 600 x 1200 mm board minimum, fit boards tight, cut of fastener spindle 3 mm beyond disk.

3.6 CAVITY WALL INSTALLATION

.1 Install mineral fibre insulation in wall cavity as recommended by manufacturer.

3.7 ROOF INSULATION INSTALLATION

.1 Rigid Cellular Polyisocyanurate

.1 Refer to Section 07 52 00 – Modified Bituminous Roofing.

.2 Refer to Section 07 61 00 – Sheet Metal Roofing.

3.8 CLEANING

.1 Upon completion of installation, remove surplus materials, rubbish, tools and equipment barriers.

END OF SECTION

Part 1 General

1.1 RELATED SECTIONS

.1 Section 06 10 11 – Rough Carpentry

.2 Section 09 22 16 – Non-Structural Metal Framing

1.2 REFERENCES

.1 American Society for Testing and Materials International (ASTM)

.1 ASTM C553-02, Specification for Mineral Fibre Blanket Thermal Insulation for Commercial and Industrial Applications.

.2 Underwriters Laboratories of Canada (ULC)

.1 CAN/ULC-S702-1997, Standard for Mineral Fibre Insulation.

.2 CAN/ULC S102 – Surface Burning Characteristics

Part 2 Products

2.1 INSULATION

.1 Batt Insulation

.1 Fibreglass batt: to ASTM C665. Interior walls as indicated in Wall and Partition Type schedule, roof parapets and as otherwise indicated in drawings.

.1 Type: 1 (Unfaced)

.2 Thickness: as indicated.

.2 Mineral Fibre Batt Insulation

.1 Mineral Fibre batt: to CAN/ULC S702. Fire rated wall interior walls and acoustic walls as indicated in Wall and Partition Type schedule and as otherwise indicated in drawings.

.1 Type: 1

.2 Density 40kg/m3.

.3 Thickness: as indicated.

Part 3 Execution

3.1 MANUFACTURER'S INSTRUCTIONS

.1 Compliance: comply with manufacturer's written data, including product technical bulletins, product catalogue installation instructions, product carton installation instructions, and data sheets.

3.2 INSULATION INSTALLATION

.1 Install insulation to maintain continuity of thermal protection to building elements and spaces and to ASTM C1320.

.2 Fit insulation closely around electrical boxes, pipes, ducts, frames and other objects in or passing through insulation.

.3 Do not compress insulation to fit into spaces.

.4 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 CAN/CGA-B149.1 and CAN/CGA-B149.2 Type B vents.

3.3 CLEANING

.1 Upon completion of installation, remove surplus materials, rubbish, tools and equipment barriers.

END OF SECTION

Part 1 General

1.1 RELATED SECTIONS

.1 Section 04 22 00 - Concrete Unit Masonry.

.2 Section 07 42 33 – Phenolic Wall Panels

.3 Section 07 52 00 – Modified Bituminous Membrane roofing

.4 Section 07 61 00 – Sheet Metal Roofing

.5 Section 07 92 00 - Joint Sealants.

.6 Section 08 54 13 – Fiberglass Windows

1.2 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.

1.3 SUBMITTALS

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

.2 Product Data:

.1 Submit manufacturer's printed product literature, specifications and datasheets.

1.4 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 h for inspection of mock-up by Consultant before proceeding with air/vapour barrier Work.

1.5 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 52 00 – Modified Bituminous Membrane Roofing and 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 Soprema: Sopraseal Stick 1100T

.2 IKO: Aquabarrier AVB

.3 Carlisle: CCW 705 A/V Barrier

.4 Approved equivalent

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 equivalent

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 Staples: minimum 6 mm leg.

.4 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.

.7 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 INSTALLATION – MASONRY CAVITY FLASHING

.1 Install masonry cavity flashing in a shingle style manner integrated with other air barrier membranes, as indicated in drawings. Coordinate work with adjacent work to ensure proper lapping of membranes.

3.5 CLEANING

.1 Proceed in accordance with Section 01 74 11 – Cleaning.

.2 Upon completion and verification of performance of installation, remove surplus materials, excess materials, rubbish, tools and equipment.

END OF SECTION

Part 1 General

1.1 RELATED REQUIREMENTS

.1 Section 07 21 13 - Board Insulation .

.2 Section 07 27 00 - Air and Vapour Barriers

1.2 REFERENCES

.1 American Society for Testing and Materials International (ASTM)

.1 ASTM D 638 - Standard Test Method for Tensile Properties of Plastics.

.2 ASTM D 6272 - Standard Test Method for Flexural Properties of Unreinforced and Reinforced Plastics and Electrical Insulating Materials by Four-Point Bending.

.3 ASTM E 84 - Standard Test Method for Surface Burning Characteristics of Building Materials.

.4 ASTM E 831 - Standard Test Method for Linear Thermal Expansion of Solid Materials by Thermomechanical Analysis

.2 Canadian General Standards Board (CGSB)

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

.1 Material Safety Data Sheets (MSDS).

1.3 DESIGN REQUIREMENTS

.1 Design and size wall panel assemblies including wall panels, mounting system, sub-structure and fasteners to withstand live loads of minimum 1kPa caused by pressure of wind acting normal to plane of wall.

.2 Deflection Limits: Wall panel assemblies shall withstand wind loads with horizontal deflections no greater than 1/175 of the span at the perimeter and 1/60 of the span anywhere in the panel.

.3 Normal to the plane of the wall between supports, deflection of the aluminum sub-framing members shall not exceed L/175 or 19 mm, whichever is less

.4 At 1-1/2 times design pressure, permanent deflection of framing members shall not exceed L/100 of span length and components shall not experience failure or gross permanent distortion.

.5 Design cladding to allow for thermal movement of component materials caused by variation in ambient temperature range of 80 degrees C without causing buckling, failure of joint seals, undue stress on fasteners or other detrimental effects.

.6 Maximum deviation from vertical and horizontal alignment of erected panels: 1 to 1000.

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 printed product literature for cladding system materials, specifications and datasheet and include product characteristics, performance criteria, physical size, finish and limitations.

.2 Submit manufacturer's installation instructions and special handling criteria, installation sequence and cleaning procedures.

.3 Submit two copies WHMIS MSDS - Material Safety Data Sheets in accordance with Section 02 81 01 - Hazardous Materials.

.3 Closeout Submittals:

.1 Provide manufacturer's recommendations for periodic cleaning and maintenance of all components.

.4 Shop Drawings:

.1 Shop drawings: submit drawings stamped and signed by professional engineer registered or licensed in Province of Saskatchewan, Canada showing that the installed panels and attachments system meets the performance requirements for the project.

.2 Indicate dimensions and thickness of panels, fastening and anchoring methods, detail and location of joints and gaskets, thermal movement provision, wall openings, head, jamb and sill details, materials and finish, compliance with design criteria and requirements of related work.

.5 Samples:

.1 Submit duplicate 600 x 300 mm samples of wall system, representative of materials, finishes and colours.

.6 Quality assurance submittals:

.1 Submit following in accordance with Section 01 45 00 - Quality Control.

.2 Certificates: submit certificate signed by manufacturer certifying that wall panels comply with specified performance characteristics and physical properties.

.3 Manufacturer's Field Reports: submit manufacturer's written reports within 3 days of review, verifying compliance of Work.

1.5 QUALIFICATIONS

.1 Manufacturer Qualifications: A single manufacturer with a minimum of five years experience.

.2 Installer Qualifications: Company specializing in installing work similar in material, design, and extent to that indicated for this Project, and with a minimum of three years documented experience.

.3 Mock-ups: construct mock-ups in accordance with Section 01 45 00 - Quality Control and to requirements supplemented as follows:

.1 Provide full size panel on site prior to brick mock-up for preliminary colour comparison between phenolic panel and brick mock-up. Panel need not be installed prior to brick mock-up.

.2 Provide phenolic panel mock-up for evaluation of surface finishes and workmanship.

.3 Co-ordinate type and location of mock-ups with project requirements.

.4 Mock-up will be approximately 5 m2 and include an edge detail at a change in materials (brick/metal panels) as well as a wall opening.

.5 Do not proceed with remaining work until workmanship, colour, and finish are approved by Departmental Representative.

.6 When accepted, mock-up will demonstrate minimum standard of quality required for this work.

.1 Approved mock-up may remain as part of finished work.

.4 Pre-Installation Meetings: convene pre-installation meeting prior to beginning work of this Section with contractor's representative and Departmental Representative.

.1 Verify project requirements.

.2 Review installation and substrate conditions.

.3 Co-ordination with other building subtrades.

.4 Review manufacturer'sinstallation instructions and warranty requirements.

1.6 DELIVERY, STORAGE AND HANDLING

.1 Deliver, store and handle materials in accordance with Section 01 61 00 - Common Product Requirements.

.2 Deliver, store and protect material in accordance with panel manufacturer's recommendations.

.3 Do not expose panels with strippable film to direct sunlight or extreme heat.

.4 When moving sheets, lift evenly to avoid dragging panels across each other and scratching the surface. Remove all labels and stickers immediately after installation.

1.7 PROJECT CONDITIONS

.1 Field Measurements: Verify locations of structural members and wall opening dimensions by field measurements before composite wall panel fabrication and indicate field measurements on Shop Drawings.

1.8 WARRANTY

.1 Provide Manufacturer’s ten (10) year warranty covering entire cost of replacement of panels due to defects in materials including panel finish.

Part 2 Products

2.1 MATERIALS

.1 Acceptable Manufacturers

.1 Trespa (Meteon) International

.2 FunderMAX

.3 Approved alternate

.2 Phenolic Wall Panels

.1 Phenolic Composite Wall Panels: rain screen wall system, solid wall panels manufactured of thermosetting resins, homogenously reinforced with wood-based fibers heated and compressed to become a solid sheet material.

.2 Physical Properties:

.1 Modulus of Elasticity: 1,300,000 psi (9000 N/mm2) minimum, ISO 178.

.2 Tensile Strength: 10,100 psi (70 N/mm2) minimum, ISO 527-2.

.3 Flexural Strength: 14,500psi (120 N/mm2) minimum, ISO 178.

.4 Thermal Conductivity: 2.1 BTU/inch/ft2.hr.°F, EN 12524.

.3 Panel Thickness: 10 mm.

.4 Panel Size: as shown on drawings.

.5 Mounting System (ASTM E330):

.1 Exposed fastening system over aluminum sub-frame.

.2 Aluminum sub-structure designed to withstand structural loading due to wind load and dead load of the panel.

.3 Extrusions, including corner closures, joint closures and vent screens, formed members, sheet, and plate shall conform with the recommendations of the manufacturer.

.6 Fasteners: Fasteners (Exposed): Fasteners shall be non-corrosive and as recommended by panel manufacturer. Exposed fasteners shall be coloured to match panels where permitted by Departmental Representative.

.7 Finish: as selected by Departmental Representative from manufacturer's standard range of wood décor finishes.

2.2 FABRICATION

.1 Panels: Solid phenolic impregnated kraft paper wall panels with no voids, air spaces or foamed insulation in the core material. Accessory items in accordance with manufacturer's recommendations and approved submittals.

.2 Panel Bow: ≤ 2 mm / m.

.3 Panel Dimensions: Field fabrication shall be allowed where necessary, but kept to an absolute minimum.

.4 Appearance: Panel lines, breaks, and angles shall be sharp, true, and surfaces free from warp and buckle.

2.3 FABRICATION TOLERANCES

.1 Panel lines, breaks, and angles: Sharp and true. No warp or buckle.

.2 Panel Bow: Maximum 0.8% of panel dimension in width and length measured over any 1828 mm panel dimension.

.3 Panel Length and Width: 1 mm +/- maximum.

.4 Panel diagonal: 3 mm +/- maximum.

2.4 ACCESSORIES

.1 Fasteners– Fasteners shall be manufacturer's standard, non-corrosive type to suit application.

.1 Subgirts: 1.2 mm minimum, 2275 galvanized steel. Sub-structure designed to withstand structural loading due to wind load and the dead load of the panel.

.2 Extrusions, formed members, sheet, and plate shall conform with the recommendations of the manufacturer.

.3 Extruded Aluminum Trim -Black in colour.

Part 3 Execution

3.1 EXAMINATION

.1 Do not begin installation until substrates have been properly prepared.

.2 Surfaces to receive panels shall be even, smooth, dry, and free from defects detrimental to the installation of the panel system. Notify Contractor in writing of conditions detrimental to proper and timely completion of the work.

.3 Do not proceed with installation until unsatisfactory conditions have been corrected.

3.2 MANUFACTURER'S INSTRUCTIONS

.1 Compliance: comply with manufacturer's written recommendations or specifications, including product technical bulletins, handling, storage and installation instructions, and datasheets.

3.3 INSTALLATION

.1 Install composite panels in accordance with manufacturer's written instructions and shop drawings.

.1 Allow for thermal movement.

.2 Install solid phenolic wall panels plumb and level and accurately spaced in accordance with manufacturer's recommendations and approved submittals and drawings.

.3 Anchor panels and sub-framing securely per engineering recommendations and in accordance with approved shop drawings to allow for necessary movement and structural support.

.4 Fasten solid phenolic wall panels with fasteners approved for use with supporting substrate.

.5 Install fasteners in straight lines aligned both horizontally and vertically.

.6 Do not install panels or component parts which are observed to be defective or damaged including, but not limited to: warped, bowed, abraded, scratched, and broken members.

.7 Remove and replace exposed fasteners that show damage or discolouration.

.8 Do not cut or trim component parts during installation in a manner that would damage the finish, decrease the strength, or result in visual imperfection or a failure in performance.

Return component parts with require alteration to the shop for re-fabrication or replacement.

.9 Install corner profiles and trim with fasteners appropriate for use with adjoining construction as indicated on the Contract Drawings and as recommended by manufacturer.

.10 Adjust final panel installation so that all joints are true and even throughout the installation.

3.4 FIELD QUALITY CONTROL

.1 Manufacturer's Field Services:

.1 Provide manufacturer's field services consisting of product use recommendations and 3 site visits for inspection of product installation in accordance with manufacturer's written instructions.

.2 Manufacture’s site visit will take place at pre-installation meeting, at approximately 25% of panel installation and at completion of panel installation.

3.5 CLEANING

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

.2 Remove masking or panel protection as soon as possible after installation.

.3 Clean finished surfaces as recommended by panel manufacturer.

END OF SECTION

Part 1 General

1.1 RELATED REQUIREMENTS

.1 Section 07 27 00 – Air and Vapour Barriers

.2 Section 07 46 13 – Board Insulation

.3 Section 07 62 00 – Sheet Metal Flashing and Trim.

.4 Section 07 92 00 - Joint Sealing.

1.2 REFERENCES

.1 American Society of Mechanical Engineers (ASME)

.1 ASME B18.6.3-2011, Machine Screws, Tapping Screws, and Metallic Drive Screws (Inch Series).

.2 ASTM International

.1 ASTM D2369-10e1, Test Method for Volatile Content of Coatings.

.2 ASTM D2832-92(2011), Standard Guide for Determining Volatile and Nonvolatile Content of Paint and Related Coatings.

.3 ASTM D5116-10, Standard Guide For Small-Scale Environmental Chamber Determinations of Organic Emissions From Indoor Materials/Products.

.3 Canadian General Standards Board (CGSB)

.1 CAN/CGSB-93.3-M91, Prefinished Galvanized and Aluminum-Zinc Alloy Steel Sheet for Residential Use.

.2 CAN/CGSB-93.4-92, Galvanized and Aluminum-Zinc Alloy Coated Steel Siding Soffits and Fascia, Prefinished, Residential.

.3 CAN/CGSB-93.5-92, Installation of Metal Residential Siding, Soffits and Fascia.

.4 CSA International

.1 CSA B111-1974(R2003), Wire Nails, Spikes and Staples.

1.3 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.

1.4 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.

.3 Shop Drawings:

.1 Indicate dimensions, profiles, attachment methods, schedule of wall elevations, trim and closure pieces, metal furring, and related work.

.4 Samples:

.1 Submit duplicate 300 x 300 mm samples of siding material, of colour and profile specified.

1.5 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 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.

Part 2 Products

2.1 STEEL CLADDING AND COMPONENTS

.1 Strip siding: to CAN/CGSB-93.4, Horizontal; Class: plain.

.1 Thickness: 0.61 mm base metal thickness.

.2 Profile: 38 mm deep by 935 wide panels to match Vicwest CL 7040 profile or approved alternate.

.3 Finish: factory prefinished 2 coat system.

.1 Base metal: ASTM A653 / ASTM A653M for Zinc coated steel (galvanized).

.2 Film thickness: To ASTM A755/A755M and AAMA 621-02. Minimum topcoat dry film thickness of 18microns (0.7 mils) and 5microns (0.2 mils) primer.

.3 Film hardness: to ASTM D3363.

.4 Gloss: to ASTM D523

.5 Humidity resistance: to ASTM D2247

.6 Film integrity: no evidence of cracking, flacking, or checking that is apparent on ordinary outdoor observations for first 40 years.

.7 Product Attributes: minimum of 70% Kynar 500 or Hylar 5000 PVDF resins, 10000 Series.

.1 Medium gloss.

.2 Colour to be selected from manufacturer’s standard range of colours.

.2 Subgirts: gauge to suit intended application, profile as required and as indicated; to attach panel system to building structure.

.3 Insulation: semi-rigid mineral fibre insulation: 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.

2.2 FASTENERS

.1 Nails: CSA B111. Screws: ASME B18.6.3. Purpose made stainless steel

2.3 CAULKING

.1 Sealants:as recommended by manufacturer and in accordance with Section 07 92 00 - Joint Sealants.

2.4 ACCESSORIES

.1 Exposed trim: inside corners, outside corners, cap strip, drip cap, undersill trim, starter strip and window/door trim of same material, colour gloss as cladding, with fastener holes pre-punched.

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.

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, soffit, 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 Maintain joints in exterior cladding, true to line, tight fitting, hairline joints.

.6 Attach components in manner not restricting thermal movement.

.7 Caulk junctions with adjoining work with sealant. Do work in accordance with Section 07 92 00 - Joint Sealants.

3.4 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 Latex modified concrete facing, bonded to rigid polystyrene foam insulation backing, for exterior application to perimeter foundation walls, with related flashings.

1.2 RELATED SECTIONS

.1 Section 03 30 00 – Cast-In-Place Concrete

1.3 REFERENCES

.1 American Society for Testing and Materials (ASTM International):

- .1 ASTM A123/A123M-09, Zinc (Hot Dip Galvanized) Coatings on Iron or Steel Products
- .2 ASTM C518-04, Standard Test Method for Steady-State Thermal Transmission Properties by Means of the Heat Flow Meter Apparatus.
- .3 ASTM D1621-04a, Standard Test Method for Compressive Properties of Rigid Cellular Plastics
- .4 ASTM D2842-06, Standard Test Method for Water Absorption of Rigid Cellular Plastics
- .5 ASTM D696-08, Standard Test Method for Determining Coefficient of Linear Thermal Expansion of Plastics between -30C and +30C

1.4 SYSTEM DESCRIPTION

.1 Assembly of components includes purpose supplied, preformed panel mounting clips capable of securing factory bonded concrete faced insulated wall panels to structural supporting wall.

1.5 SUBMITTALS

.1 Submission procedures as specified in Section 01 33 00 - Submittal Procedures.

.2 Installation Data: Manufacturer's special installation requirements.

.3 Shop Drawings: Indicate dimensions, layout, construction and expansion joints, construction details, methods of anchorage.

.4 Samples: Submit two (2) samples of full size wall siding, 200 x 200 mm (8 x 8 inch) in size illustrating manner of fitment devices with adjacent panels, with specified finishes and surface texture.

1.6 DELIVERY, STORAGE, AND PROTECTION

.1 Transport, handle, store, and protect delivered products as specified in Section 01 61 00 - Common Product Requirements.

.2 Store concrete faced insulated wall panels under cover, and in original packaging until ready to install. Store opened packages under cover until installed. Schedule installation to minimize open package time

.3 Store prefinished material off ground protected from weather, to prevent twisting, bending, or abrasion, and to provide ventilation.

.4 Prevent contact with materials which may cause electrolysis, discolouration or staining.

1.7 WARRANTY

.1 Provide manufacturers five (5) year limited warranty to include panel replacement for delamination of concrete facing.

Part 2 Products

2.1 MANUFACTURERS

.1 Tech-Crete Processors Ltd: “Concrete Faced Insulated Panels” or approved equivalent.

2.2 WALL PANEL ATTACHMENT

.1 Galvanized Steel: ASTM A123/A123M-08 - Zinc-Coated (Galvanized), Z275 to G90 coating designation

2.3 INSULATION

.1 Extruded polystyrene, flame/smoke classification to code requirements in accordance with CAN/ULC S-102.2-03

.2 Thermal resistance per 25.4mm: RSI $\geq$ 0.88 (R-Value $\geq$ 5.0 inch)

.3 Foam Compressive Strength: 240 kPa (35 PSI) in accordance with ASTM D1621

.4 Water Absorption, ASTM D2842: <0.7 % by volume, to ASTM D2842-06.

.5 Water Vapour Permeance, ASTM E96: 1.0 perms.

.6 Insulation Thickness: 76 mm. (RSI 2.64)

2.4 CONCRETE FACED INSULATED WALL PANELS

.1 Concrete: Latex modified concrete mix, 8 mm (5/16”) thick, with control joint score at mid-length.

.2 Edge Treatment: Tongue and groove along longitudinal foam edges, butt joints on lateral edges.

.3 Surface Finish: Textured Broom finish; Grey colour.

2.5 ACCESSORIES

.1 Gaskets to Adjacent Substrates: Standard type suitable for use with system, permanently resilient; ultraviolet and ozone resistant; colour to match adjacent colour.

.2 Sealants to Adjacent Substrates: Standard type suitable for use with installation of system; non-staining, non-skinning, non-shrinking and non-sagging; ultraviolet and ozone resistant; colour as selected.

.3 Clips and Fasteners: Manufacturer's standard type to suit application; as supplied.

.4 Field Repair and Touch-up: As recommended by panel manufacturer.

2.6 COMPONENTS

.1 Exterior concrete faced insulated wall panel sizes:

.1 Width: 610 mm (24 inches).

.2 Length: 1220 mm (48 inches).

.2 Internal and External Corners:

.1 Trim, Closure Pieces, Caps, Flashings, Facias, and Infills: Brake formed to required profiles.

Part 3 Execution

3.1 EXAMINATION

.1 Verify existing conditions and substrates before starting work as specified in Section 01 71 00 - Examination and Preparation.

.2 Verify that building support is ready to receive panel assembly.

.3 Remove substrate surface irregularities before installing wall panels. Sweep and clear debris clear of surfaces to receive panels.

3.2 COMPONENT FABRICATION

.1 Form sections and fastening clips true to shape, accurate in size, square, and free from distortion or defects.

.2 Form custom pieces in longest practicable lengths.

.3 Fabricate corners in one continuous piece.

3.3 INSTALLATION

.1 Ensure snug fit between panel tongue and grooves, and lateral butt joints.

.2 Fasten concrete faced insulated panels to structural support; aligned level and plumb.

.3 Install panels with vertical joints and panel control joints in alignment.

.4 Cut back insulation on back of panels, where they meet at an outside corners, to allow concrete face of panels to meet each other.

.5 Use manufacturer's recommended concealed fasteners. Maintain neat appearance.

3.4 CLEANING

.1 Clean installed work as specified in Section 01 74 11 - Cleaning.

END OF SECTION

Part 1 General

1.1 SECTION INCLUDES

.1 Materials and installation for modified bituminous roofing for conventional installation over sloped insulation and vapour retarder on metal and concrete deck.

1.2 RELATED SECTIONS

.1 Section 06 10 00- Rough Carpentry

.2 Section 07 21 13 – Board Insulation

.3 Section 07 21 16 – Blanket Insulation

.4 Section 07 61 00 – Sheet Metal Roofing

.5 Section 07 62 00 - Sheet Metal Flashing and Trim.

1.3 REFERENCES

.1 ASTM C 1177/C1177M-01, Standard Specification for Glass Mat Gypsum Substrate for Use as Sheathing.

.2 ASTM D6164-00, Standard Specification for Styrene Butadiene Styrene (SBS) Modified Bituminous Sheet Materials Using Polyester Reinforcements.

.2 Canadian General Standards Board (CGSB).

.1 CGSB 37-GP-19M-85, Cement, Plastic, Cutback Tar.

.2 CAN/CGSB-37.29-M89, Rubber-Asphalt Sealing Compound.

.3 CGSB 37-GP-56M-80b(A1985), Membrane, Modified, Bituminous, Prefabricated, and Reinforced for Roofing.

.4 CAN/CGSB-51.33-M89, Vapour Barrier Sheet, Excluding Polyethylene, for Use in Building Construction.

.3 Canadian Roofing Contractors Association (CRCA).

.1 CRCA Roofing Specifications Manual-2011.

.4 Canadian Standards Association (CSA International).

.1 CSA A123.21 Standard Test Method for The Dynamic Wind Uplift resistance of Membrane Roofing Systems.

1.4 ROOF DESCRIPTION

.1 Modified Bituminous Membrane roofing types are indicated on drawings as follows:

.1 Roof Type 3 (R3) – Conventional two-ply, installed over tapered insulation on flat metal deck.

.2 Roof Type 4 (R4) – Conventional two-ply, installed over tapered insulation on concrete deck.

1.5 PERFORMANCE REQUIREMENTS

.1 Wind Uplift Resistance testing will be in accordance with CSA123.21

.2 Building parameters

.1 Geometry: Low rise, low slope roof.

.2 Exposure: Open.

.3 Openings: Category 2

.4 Importance: High

.3 Submit a report, issued by a certified materials testing laboratory, showing the roofing system offered was tested in accordance with CSA A 123.21-10, Standard Test Method for the Dynamic Wind Uplift Resistance of Membrane Roofing Systems. Test results shall demonstrate the roofing system provides a Dynamic Uplift Resistance pressure for the field, edges and corners of the roof that satisfy the wind load requirements per the NBCC.

.4 Compatibility between components of roofing system is essential. Provide written declaration to Consultant stating that materials and components, as assembled in system, meet this requirement.

1.6 ACTION AND INFORMATIONAL SUBMITTALS

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

.2 Submit two copies of most recent technical roofing components data sheets describing materials' physical properties.

.3 Submit WHMIS MSDS - Material Safety Data Sheets in accordance with Section 01 33 00 - Submittal Procedures.

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

.1 Indicate membrane flashing, and tapered insulation details.

.2 Provide layout for tapered insulation.

.5 Manufacturer's Installation Instructions:

.1 Provide complete installation instructions for all materials and conditions.

.2 Indicate special precautions required for seaming membrane.

.3 Indicate minimum installation temperatures.

.6 Maintenance Manuals:

.1 Conform to Section 01 78 00 - Closeout Submittals.

1.7 QUALITY ASSURANCE

.1 Convene pre-installation meeting one week prior to beginning Work, with roofing contractor's representative to:

.1 Verify project requirements.

.2 Review installation and substrate conditions.

.3 Co-ordination with other building subtrades.

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

1.8 DELIVERY, STORAGE AND HANDLING

.1 Provide and maintain dry, off-ground weatherproof storage.

.2 Store rolls of felt and membrane in upright position. Store membrane rolls with selvage edge up.

.3 Remove only in quantities required for same day use.

.4 Place plywood runways over completed Work and existing roof membranes to enable movement of material and other traffic.

.5 Store sealants at +5 degrees C minimum.

.6 Store insulation protected from daylight and weather and deleterious materials.

.7 Handle roofing materials in accordance with manufacturer's written directives, to prevent damage or loss of performance.

1.9 PROTECTION

.1 Fire Extinguishers: maintain one cartridge operated type or stored pressure rechargeable type with hose and shut-off nozzle, ULC labeled for A, B and C class protection on roof per torch applicator, within 6 m of torch applicator.

.2 Maintain fire watch for 1 hour after each day's roofing operations cease.

1.10 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.

1.11 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.

1.12 WARRANTY

.1 Contractor shall warrant that modified bituminous roofing and membrane flashings will stay in place and remain leakproof in accordance with General Conditions (GC) - CCDC GC 12.3, but for two years.

.2 Membrane manufacturer will issue a written and signed document in the Owner’s name, valid for a 10-year period, stating it will repair any leaks in the roofing membrane to

restore the roofing system to a dry and watertight condition should defects in either the membrane manufacturing or workmanship of the installation cause water infiltration. The warranty will cover the full cost of the repairs during the entire warranty period.

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 PRIMER

.1 Elastomeric bitumen and solvent based for self-adhesive waterproofing membranes as recommended by vapour retarder membrane manufacturer. Primer must be suitable for temperatures at which it will be installed.

2.3 ADHESIVES

.1 Dual component urethane, solvent free, cold process roofing adhesive as recommended by roof membrane manufacturer. Adhesive must be suitable for temperatures at which it will be installed.

- .1 IKO Millennium: One Step Foamable Adhesive.
- .2 Soprema: Duotack Adhesive.
- .3 Or equivalent

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.
- .7 Acceptable Products:
  - .1 IKO: IKO- MVP
  - .2 Soprema –Sopravap'R
  - .3 Approved alternate.

2.5 PROTECTION PANELS

.1 Multi-ply, semi-rigid asphaltic roofing substrate board composed of a mineral fortified asphaltic core formed between two asphaltic saturated fibreglass liners.

.1 Insulation protection panels:1220mm x 2440mm, minimum thickness 4.8mm.

.2 Acceptable products:

.1 IKO: Protectoboard

.2 Soprema: Sopraboard

.3 Approved alternate.

2.6 FIRE PROTECTION TAPE

.1 Self-adhesive membrane composed of a reinforced glass mat and SBS modified bitumen designed to prevent flames from penetrating into empty spaces and openings while installing heat-welded membranes

2.7 BOARD INSULATION

.1 Refer to section 07 21 13 Board Insulation.

.2 Roof Type 3 (R3) and Roof Type 4 (R4) as noted on drawing:

.1 Rigid Cellular Polyisocyanurate:

.1 Shape: flat and tapered as required to suit roof drainage slopes and plan.

.2 Pre-manufactured tapered sump panels.

.3 Average RSI (R-Value): as noted in drawings.

.2 Approved product:

.1 Compatible with roof membrane system and acceptable to membrane manufacturer as part of the specified extended warranty.

.3 Adhere insulation to meet requirements of CSA 123.21 and in accordance with manufacturer’s written instructions.

2.8 MEMBRANES

.1 Base sheet membrane systems:

.2 Factory laminated base sheet to asphaltic board or base membrane torched to protection panels on site are both acceptable systems for base sheet installation. Selection of either base sheet system is at the discretion of the Contractor.

.3 To CGSB-37.56-M and ASTM D6164. Styrene Butadiene Styrene(SBS) elastomeric polymer prefabricated sheet, polyester reinforcement, having nominal weight of 180 g/m2.

.1 Factory-laminated Base Sheet Panel:

.1 SBS modified base sheet membrane factory-laminated on a semi-rigid asphaltic board. Top surface is covered with thermofusible plastic film. base sheet has a duo selvedge composed of both self-adhesive and

thermofusible sections. Minimum panel thickness including membrane : 6.5 mm. Minimum membrane thickness 2.0 mm.

.1 Soprema: Soprasmart Board 180.

.2 Approved equivalent.

.2 Fibre board panels are not acceptable.

.2 Base Sheet membrane (installed over protection panels):

.1 Non-woven reinforced polyester reinforcing mat coated and impregnated with SBS modified bitumen to a nominal thickness of 3.0 mm. Both sides covered with a thermofusible plastic film.

.1 IKO: Torchflex TP-180-FF-Base

.2 Soprema: Sopralene Flam 180

.3 Approved equivalent.

.4 Cap Sheet Membrane:

.1 To CGSB 37-GP-56M polyester fibres to ASTM D6164. Styrene Butadiene Styrene(SBS) elastomeric polymer prefabricated sheet, polyester reinforcement, having nominal weight of 250 g/m2. Top face is covered with coloured granules. underface is covered with a thermofusible plastic film.

.2 Colour for granular surface: white, minimum SRI 75.

.1 IKO: Armourcool HD TP

.2 Soprema: Soprastar Flam HD GR

.3 Approved equivalent.

.5 Flashing Membranes

.1 Base Sheet Flashing: to CGSB 37 GP 56M. Styrene Butadiene Styrene elastomeric polymer, prefabricated sheet, heavy duty reinforcement, self-adhesive underface, top surface torchable polyethylene

.1 IKO: Armour Bond Flash.

.2 Soprema: Sopraflash Flam Stick

.3 Approved equivalent.

.2 Cap Sheet Flashing: to CGSB 37 GP 56M. Styrene Butadiene Styrene (SBS) elastomeric polymer, prefabricated sheet, heavy duty reinforcement. Fully adhered torched on membrane. Cap sheet flashing underface is covered with a plastic thermofusible film. Top face is protected by coloured granules to match cap sheet.

.1 IKO: TP-250-CAP

.2 Soprema: Sopralene Flam 250

.3 Approved equivalent.

.6 Walkway

.1 Walkway to consist of one additional ply of cap sheet membrane. Colour: black.

.7 Warning Strip

.1 Warning strip to consist of one additional ply of cap sheet membrane. Colour: red.

.8 Perimeter Fastening Strip

.1 Prefinished metal angle 22GA., galvanized, 100mm x 100mm metal angle, fabricated with 90 degree bend to be used for mechanical attachment of roofing base sheet panels to parapet or area divider walls and curbs greater than 600mm in length.

2.9 SEALERS

.1 Plastic cement: asphalt, to CAN/CGSB-37.5

.2 Sealing compound: to CAN/CGSB-37.29, rubber asphalt type.

.3 Sealants:

.1 Urethanes Two Part.

.1 Non-sag to CAN/CGSB-19.24, Type 2, Class B, colour to match adjacent surfaces.

.2 Silicones One part

.1 Mildew resistant.

2.10 FASTENERS

.1 As recommended by manufacturer.

Part 3 Execution

3.1 QUALITY OF WORK

.1 Compliance: comply with manufacturer's written recommendations, including product technical bulletins, handling, storage and installation instructions, and datasheets.

.2 Do examination, preparation and roofing Work in accordance with Roofing Manufacturer's Specification Manual, CRCA Roofing Specification Manual and to FM Design No. as specified.

3.2 SUBSTRATE EXAMINATION

.1 Prepare surfaces and complete waterproofing work in conformance with manufacturer’s written instructions. Install roofing elements on clean and dry surfaces, in conformance with manufacturer's instructions and recommendations.

.2 Prior to beginning of work ensure:

.1 Decks are firm, straight, smooth, dry, free of snow, ice or frost, and swept clean of dust and debris. Do not use calcium or salt for ice or snow removal.

.2 Curbs have been built.

.3 Roof drains have been installed at proper elevations relative to finished roof surface.

.4 Sheathing has been installed to walls and parapets as indicated.

.3 Inform Consultant immediately of any damage or deterioration of existing substrates to remain in place. Do not proceed with Work until instructed by Consultant

.4 Do not install roofing materials during rain or snowfall.

3.3 PROTECTION

.1 Cover walls, walks and adjacent work where materials hoisted or used.

.2 Use warning signs and barriers. Maintain in good order until completion of Work.

.3 Clean off drips and smears of bituminous material immediately.

.4 Dispose of rain water off roof and away from face of building until roof drains or hoppers installed and connected.

.5 Protect new and existing roof membranes from traffic and damage. Comply with precautions deemed necessary by Consultant .

.6 At end of each day's work or when stoppage occurs due to inclement weather, provide protection for completed Work and materials out of storage.

.7 Metal connectors and decking will be treated with rust proofing or galvanization.

3.4 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.

.7 Concrete Deck

.1 Prime all concrete surfaces to receive membrane with specified primer. Ensure concrete surfaces are clean, dry, and free of any loose material or sharp edges.

.2 Only once primed surfaces are dry, install self-adhesive membrane in conformance with manufacturer's specifications and recommended methods. Unroll the vapour retarder membrane onto the substrate and align the longitudinal edge with the roof edge. At one end of the roll, remove approximately 1 meter of the siliconized release film from the underside and adhere to substrate. From the other end of the roll, pull the membrane taut and, with the membrane held 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.

.3 Install subsequent rolls in the same manner taking care to overlap the side laps a minimum of 75 mm. Overlap the end laps a minimum of 150 mm. Roll all laps with a steel or nylon roller to ensure positive adhesion.

3.5 PRIMING PARAPET

.1 Apply deck primer to substrate at rate recommended by manufacturer for adherence of self-adhesive parapet base membranes.

3.6 PROTECTION PANELS

.1 Protection Panel is not required if factory-laminated base sheet panels are used.

.2 Apply adhesive in strict conformance with manufacturer's written recommendations.

.3 Measure and cut asphalt core panels to fit profile of curb or parapet. Cut sheets to proper length in maximum 1200mm widths.

.4 Apply adhesive to substrate and carefully lay insulation protection panels onto adhesive. Avoid excessive sliding of boards and smearing of adhesive. Once panel is in place, use a 100lb steel roller over entire surface of panel to ensure complete contact with adhesive.

.5 Measure and cut insulation protection panels to ensure minimum ½ size panels adjacent to parapets and roof dividers.

.6 Install only as many panels as can be covered same day with waterproofing layer.

3.7 FIRE PROTECTION TAPE

.1 Apply fire protection tape according to manufacturer's written instructions.

.2 Install prior to torch-applied vapour retarders, base sheets or stripping membranes. Install over substrate cracks, voids, vertical abutments, panel joints and any locations subject to back drafts or entrance of flame from torch.

3.8 PERIMETER FASTENING

.1 Prior to installation of base sheet panels, install the prefinished metal angle at all parapet and divider walls and curbs greater than 600mm in length.

.2 Place the angle tight to the roof/wall connection and directly on top of the insulation panels. Mechanically attach the metal angle to the side walls @ 300mm o/c (or at stud spacing for gypsum substrates).

3.9 EXPOSED MEMBRANE ROOFING APPLICATION

.1 Insulation: fully adhered. Refer to Section 07 21 13 Board Insulation.

.2 Factory-laminated Base Sheet Application:

.1 Fully adhere factory-laminated base sheet panel directly to insulation layer. Insulation Protection Panel is not required if factory-laminated base sheet panels are used.

.2 Apply adhesive in strict conformance with manufacturer's written recommendations.

.3 Starting at low point or roof drain, install base sheet panels over insulation layer, aligned with edge of roof. Panels must be snugly fitted, without any significant differences in level.

.4 Install factory-laminated base sheet panel in strict accordance with manufacturer's written instructions.

.5 All vertical joints between substrate and base sheet panels will be staggered.

.6 Application to be free of blisters, wrinkles and fishmouths.

.3 Base Sheet Membrane application (when factory laminated base sheet is not used).

.1 Install torch applied base sheet in strict accordance with manufacturer's written instructions.

.2 Unroll base sheet at drain with side lap lined up with drain centre and ensure roll is parallel to roof edge.

.3 Torch apply base sheet directly to bituminous protection panels. Ensure adequate heat is used to liquefy bitumen and obtain positive adherence to substrate.

.4 Ensure installation is free of wrinkles, air pockets, and fishmouths.

.4 Cap Sheet Application:

.1 Install torch applied cap sheet in strict accordance with manufacturer's written instructions.

.2 Starting at low point on roof, perpendicular to slope, unroll cap sheet, align and reroll from both ends.

.3 Unroll and torch cap sheet onto base sheet taking care not to burn membrane or its reinforcement.

.4 Application to be free of blisters, fishmouths and wrinkles.

.5 Membrane Flashings:

.1 Complete installation of flashing base sheet stripping prior to installing membrane cap sheet. Install flashing in strict accordance with manufacturer's written instructions.

.2 Lap flashing base sheet to membrane base sheet minimum 150 mm and seal torch welding.

.3 Lap flashing cap sheet to membrane cap sheet 250 mm minimum and torch weld.

.4 Provide 75 mm minimum side lap and seal.

.5 Properly secure flashings to their support, without sags, blisters, fishmouths, wrinkles or excessive bleed-out at joints.

.6 Reinforced Gussets

.1 Install reinforcing gussets in all inside and outside corners in conformance to manufacturer's specifications.

.2 Install gussets after installation of base sheet membranes. Heat weld and butter gussets to provide a smooth finish.

.7 Roof penetrations:

.1 Install roof drain pans, vent stack covers and other roof penetration flashings and seal to membrane in accordance with manufacturer's recommendations and details and as noted in drawings

3.10 WALKWAY

.1 Install over cap sheet. Prepare cap sheet as required for additional walkway layer.

.2 Refer to drawings for location.

3.11 WARNING STRIP

.1 Install over cap sheet. Prepare cap sheet as required for additional warning strip layer.

.2 Refer to drawings for location.

3.12 SCUPPERS

.1 Install scuppers in locations shown on drawings.

.2 Tie-in roof membranes with scupper as shown on drawings to create a water-tight seal.

3.13 WALKWAYS

.1 Install walkway membrane in accordance with manufacturer's instructions and as indicated on drawings.

3.14 CLEANING

.1 Remove bituminous markings from finished surfaces.

.2 In areas where finished surfaces are soiled caused by work of this section, consult manufacturer of surfaces for cleaning advice and complying with their documented instructions.

.3 Repair or replace defaced or disfigured finishes caused by work of this section.

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 and wood deck. Includes Roof Type 1, Roof Type 2 and Roof Type 5.

.2 The work of this section includes the installation of the complete roof assembly including the air vapour barrier, insulation, protection board, roof membrane, metal roof and snow fence.

1.2 RELATED SECTIONS

.1 Section 07 21 13 – Board Insulation.

.2 Refer to Section 07 52 00 – Modified Bituminous Membrane Roofing

.3 Section 07 62 00 – Sheet Metal Flashing and Trim.

.4 Section 07 72 53 – Snow Guards

.5 Section 07 72 69 – Roof Anchors and Safety Restraints

.6 Section 07 92 00 - Joint Sealants.

1.3 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.

1.4 ROOF DESCRIPTION

.1 Roof Type 1 (R1) – as noted on drawings.

.2 Roof Type 2 (R2) – as noted on drawings.

.3 Roof Type 5 (R5) – as noted on drawings.

1.5 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.

.4 This section is responsible to provide a snow guard designed specifically for this roof by a professional engineer registered in the province of Saskatchewan.

1.6 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.

1.7 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.

1.8 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.

1.9 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.

1.10 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.

1.11 WARRANTY

.1 Contractor shall warrant that the sheet metal roofing and companion flashing and snow guard will stay in place and remain leakproof 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 Profile equivalent to Vicwest, "Tradition 150"

.2 Standing Seam:

.1 T-style standing seam, 38mm high, 400mm wide panels.

.3 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.

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 SHEATHING MEMBRANE (Outbuilding Only)

Modified bitumen roll roofing to ASTM D1970.

Self-adhesive backing protected by a silicone-treated release sheet, which is removed during installation. Inner membrane of the roll consists of a non-woven, glass fiber mat impregnated and coated with a modified bitumen with exceptional elasticity. Sand is embedded into the top surface to provide a non-slip surface.

2.9 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 Snow fence: Refer to Section 07 72 53 – Snow Guards.

.5 Closures: Foam and metal closures to suit profiles selected, to manufacturer's recommendations.

.6 Sealants: In accordance with manufacturer's recommendation and Section 07 92 00.

.7 Isolation coating: alkali resistant bituminous paint.

.8 Touch-up paint: as recommended by sheet metal roofing manufacturer.

2.10 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.

.7 Wood Deck

.1 Prime all existing wood surfaces to receive membrane with specified primer. Ensure wood deck surfaces are clean, dry, and free of any nails, loose material or sharp edges.

.2 Only once primed surfaces are dry, install self-adhesive membrane in conformance with manufacturer’s specifications and recommended methods. Unroll the vapour retarder membrane onto the substrate and align the longitudinal edge with the roof edge. At one end of the roll, remove approximately 1 meter of the siliconized release film from the underside and adhere to substrate. From the other end of the roll, pull the membrane taut and, with the membrane held in place, remove the siliconized release film from the underside by pulling diagonally. Apply pressure with a roller over the entire surface of the membrane to ensure positive adhesion to the surface.

.3 Install subsequent rolls in the same manner taking care to overlap the side laps a minimum of 75 mm. Overlap the end laps a minimum of 150 mm. Roll all laps with a steel or nylon roller to ensure positive adhesion.

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 SHEATHING MEMBRANE (Outbuilding Only)

.1 Cut the membrane into 3 m to 4.5 m lengths.

.2 Unroll and align with the lower edge of roof. Tack top selvage edge with four equally-spaced temporary fasteners.

.3 Lift the lower half and remove the lower release film, exposing the adhesive surface.

.4 Reposition membrane down onto deck and press firmly in place. Avoid wrinkles. Remove temporary fasteners.

.5 Fold top half down and remove release film.

.6 Reposition the membrane up onto the deck and press firmly in place. Avoid wrinkles.

.7 If two courses are required, the top course should overlap the selvage tape on the lower course.

.8 End laps must be at least 15 cm (6 in.) and rolled to ensure adhesion and should be located at least 61 cm (24 in.) from those in the previous course.

3.7 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 manufacturers 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.

3.8 INTERNAL GUTTER

.1 At roof edges extend prefinished metal under metal roofing 150 mm minimum and as indicated on drawings.

3.9 SNOW GUARDS

.1 Install snow guards in accordance with approved engineered shop drawings.

3.10 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.

3.11 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 RELATED SECTIONS

.1 Section 04 21 13 – Brick Masonry

.2 Section 07 52 00 – Modified Bituminous Roofing

.3 Section 07 61 00 – Sheet Metal Roofing

1.2 REFERENCES

.1 American Society for Testing and Materials (ASTM International)

.1 ASTM A653/A653M-01a, Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.

.2 Canadian Roofing Contractors Association (CRCA)

.1 Roofing Specifications Manual 1997.

.3 Canadian Standards Association (CSA International)

.1 CSA B111-1974 (R1998), Wire, Nails, Spikes and Staples

1.3 SAMPLES

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

.2 Submit duplicate 100 x 100 mm samples of each type of sheet metal material, colour and finish.

1.4 WARRANTY

.1 Contractor shall warrant that sheet metal flashings will stay in place and remain leakproof in accordance with General Conditions (GC) - CCDC GC 12.3 , but for two years.

Part 2 Products

2.1 SHEET METAL MATERIALS

.1 Zinc coated steel sheet: 0.8 mm thickness, commercial quality to ASTM A653/A653M, with Z275 designation coating.

2.2 PREFINSIHED STEEL SHEET

.1 Prefinished steel with factory applied silicone modified polyester finish.

.1 Stelco / Dafasco 8000 Series

.2 Colour selected by Consultant from manufacturer’s standard range of colours.

2.3 ACCESSORIES

.1 Isolation coating: alkali resistant bituminous paint.

.2 Plastic cement: to CAN/CGSB 37.5.

.3 Sealants: two component polyurethane, colour to match adjacent materials.

.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 Solder: to ASTM B32, alloy composition.

.8 Touch-up paint: as recommended by prefinished material manufacturer.

2.4 METAL FLASHINGS AND CAP FLASHINGS

.1 Form flashings, copings and fascias to profiles indicated of 0.8mm thick prefinished steel

2.5 EAVES TROUGHS

.1 Form eaves troughs and downpipes from prefinished steel, 28 gauge.

.2 Clip hanger: galvanized metal hanger and stainless steel screws as recommended by eave trough manufacturer.

.3 Sizes and profiles as indicated.

.4 Provide goosenecks, outlets, strainer baskets and necessary fastenings.

.5 Provide transition from eave trough to HSS rainwater leader. Refer to Section 05 50 00 Metal Fabrications.

2.6 DOWN SPOUTS

.1 Hollow structural steel section: 152mm x 102mm x 4.8mm.

.2 Finish: minimum SSPC SP-6 commercial blast. Shop prime and paint - epoxy primer to MPI paint system 5.1M.

2.7 SCUPPERS

.1 Form scuppers from 1.2mm thick prefinished metal.

.2 Sizes and profiles as indicated in drawings.

.3 Provide necessary fastenings.

.4 Colour selected from manufacturer’s standard range of colours.

Part 3 Execution

3.1 FABRICATION

.1 Fabricate metal flashings and other sheet metal work in accordance with applicable CRCA 'FL' series details as indicated.

.2 Form pieces in 2400 mm maximum lengths. Make allowance for expansion at joints.

.3 Hem exposed edges on underside 12 mm. 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.

3.2 INSTALLATION

.1 Install sheet metal work in accordance with CRCA FL series details, FL Aluminum Sheet Metal Work in Building Construction and as detailed.

.2 Use concealed fastenings except where approved before installation.

.3 Counterflash bituminous flashings at intersections of roof with vertical surfaces and curbs. Flash joints using S-lock forming tight fit over hook strips, as detailed.

.4 “S-Lock” end joints and caulk with sealant.

.5 Install metal flashing under cap flashing to form weather tight junction.

3.3 EAVES TROUGHS AND DOWNPIPES

.1 Install eaves troughs and secure to building at 750 mm on centre with strap anchors.

.1 Slope eaves troughs to downpipes as indicated.

.2 Match exposed screw heads to colour of eave trough.

.3 Seal joints watertight.

.2 Install downpipes and provide goosenecks back to wall.

.1 Secure downpipes to wall with straps at [1800] mm on centre; minimum two straps per downpipe.

.3 Install splash pans as indicated.

3.4 DOWN SPOUTS

.1 Fabricate down spouts as indicated.

.2 Install down spouts as indicated.

3.5 SCUPPERS

.1 Form scuppers from 1.2 mm prefinished metal. Provide fasteners as required to secure scupper in wall. Scuppers shall be formed in a box shape and shall be continuous through entire depth of wall.

.2 Install in locations indicated on drawings.

END OF SECTION

Part 1 General

1.1 RELATED SECTIONS

.1 Section 07 61 00 - Sheet Metal Roofing

1.2 REFERENCES

.1 Conform to the current edition of the following codes and standards:

.1 Aluminum Association (AA) - Aluminum Standards and Data, 2003 Edition.

.2 ASTM International (ASTM):
- .1 B85-03 - Standard Specification for Aluminum-Alloy Die Castings.
- .2 B221-04a - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes.

1.4 SYSTEM DESCRIPTION

.1 Snow fence designed by a professional engineer registered in the province of Saskatchewan. Refer to Section 07 61 00 – Sheet Metal Roofing.

.2 Loading: The Supplier to Design the 'Snow Guard System' to meet all applicable codes and loading requirements.

.3 Factor of safety: Utilize a factor of safety 2 to determine allowable loads from ultimate tested clamp tensile load values.

.4 Attachment system to provide attachment to standing seam metal roof:

- .1 With only minor dimpling of panel seams.
- .2 Without penetrations through roof seams or panels.
- .3 Without use of sealers or adhesives.
- .4 Without voiding roof warranty.

1.5 SUBMITTALS

.1 Submittals for Review:
- .1 Shop Drawings: Show locations of snow guards on roof and attachment spacing.
- .2 Product Data: Include product description and installation instructions.
- .3 Samples:
  - .1 Clamp samples.
  - .2 24 inch long cross member samples including coupler and other hardware.

.2 Quality Control Submittals:
- .1 Test results: Results of product load testing, issued by a recognized independent testing laboratory, showing load-to-failure value of attachment.

.3 Closeout Submittals:

.1 Certification: Installer's certification that snow guard system was installed in accordance with manufacturer's instructions and approved Shop Drawings.

Part 2 Products

2.1 COMPONENTS

.1 Clamps:

.1 Manufactured from 6061-T6 aluminum extrusions conforming to ASTM B221 or aluminum castings conforming to ASTM B85 and to AA Aluminum Standards and Data.

.2 Clamp model: clamp suitable for the standing seam metal roofing.

.3 Set screws: 300 Series stainless steel, 18-8 alloy, 3/8 inch diameter, with round nose point.

.4 Attachment bolts: 300 Series stainless steel, 18-8 alloy, 10 mm diameter, with flat washers.

.2 Brackets:

1. Manufactured from 6061-T6 alloy and temper aluminum extrusions conforming to ASTM B221 and AA Aluminum Standards and Data or cast aluminum.

2. Screws for attachment of brackets to roof: Stainless steel of type best suited to application.

.3 Cross Members:

.1 Manufactured from 6061-T6 alloy and temper aluminum extrusions conforming to ASTM B221 and AA Aluminum Standards and Data.

.2 Receptacle in face to receive color-matched metal strips.

.3 Provide splice connectors ensuring alignment and structural continuity at end joints.

.4 Colour Strips: Same material and finish as roof panels; obtained from the insulated roof panel manufacturer.

.5 Snow and Ice Clips: Aluminum, with rubber foot, minimum 3 inches wide. The number of clips to be as per manufacturers recommendations.

2.2 ACCEPTABLE MANUFACTURERS

.1 Metal Roof Innovations, Ltd.- S-5! ColorGard complete with VersaBracket

.2 Approved equivalent

Part 3 Execution

3.1 EXAMINATION

.1 Prior to beginning installation, verify that:

.1 Panel seaming is complete.

.2 Panel attachment is sufficient to withstand loads applied by snow guard system.

3. Installation will not impeded roof drainage.

3.2 PREPARATION

.1 Clean areas to receive attachments; remove loose and foreign matter that could interfere with installation or performance

3.3 INSTALLATION

.1 Install system in accordance with manufacturer's instructions and approved Shop Drawings.

.2 Place clamps as required by design engineer.

.3 Place clamps in straight, aligned rows.

.4 Place both set screws on same side of clamp.

.5 Tighten set screws to manufacturer's recommended torque. Randomly test set screw torque using calibrated torque wrench.

.6 Insert color-matched metal strips into cross members, staggering strips to cover cross member joints.

.7 Attach cross members to clamps; tighten bolts to manufacturer's recommended torque.

.8 Install couplers at cross member end joints.

.9 Do not cantilever cross members more than 4 inches beyond last clamp at ends.

.11 Install SnoClips at spacings indicated on shop drawings.

END OF SECTION

Part 1 General

1.1 RELATED REQUIREMENTS

.1 Section 05 12 23 - Structural Steel for Buildings .

.2 Section 07 61 00 – Sheet Metal Roofing

1.2 REFERENCES

.1 CSA International

.1 CSA G40.20/G40.21-04(R2009), General Requirements for Rolled or Welded Structural Quality Steel/Structural Quality Steel.

.2 CSA W47.1-09, Certification of Companies for Fusion Welding of Steel.

.3 CSA W55.3-08, Certification of Companies for Resistance Welding of Steel and Aluminum.

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 roof anchors and safety restraints and include product characteristics, performance criteria, physical size, finish and limitations.

.3 Shop Drawings:

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

.1 Indicate component profiles, sizes, connection attachments, reinforcing, anchorage, size and type of fasteners, and accessories. Include erection drawings, elevations, and details where applicable.

.2 Indicate welded connections using standard welding symbols include net weld lengths.

.2 Submit design data and calculations.

.3 Submit load test results and certification.

1.4 QUALITY ASSURANCE

.1 Design structural support framing components under direct supervision of Professional Structural Engineer experienced in design of this Work and licensed in the Province of Saskatchewan of Canada.

.2 Qualifications:

.1 Welder's qualifications: welders certification to CSA W55.3

.1 Employ qualified and licensed welders possessing certificates for each procedure to be performed.

.3 Load testing

.1 Following installation of roof anchors perform load test on each roof anchor to verify anchor is capable of meeting specified load requirements.

.2 Load test to be performed by trained personnel certified to perform load testing.

.3 Submit report to Departmental Representative certifying test results and indicating pass or fail for each anchor.

1.5 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 roof anchors and safety restraints from nicks, scratches, and blemishes.

.3 Replace defective or damaged materials with new.

Part 2 Products

2.1 SYSTEM DESCRIPTION

.1 Personal Restraint Assembly: Posts and attachments to resist lateral forces of 24.03 kN at any point and in all directions, without damage or permanent set.

2.2 MATERIALS

.1 Steel Sections and Plates: CSA G40.20M/G40.21.

.2 Steel Tubing: ASTM A500/A500M, Grade B, hot dipped galvanized.

.3 Steel Rings: Type 304 stainless steel, forged, ring thickness determined by imposed loads.

.4 Cap: Stainless steel, type 304.

.5 Stack Flashing: aluminum flashing with EPDM pressure seal grommet. Sealing of unit cannot rely on caulking.

.6 Bolts, Nuts, and Washers for Stainless Steel: stainless steel, matte finish.

.7 Gaskets Under Anchors: neoprene pads, compatible with roof membrane, cut to size.

.8 Welding Materials: CSA W47.1 for materials being welded.

.9 Shop Primer: Shop Primer: Epoxy, anti-corrosive type, two coats.

2.3 FABRICATION

.1 Fit and shop assemble items in largest practical sections, for delivery to site.

.2 Fabricate items with joints tightly fitted and secured.

.3 Anchor types to suit roof assembly construction.

.4 Continuously seal joined members by intermittent welds and plastic filler.

.5 Grind exposed joints flush and smooth with adjacent finish surface.

.1 Make exposed joints butt tight, flush, and hairline.

.2 Ease exposed edges to small uniform radius.

.6 Fill hollow steel support post with urethane insulation

.7 Exposed Mechanical Fastenings: screws or bolts; consistent with design of component.

.8 Furnish and install components required for anchorage of fabrications.

.9 Fabricate anchors and related components of same material and finish as fabrication, except where specifically noted otherwise.

2.4 FABRICATION TOLERANCES

.1 Squareness: 3 mm maximum difference in diagonal measurements.

.2 Maximum Deviation from Plane: 1.5 mm from 1 m.

2.5 FINISHES

.1 Concealed steel anchors, clean surfaces of rust, scale, grease, and foreign matter prior to finishing.

.2 Do not prime surfaces in direct contact with concrete or where field welding is required.

.3 Concealed Structural Components and Anchors: galvanize after fabrication to ASTM A123/A123M to minimum 600 g/sq m galvanized coating.

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 roof anchors and safety restraint installation in accordance with manufacturer's written instructions.

.2 Verify dimensions, tolerances, and method of attachment with other work.

3.2 PREPARATION

.1 Supply and install steel items required to be attached to steel framing as clean uncoated metal, with setting templates to appropriate sections.

3.3 ERECTION TOLERANCES

.1 Maximum Variation from Plumb: 6 mm.

3.4 INSTALLATION

.1 Install items plumb and level, accurately fitted, free from distortion or defects.

.2 Provide for erection loads, and for sufficient temporary bracing to maintain true alignment until completion of erection and installation of permanent attachments.

.3 Field weld components as indicated on shop drawings.

.4 Obtain approval from Consultant prior to site cutting or making adjustments not scheduled.

.5 After erection, apply primer in accordance with MPI Painting Manual to: welds, abrasions, and surfaces not shop primed or galvanized, except surfaces to be in contact with concrete.

3.5 LOAD TESTING

.1 Perform load test on each roof anchor.

3.6 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.

3.7 PROTECTION

.1 Protect installed products and components from damage during construction.

.2 Repair damage to adjacent materials caused by roof anchors and safety restraint installation.

END OF SECTION

Part 1 General

1.1 RELATED REQUIREMENTS

.1 Section 04 22 00 – Concrete Unit Masonry .

.2 Section 09 21 16 - Gypsum Board Assemblies

1.2 REFERENCES

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

.1 Material Safety Data Sheets (MSDS).

.2 Underwriter's Laboratories of Canada (ULC)

.1 ULC-S115-1995, Fire Tests of Fire stop Systems.

1.3 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.

1.4 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 Sheets in accordance with Section 02 81 01 - Hazardous Materials.

.3 Shop Drawings:

.1 Submit shop drawings to show location, proposed material, reinforcement, anchorage, fastenings and method of installation.

.2 Construction details should accurately reflect actual job conditions.

.4 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 Manufacturer's Instructions: submit manufacturer's installation instructions and special handling criteria, installation sequence and cleaning procedures.

1.5 QUALITY ASSURANCE

.1 Qualifications:

.1 Installer: company or person specializing in fire stopping installations with 5 documented years experience.

1.6 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, ULC markings.

.2 Storage and Protection:

.1 Store materials in dry location and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.

.2 Replace defective or damaged materials with new.

Part 2 Products

2.1 MATERIALS

.1 Fire stopping and smoke seal systems: in accordance with CAN-ULC-S115.

.1 Asbestos-free materials and systems capable of maintaining effective barrier against flame, smoke and gases in compliance with requirements of CAN-ULC-S115 and not to exceed opening sizes for which they are intended.

.2 Fire stop system rating: as indicated in drawings.

.2 Service penetration assemblies: systems tested to CAN-ULC-S115.

.3 Service penetration fire stop components: certified by test laboratory to CAN-ULC-S115.

.4 Fire-resistance rating of installed fire stopping assembly in accordance with NBC.

.5 Fire stopping and smoke seals at openings intended for ease of re-entry such as cables: elastomeric seal.

.6 Fire stopping and smoke seals at openings around penetrations for pipes, ductwork and other mechanical items requiring sound and vibration control: elastomeric seal.

.7 Primers: to manufacturer's recommendation for specific material, substrate, and end use.

.8 Water (if applicable): potable, clean and free from injurious amounts of deleterious substances.

.9 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.

.10 Sealants for vertical joints: non-sagging.

Part 3 Execution

3.1 MANUFACTURER'S INSTRUCTIONS

.1 Compliance: comply with manufacturer's written recommendations or specifications, including product technical bulletins, handling, storage and installation instructions, and datasheets.

3.2 PREPARATION

.1 Examine sizes and conditions of voids to be filled to establish correct thicknesses and installation of materials.

.1 Ensure that substrates and surfaces are clean, dry and frost free.

.2 Prepare surfaces in contact with fire stopping materials and smoke seals to manufacturer's instructions.

.3 Maintain insulation around pipes and ducts penetrating fire separation without interruption to vapour barrier.

.4 Mask where necessary to avoid spillage and over coating onto adjoining surfaces; remove stains on adjacent surfaces.

3.3 INSTALLATION

.1 Install fire stopping and smoke seal material and components in accordance with manufacturer's certified tested system listing.

.2 Seal holes or voids made by through penetrations, poke-through termination devices, and unpenetrated openings or joints to ensure continuity and integrity of fire separation are maintained.

.3 Provide temporary forming as required and remove forming only after materials have gained sufficient strength and after initial curing.

.4 Tool or trowel exposed surfaces to neat finish.

.5 Remove excess compound promptly as work progresses and upon completion.

3.4 SPECIAL REQUIREMENTS

.1 Location of special requirements for fire stopping and smoke seal materials at openings and penetrations in fire resistant rated assemblies are as follows:

.1 Designed for re-entry, removable at:

.1 LAN 140

.2 TEL 141.

3.5 SEQUENCES OF OPERATION

.1 Proceed with installation only when submittals have been reviewed by Consultant.

.2 Mechanical pipe insulation: certified fire stop system component.

.1 Ensure pipe insulation installation precedes fire stopping.

3.6 FIELD QUALITY CONTROL

.1 Inspections: notify Consultant when ready for inspection and prior to concealing or enclosing fire stopping materials and service penetration assemblies.

3.7 CLEANING

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

.2 On completion and verification of performance of installation, remove surplus materials, excess materials, rubbish, tools and equipment.

.3 Remove temporary dams after initial set of fire stopping and smoke seal materials.

3.8 SCHEDULE

.1 Fire stop and smoke seal at:

.1 Penetrations through fire-resistance rated masonry, concrete, and gypsum board partitions and walls.

.2 Top of fire-resistance rated masonry and gypsum board partitions.

.3 Intersection of fire-resistance rated masonry and gypsum board partitions.

.4 Control joints in fire-resistance rated masonry and gypsum board partitions and walls.

.5 Penetrations through fire-resistance rated floor slabs.

.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 SECTION INCLUDES

.1 Materials, preparation and application for caulking and sealants.

1.2 RELATED SECTIONS

.1 Section 06 40 00 - Architectural Woodwork.

.2 Section 07 42 33 – Phenolic Wall Panels.

.3 Section 07 27 00 – Air and Vapour Barriers

.4 Section 07 62 00 – Sheet Metal Flashing and Trim

.5 Section 08 54 13 – Fiberglass Windows

.6 Section 09 30 13 – Ceramic Tiling

1.3 REFERENCES

.1 Canadian General Standards Board (CGSB)

.1 CGSB 19-GP-5M-1984, Sealing Compound, One Component, Acrylic Base, Solvent Curing (Issue of 1976 reaffirmed, incorporating Amendment No. 1).

.2 CAN/CGSB-19.13-M87, Sealing Compound, One-component, Elastomeric, Chemical Curing.

.3 CGSB 19-GP-14M-1984, Sealing Compound, One Component, Butyl-Polyisobutylene Polymer Base, Solvent Curing (Reaffirmation of April 1976).

.4 CAN/CGSB-19.17-M90, One-Component Acrylic Emulsion Base Sealing Compound.

.5 CAN/CGSB-19.24-M90, Multi-component, Chemical Curing Sealing Compound.

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

.1 Material Safety Data Sheets (MSDS).

1.4 SUBMITTALS

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

.2 Product Data

.1 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.

.2 Submit manufacturer's instructions in accordance with Section 01 33 00 - Submittal Procedures.

.1 Instructions to include installation instructions for each product used.

.3 Samples:

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

.2 Submit duplicate samples of each type of material and colour.

.3 Submit cured samples of exposed sealants for each color where required to match adjacent material.

.4 Maintenance Manuals:

.1 Conform to Section 01 78 00 - Closeout Submittals.

1.5 DELIVERY, STORAGE, AND HANDLING

.1 Deliver, handle, store and protect materials in accordance with Section 01 61 00 - Common Product Requirements.

.2 Deliver and store materials in original wrappings and containers with manufacturer's seals and labels, intact. Protect from freezing, moisture, water and contact with ground or floor.

1.6 PROJECT CONDITIONS

.1 Environmental Limitations:

.1 Do not proceed with installation of joint sealants under following conditions:

.1 When ambient and substrate temperature conditions are outside limits permitted by joint sealant manufacturer or are below 5 degrees C.

.2 When joint substrates are wet.

.2 Joint-Width Conditions:

.1 Do not proceed with installation of joint sealants where joint widths are less than those allowed by joint sealant manufacturer for applications indicated.

.3 Joint-Substrate Conditions:

.1 Do not proceed with installation of joint sealants until contaminants capable of interfering with adhesion are removed from joint substrates.

1.7 ENVIRONMENTAL REQUIREMENTS

.1 Conform to manufacturer's recommended temperatures, relative humidity, and substrate moisture content for application and curing of sealants including special conditions governing use.

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 offgass to exterior, are contained behind air barriers, or are applied several months before occupancy to maximize offgas time.

.3 Where sealants are qualified with primers use only these primers.

2.2 SEALANT TYPES

.1 Type 1 -Urethanes Three Part.

.1 Non-Sag to CAN/CGSB-19.24, Type 2, Class B, colour as selected by Consultant from standard range of manufacturer's colours.

.1 Acceptable material: Tremco "Dymeric 240",

.2 Or equivalent.

.2 Type 2 -Urethanes One Part.

.1 Non-Sag to CAN/CGSB-19.13, Type 2, colour as selected by Consultant from standard range of manufacturer's colours.

.1 Acceptable material: BASF "Sonolastic NP 1".

.2 Or equivalent.

.3 Type 3 -Silicones One Part.

.1 To CAN/CGSB-19.13. Colour as selected by Consultant from standard range of manufacturer's colours.

.1 Acceptable material: Dow Corning "Tub, Tile & Ceramic Silicone Sealant".

.2 Or equivalent.

.4 Type 4 -Acrylic Latex One Part.

.1 To CAN/CGSB-19.17.

.5 Type 5 -Acoustical Sealant.

.1 To ASTM C919.

.6 Type 6 –Single Component Silicone Rubber sealant

.1 Self-leveling elastomeric polyurethane to ASTM C 920 Type S, Grade P. Colour as selected by Consultant from standard range of manufacturer's colours.

.1 Acceptable material: BASF "Silcoferm S".

.2 Or equivalent.

.7 Type 7 –Epoxy Adhesive – Security Sealant

.1 Acceptable material: “Dynapoxy EP-430 Fast”

.2 No substitutions permitted.

.3 Refer to schedule at the end of this section for locations.

2.3 PREFORMED COMPRESSIBLE AND NON-COMPRESSIBLE BACK-UP MATERIALS.

.1 Polyethylene, Urethane, Neoprene or Vinyl Foam.

.1 Extruded open closed cell foam backer rod.

.2 Size: oversize 30 to 50 %.

.2 Neoprene or Butyl Rubber.

.1 Round solid rod, Shore A hardness 70.

.3 High Density Foam.

.1 Extruded closed cell polyvinyl chloride (PVC), extruded polyethylene, closed cell, Shore A hardness 20, tensile strength 140 to 200 kPa, extruded polyolefin foam, 32 kg/m^3 density, or neoprene foam backer, size as recommended by manufacturer.

.4 Bond Breaker Tape.

.1 Polyethylene bond breaker tape which will not bond to sealant.

2.4 SEALANT SELECTION

.1 Exterior sealant: Sealant type: 1 or 2 (colour to be selected by consultant).

.2 Masonry control joints, Sealant type: 2 (match mortar colour)

.3 Perimeters of exterior openings where door and window frames meet exterior facade of building : Sealant type: 1 or 2.

.4 Seal interior perimeters of exterior openings: Sealant type: 3.

.5 Poly Vapour Barrier: Sealant type: 5.

.6 Perimeters of interior window and door frames, base of interior door frames between frame and floor finish: Sealant type: 4.

.7 Tops and bottoms of acoustic walls. Sealant type: 5.

.8 Perimeters of countertop edges, Sealant type: 4.

.9 Perimeter of fixtures (e.g. sinks, urinals, waterclosets, basins, vanities): Sealant type: 3.

.10 Ceramic tile control joints: Sealant type: 6.

.11 In additional locations as noted on the drawings: confirm with Consultant.

2.5 JOINT CLEANER

.1 Non-corrosive and non-staining type, compatible with joint forming materials and sealant recommended by sealant manufacturer.

.2 Primer: as recommended by manufacturer.

Part 3 Execution

3.1 PROTECTION

.1 Protect installed Work of other trades from staining or contamination.

3.2 SURFACE PREPARATION

.1 Examine joint sizes and conditions to establish correct depth to width relationship for installation of backup materials and sealants.

.2 Clean bonding joint surfaces of harmful matter substances including dust, rust, oil grease, and other matter that may impair Work.

.3 Do not apply sealants to joint surfaces treated with sealer, curing compound, water repellent, or other coatings unless tests have been performed to ensure compatibility of materials. Remove coatings as required.

.4 Ensure joint surfaces are dry and frost free.

.5 Prepare surfaces in accordance with manufacturer's directions.

3.3 PRIMING

.1 Where necessary to prevent staining, mask adjacent surfaces prior to priming and caulking.

.2 Prime 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 Refer to referenced Sections for specific installation instructions.

.2 General Installation.

.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 Apply 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.

.3 Curing.

.1 Cure sealants in accordance with sealant manufacturer's instructions.

.2 Do not cover up sealants until proper curing has taken place.

.4 Cleanup.

.1 Clean adjacent surfaces immediately and leave Work neat and clean.

.2 Remove excess and droppings, using recommended cleaners as work progresses.

.3 Remove masking tape after initial set of sealant.

3.7 SCHEDULE – SEALANT TYPE 7

.1 Apply Type 7 sealant to all gaps within scheduled rooms including, but not limited to toilet/sink, light fixtures, door frames, air grilles, smoke detector covers, and security camera housings.

.2 Room schedule:

142, 142.1, 142.2, 143, 144, 145, 146, 147, 149, 150, 151, 152, 153, 154, 155 and 156.

END OF SECTION

Part 1 General

1.1 RELATED SECTIONS

.1 Section 08 71 00 - Door Hardware.

.2 Section 08 90 10 - Door, Frame, and Hardware Schedule.

1.2 REFERENCES

.1 American Society for Testing and Materials International (ASTM)

.1 ASTM A653/A653M-11, Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.

.2 ASTM C591-13, Standard Specification for Unfaced Preformed Rigid Cellular Polyisocyanurate Thermal Insulation

.3 ASTM C1289-13e1, Standard Specification for Faced Rigid Cellular Polyisocyanurate Thermal Insulation Board

.2 Canadian General Standards Board (CGSB)

.1 CAN/CGSB-1.181-99, Ready-Mixed Organic Zinc-Rich Coating.

.2 CGSB 41-GP-19Ma-84, Rigid Vinyl Extrusions for Windows and Doors.

.3 Canadian Standards Association (CSA International)

.1 CSA-G40.20-13/G40.21-13, General Requirements for Rolled or Welded Structural Quality Steel/Structural Quality Steel.

.2 CSA W59-13, Welded Steel Construction (Metal Arc Welding).

.4 Canadian Steel Door Manufacturers' Association (CSDMA)

.1 CSDMA, Recommended Specifications for Commercial Steel Doors and Frames, 2006.

.2 CSDMA, Selection and Usage Guide for Commercial Steel Doors, 2009.

.5 National Fire Protection Association (NFPA)

.1 NFPA 80-2013, Standard for Fire Doors and Fire Windows.

.2 NFPA 252-2013, Standard Methods of Fire Tests of Door Assemblies.

.6 Underwriters' Laboratories of Canada (ULC)

.1 CAN/ULC S104-10, Standard Method for Fire Tests of Door Assemblies.

1.3 SYSTEM DESCRIPTION

.1 Design Requirements:

.1 Design exterior frame assembly to accommodate to expansion and contraction when subjected to minimum and maximum surface temperature of -35 degrees C to 35 degrees C.

.2 Steel fire rated doors and frames: labelled and listed by an organization accredited by Standards Council of Canada in conformance with CAN/ULC S104 for ratings specified or indicated.

.3 Provide fire labelled frames for openings requiring fire protection ratings. Test products in conformance with CAN/ULC S104, ASTM E152 or NFPA 252 and listed by nationally recognized agency having factory inspection services.

1.4 SUBMITTALS

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

.2 Provide product data: in accordance with Section 01 33 00 - Submittal Procedures.

.3 Provide shop drawings: in accordance with Section 01 33 00 - Submittal Procedures.

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

.2 Indicate each type of door, material, steel core thicknesses, mortises, reinforcements, location of exposed fasteners, openings, glazed, louvred, arrangement of hardware and fire rating and finishes.

.3 Indicate each type frame material, core thickness, reinforcements, glazing stops, location of anchors and exposed fastenings and reinforcing, fire rating, and finishes.

.4 Include schedule identifying each unit, with door marks and numbers relating to numbering on drawings and door schedule.

1.5 DELIVERY, STORAGE AND HANDLING

.1 Deliver, store and handle materials in accordance with Section 01 61 00 - Common Product Requirements.

Part 2 Products

2.1 MATERIALS

.1 Hot dipped galvanized steel sheet: to ASTM A653M, ZF75, minimum base steel thickness in accordance with CSDMA Table 1 - Thickness for Component Parts.

.2 Reinforcement channel: to CSA G40.20/G40.21, Type 44W, coating designation to ASTM A653M, ZF75.

2.2 DOOR CORE MATERIALS

.1 Honeycomb construction:

.1 Structural small cell, 24.5 mm maximum kraft paper 'honeycomb', weight: 36.3 kg per ream minimum, density: 16.5 kg/m^3 minimum sanded to required thickness.

.2 Insulated core:

.1 Polyisocyanurate: Rigid, modified polyisocyanurate, closed cell board. Density; 32 kg/m^3 (2.0 pcf) minimum, thermal values; RSI 1.9 (R 11.0) minimum, in accordance with ASTM C591 (un-faced) or C 1289 (faced).

.3 Temperature rise rated (TRR): core composition to limit temperature rise on unexposed side of door. Core to be tested as part of a complete door assembly, in accordance with CAN/ULC S104, ASTM E152 or NFPA 252, covering Standard Method of Tests of Door Assemblies and listed by nationally recognized testing agency having factory inspection service.

2.3 ADHESIVES

.1 Honeycomb cores and steel components: heat resistant, spray grade, resin reinforced neoprene/rubber (polychloroprene) based, low viscosity, contact cement.

.1 Adhesive: maximum VOC content 50 g/L.

.2 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 Sections 09 91 13 - Exterior Painting and 09 91 23 - Interior Painting. Protect weatherstrips from paint. Provide final finish free of scratches or other blemishes.

2.6 ACCESSORIES

.1 Door silencers: single stud rubber/neoprene type.

.2 Exterior and interior top and bottom caps: steel.

.3 Fabricate glazing stops as formed channel, minimum 16 mm height, accurately fitted, butted at corners and fastened to frame sections with counter-sunk oval head sheet metal screws.

.4 Metallic paste filler: to manufacturer's standard.

.5 Fire labels: metal rivited.

.6 Sealant: in accordance with Section 07 92 00 – Joint Sealants.

.1 Maximum VOC limit 250 g/L.

.7 Glazing: in accordance with Section 08 80 50 - Glazing.

.8 Make provisions for glazing as indicated and provide necessary glazing stops.

.1 Provide removable stainless steel glazing beads for use with glazing tapes and compounds and secured with countersunk stainless steel screw.

.2 Design exterior glazing stops to be tamperproof.

2.7 FRAMES FABRICATION GENERAL

.1 Fabricate frames in accordance with CSDMA specifications.

.2 Fabricate frames to profiles and maximum face sizes as indicated.

.3 Exterior frames: 1.6 mm welded, thermally broken type construction using rigid polyvinylchloride extrusion conforming to CGSB 41-GP-19MA.

.4 Interior frames: 1.6 mm welded type construction.

.5 Strike bucket: accept a 25 mm throw dead bolt. Grout or wedge in the area of the strike bucket to prevent spreading.

.6 Blank, reinforce, drill and tap frames for mortised, templated hardware, and electronic hardware using templates provided by finish hardware supplier. Reinforce frames for surface mounted hardware.

.7 Protect mortised cutouts with steel guard boxes.

.8 Prepare frame for door silencers, 3 for single door, 2 at head for double door.

.9 Manufacturer's nameplates on frames and screens are not permitted.

.10 Conceal fastenings except where exposed fastenings are indicated.

.11 Provide factory-applied touch up primer at areas where zinc coating has been removed during fabrication.

.12 Insulate exterior frame components with polyurethane insulation.

.13 Prepare frames to receive electronic monitoring and security devices. Refer to Section 08 71 10 - Door Hardware and Section 08 90 10 - Door, Frame and Hardware Schedule. Coordinate frame preparation with Electrical Divisions 26 and 28.

.14 Frames to be prepped to accommodate

2.8 FRAME ANCHORAGE

.1 Provide appropriate anchorage to floor and wall construction.

.2 Locate each wall anchor immediately above or below each hinge reinforcement on hinge jamb and directly opposite on strike jamb.

.3 Provide 2 anchors for rebate opening heights up to 1520 mm and 1 additional anchor for each additional 760 mm of height or fraction thereof.

.4 Locate anchors for frames in existing openings not more than 150 mm from top and bottom of each jambs and intermediate at 660 mm on centre maximum.

2.9 FRAMES: WELDED TYPE

.1 Welding in accordance with CSA W59.

.2 Accurately mitre or mechanically joint frame product and securely weld on inside of profile.

.3 Cope accurately and securely weld butt joints of mullions, transom bars, centre rails and sills.

.4 Grind welded joints and corners to a flat plane, fill with metallic paste and sand to uniform smooth finish.

.5 Securely attach floor anchors to inside of each jamb profile.

.6 Weld in 2 temporary jamb spreaders per frame to maintain proper alignment during shipment.

2.10 DOOR FABRICATION GENERAL

.1 Doors: swing type, flush, with provision for glass and/or louvre openings as indicated.

.2 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.

.3 Blank, reinforce, drill doors and tap for mortised, templated hardware and electronic hardware.

.4 Factory prepare holes 12.7 mm diameter and larger except mounting and through-bolt holes, on site, at time of hardware installation.

.5 Reinforce doors where required, for surface mounted hardware. Provide flush steel top caps to exterior doors. Provide inverted, recessed, spot welded channels to top and bottom of interior doors.

.6 Provide factory-applied touch-up primer at areas where zinc coating has been removed during fabrication.

.7 Provide fire labelled doors for those openings requiring fire protection ratings, as scheduled. Test such products in conformance with CAN/ULC S104, ASTM E152, or NFPA 252 and list by nationally recognized agency having factory inspection service and construct as detailed in Follow-Up Service Procedures/Factory Inspection Manuals issued by listing agency to individual manufacturers.

.8 Manufacturer's nameplates on doors are not permitted.

2.11 DOORS: HONEYCOMB CORE CONSTRUCTION

.1 Form face sheets for exterior doors from 1.6 mm sheet steel with honeycomb core laminated under pressure to face sheets.

.2 Form face sheets for interior doors from 1.6 mm sheet steel with honeycomb core laminated under pressure to face sheets.

2.12 THERMALLY BROKEN DOORS AND FRAMES

.1 Fabricate thermally broken doors by using polyisocyanurate 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.

.6 Maintain continuity of air barrier and vapour retarder.

3.4 DOOR INSTALLATION

.1 Install doors and hardware in accordance with hardware templates and manufacturer's instructions and Section 08 71 00 - Door Hardware.

.2 Provide even margins between doors and jambs and doors and finished floor and thresholds as follows.

.1 Hinge side: 1.0 mm.

.2 Latchside and head: 1.5 mm.

.3 Finished floor, top of carpet, and thresholds: 13 mm.

.3 Adjust operable parts for correct function.

.4 Install louvres.

3.5 FINISH REPAIRS

.1 Touch up with primer finishes damaged during installation.

.2 Fill exposed frame anchors and surfaces with imperfections with metallic paste filler and sand to a uniform smooth finish.

3.6 GLAZING

.1 Install glazing for doors and frames in accordance with Section 08 80 50 - Glazing.

END OF SECTION

Part 1 General

1.1 RELATED SECTIONS

.1 Section 06 10 11 – Rough Carpentry

.2 06 40 00 - Architectural Woodwork.

.3 Section 07 92 00 – Joint Sealing

.4 Section 08 80 50 – Glazing

1.2 REFERENCES

.1 Aluminum Association (AA).

.1 DAF 45-03, Designation System for Aluminum Finishes.

.2 American Architectural Manufacturers Association (AAMA).

.1 AAMA CW-10, Care And Handling of Architectural Aluminum from Shop to Site

.2 AAMA 611, Voluntary Specifications for Anodized finishes Architectural Aluminum

.3 AAMA 609-93, Voluntary Guide Specification for Cleaning and Maintenance of Architectural Anodized Aluminum.

.3 American Society for Testing and Materials International, (ASTM).

.1 ASTM B209M, Aluminum and Aluminum-Alloy sheet and Plate Metric

.2 ASTM E330-02, Standard Test Method for Structural Performance of Exterior Windows, Doors, Skylights and Curtain Walls by Uniform Static Air Pressure Difference.

1.3 SUBMITTALS

.1 Product Data:

.1 Submit catalogue details for each type of frame illustrating profiles, dimensions and methods of assembly.

.2 Shop Drawings

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

.1 Indicate materials and profiles and provide scaled details of components for each type of door and frame.

.3 Closeout Submittals

.1 Conform to Section 01 78 00 - Closeout Submittals.

1.4 DELIVERY, STORAGE, AND HANDLING

.1 Storage and Protection:

.1 Apply temporary protective coating to finished surfaces. Remove coating after erection. Do not use coatings that will become hard to remove or leave residue.

.2 Leave protective covering in place until final cleaning of building.

Part 2 Products

2.1 MATERIALS

.1 Aluminum extrusions: Aluminum Association alloy AA6063-T5 anodizing quality.

.2 Fasteners: stainless steel where exposed

.3 Isolation coating: bituminous paint.

.4 Glass: refer to Section 08 80 50 – Glazing

2.2 ALUMINUM FRAMES

.1 Interior aluminum frames:

.1 Extruded aluminum frames nominal size 100 x 45 mm, front glazed system.

.2 Thickness: 3 mm

.3 Kawneer: Trifab 450 series or approved alternate.

2.3 ALUMINUM WINDOW FRAME HARDWARE (ANTI-VAULT)

.1 All components to be heavy duty.

.2 Horizontal Sliding Panel: Suspended by two heavy duty roller brackets, each having self-lubricating nylon wheel and ball bearing assembly; running in an extruded aluminum track assembly. Provide continuous extruded aluminum door glides and retainer clips along bottom for positive guide no-sway operation.

.3 Recessed pull handle (installed on office side).

.4 Cylinder thumb turn (non key design) locking device with one hand operation. Interior side Locking device to be self-activating upon closing, slam latch operation.

.1 Device: Spring loaded Transcom latch Model #865 manufactured by Sbinco (as supplied by Anotec MFG Inc.)

.2 Locate lock so it cannot be reached through the adjacent opening. Confirm location with Consultant.

.5 Pass through latch: Heavy duty, spring loaded mechanical latch.

.6 Rubber faced door stop to restrict window movement at maximum window opening.

2.4 HARDWARE

.1 Hardware to match colour of aluminum frames.

2.5 ALUMINUM FINISHES

.1 Finish exposed surfaces of aluminum components in accordance with Aluminum Association Designation System for Aluminum Finishes.

.1 Finish: Clear anodized AA-M12C22A31, 0.7 mil thickness, Class 1.

2.6 FABRICATION

.1 Framing to be by same manufacturer.

.2 Fabricate frames to profiles and maximum face sizes as shown. Provide minimum 22 mm bite for insulating glazed units.

.3 Reinforce mechanically joined corners and components areas of aluminum framing with interior steel clips to provide strength, stiffness and rigidity in the completed installation.

.4 Fit joints tightly and secure mechanically.

.5 Conceal fastenings.

.6 Mortise, reinforce, drill and tap frames and reinforcements to receive hardware.

.7 Isolate aluminum from direct contact with dissimilar metals, concrete and masonry.

Part 3 Execution

3.1 MANUFACTURER'S INSTRUCTIONS

.1 Compliance: comply with manufacturer's written data, including product technical bulletins, product catalogue installation instructions, product carton installation instructions, and data sheets.

3.2 WINDOW INSTALLATION

.1 Install windows in accordance with manufacturer's instructions. Set frames plumb, square, level at correct elevation in alignment with adjacent work.

.2 Anchor securely.

.3 Adjust operable parts for correct function and smooth friction free operation.

.4 Make allowances for deflection of structure to ensure that structural loads are not transmitted to frames.

.5 Seal joints between window frame and other building components with clear silicone caulking.

3.3 GLAZING

.1 Glaze aluminum doors and frames in accordance with Section 08 80 50 – Glazing.

3.4 CAULKING/SEALING

.1 Apply sealant in accordance with Section 07 92 00 - Joint Sealing. Conceal sealant within the aluminum work except where exposed use is permitted by Consultant.

3.5 CLEANING

.1 Perform cleaning of aluminum components in accordance with AAMA 609.1 - Voluntary Guide Specification for Cleaning and Maintenance of Architectural Anodized Aluminum.

.2 Clean aluminum with damp rag and approved non-abrasive cleaner.

.3 Remove traces of primer, caulking, epoxy and filler materials; clean doors and frames.

.4 Clean glass and glazing materials with approved non-abrasive cleaner.

.5 Upon completion of installation, remove surplus materials, rubbish, tools and equipment barriers.

END OF SECTION

Part 1 General

1.1 RELATED SECTIONS

.1 Section 08 34 74 – Acoustic Steel Door and Frame Assemblies

.2 Section 08 71 00 - Door Hardware.

.3 Section 08 80 50 – Glazing.

.4 Section 08 90 10 – Door, Frame and Hardware Schedule.

.5 Section 09 91 23 - Interior Painting.

1.2 REFERENCES

.1 Architectural Woodwork Manufacturers Association of Canada (AWMAC).

.1 Quality Standards for Architectural Woodwork, 1st edition, 2009.

.2 Canadian Standards Association (CSA International).

.1 CAN/CSA O132.2 Series-90(R1998), Wood Flush Doors.

.2 CAN/CSA-O132.5-M1992(R1998), Stile and Rail Wood Doors.

1.3 SUBMITTALS

.1 Product Data:

.1 Submit manufacturer's printed product literature, specifications and data sheet in accordance with Section 01 33 00 - Submittal Procedures.

.2 Submit two copies of WHMIS MSDS - Material Safety Data Sheets in accordance with Section 01 33 00 - Submittal Procedures. Indicate VOC's:

.1 For caulking materials during application and curing.

.2 For door materials and adhesives.

.2 Shop Drawings:

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

.2 Indicate door types and cutouts for lights and louvres, sizes, core construction, transom panel construction and cutouts.

1.4 QUALITY ASSURANCE

.1 Certificates: product certificates signed by manufacturer certifying materials comply with specified performance characteristics and criteria and physical requirements.

1.5 DELIVERY, STORAGE, AND HANDLING

.1 Storage and Protection:

.1 Protect doors from dampness. Arrange for delivery after work causing abnormal humidity has been completed.

.2 Store doors in well ventilated room, off floor, in accordance with manufacturer's recommendations.

.3 Protect doors from scratches, handling marks and other damage. Wrap doors.

.4 Store doors away from direct sunlight.

Part 2 Products

2.1 WOOD FLUSH DOORS

.1 Solid core: to CAN/CSA-O132.2.1.

.2 Grade: AWMAC “Custom” grade unless otherwise noted.

.3 Performance Duty Level: AWMAC “Extra Heavy Duty” level unless otherwise noted

.1 Construction:

.1 Solid particleboard core: grade LD-1 or LD-2, stile and rail frame bonded to particleboard core with wood lock blocks and top blocks, 5-ply construction, 45 mm thickness. Door core and all materials shall contain no urea formaldehyde.

.2 Face Panels:

.1 Hardwood; veneer grades: Grade I (Premium), flat sliced Maple species.

.3 Adhesive: Type II (water resistant) for interior doors.

.4 Finish: Stain and clear varnish finish on site. Refer to Section 09 91 23 – Interior Painting.

.4 Acceptable pre-manufactured wood flush doors.

.1 Meet specified AWMAC Grade and Performance Level.

.2 Finish: Factory applied stain and clear varnish finish.

.3 Acceptable pre-manufactured door unit:

.1 Bailargeon: series: ”Extreme” or equivalent.

2.2 SOUND RETARDENT WOOD FLUSH DOORS

.1 Sound retardant doors: Min STC 46 rating.

.1 Meet specified AWMAC Grade and Performance Level.

.2 Finish: Factory applied stain and clear varnish finish.

.3 Accessories: manufacturer recommended sound retardant gaskets and threshold

.4 Acceptable pre-manufactured door unit:

.1 Bailargeon: series: ”Intense” or equivalent.

2.3 ACCESSORIES

.1 Door Seals: in accordance with Section 08 34 74 – Acoustic Steel Door and Frame Assembles and as required to meet specified STC rating.

.2 Threshold: in accordance with Section 08 34 74 – Acoustic Steel Door and Frame Assemblies and as required to meet specified STC rating.

2.4 GLAZING

.1 Glass: in accordance with Section 08 80 50 - Glazing.

.2 Accessories: in accordance with Section 08 80 50 - Glazing.

2.5 FABRICATION

.1 Vertical edge strips solid hardwood compatible with face veneer. AWMAC edge type 2.

.2 Prepare doors for louvres and glazing. Provide hardwood species to match face veneer and glazing stops with mitred corners.

.3 Bevel vertical edges of single acting doors 3 mm in 50 mm on lock side and 1.5 mm in 50 mm on hinge side.

Part 3 Execution

3.1 MANUFACTURER'S INSTRUCTIONS

.1 Compliance: comply with manufacturer's written data, including product technical bulletins, product catalogue installation instructions, product carton installation instructions, and data sheets.

3.2 INSTALLATION

.1 Unwrap and protect doors in accordance with CAN/CSA-O132.2 Series, Appendix A.

.2 Install doors and hardware in accordance with manufacturer's printed.

.3 Adjust hardware for correct function.

.4 Install glazing in accordance with Section 08 80 50 - Glazing.

.5 Install louvres and stops.

3.3 ADJUSTMENT

.1 Re-adjust doors and hardware just prior to completion of building to function freely and properly.

3.4 CLEANING

.1 Perform cleaning as soon as possible after installation to remove construction and accumulated environmental dirt.

.2 Remove traces of primer, caulking; clean doors and frames.

.3 Clean glass and glazing materials with approved non-abrasive cleaner.

.4 On completion of installation, remove surplus materials, rubbish, tools and equipment barriers.

END OF SECTION

1 General

1.1 SECTION INCLUDES

.1 Mechanical Contractor to provide access doors for mechanical components for installation by contractor under section erecting associated walls or ceilings.

1.2 SHOP DRAWINGS

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

.2 Submit catalogue details for each type of door illustrating profiles, dimensions and methods of assembly.

1.3 CLOSEOUT SUBMITTALS

.1 Provide maintenance data for cleaning and maintenance of stainless steel finishes for incorporation into manual specified in Section 01 78 00 - Closeout Submittals.

2 Products

2.1 ACCESS DOORS

.1 Sizes: Except as indicated otherwise, to be minimum sizes as follows:
- .1 For service entry: 600 x 600 mm.
- .2 For visual inspection: 300 x 300 mm.

.2 Construction: Rounded safety corners, concealed hinges, screwdriver latch, anchor straps, able to open 180 degrees.

.3 Materials
- .1 Tiled or marble surfaces and other special areas: Stainless steel with brushed satin or polished finish as directed by Departmental Representative.
- .2 Other areas: Prime coated steel.

.4 Access doors in ductwork, refer to 23 33 00 Ductwork Accessories.

.5 Access doors for infloor manifolds, refer to 23 82 00 Terminal Heat Transfer.

3 Execution

3.1 LOCATION

.1 Location: Ensure that equipment is within view and accessible for operating, inspecting, adjusting, servicing without using special tools.

.2 Provide adequately sized access doors for inspection and cleaning before and after filters, coils, fans, automatic dampers, humidifiers, at fire dampers, and elsewhere as indicated. Review locations prior to fabrication.

.3 Provide 100 x 100 mm (4"x 4") quick opening access doors for inspection of balancing dampers.

3.2 LOCATION

.1 Location: Ensure that equipment is within view and accessible for operating, inspecting, adjusting, servicing without using special tools.

Part 1 General

1.1 RELATED REQUIREMENTS

.1 Section 09 96 53 – Elastomeric Coatings.

1.2 REFERENCES

.1 American Society for Testing and Materials International (ASTM)

.1 ASTM A568/A568M-13ae1, Standard Specification for Steel, Sheet, Carbon, Structural, and High-Strength, Low-Alloy, Hot-Rolled and Cold-Rolled, General Requirements for.

.2 ASTM A924/A924M-13, Standard Specification for General Requirements for Steel Sheet, Metallic-Coated by the Hot-Dip Process.

.3 ASTM A1008/A1008M-13, Standard Specification for Steel, Sheet, Cold-Rolled, Carbon, Structural, High-Strength Low-Alloy, High-Strength Low-Alloy with Improved Formability, Solution Hardened, and Bake Hardenable.

.4 ASTM F1450-12a, Standard Test Methods for Hollow Metal Swinging Door Assemblies for Detention Facilities.

.5 ASTM F1643 - 05 Standard Test Methods for Detention Sliding Door Locking Device Assembly

.2 Canadian Standards Association (CSA International)

.1 CSA-G40.20/G40.21M-13, General Requirements for Rolled or Welded Structural Quality Steel/Structural Quality Steel.

.2 CSA W59-13, Welded Steel Construction (Metal Arc Welding)

.3 Canadian Steel Door Manufacturers Association (CSDMA),

.1 Selection and Usage Guide for Steel Doors and Frames, 2009.

.4 National Association of Architectural Metal Manufacturers (NAAMM)

.1 NAAMM HMMA 840-07, Installation and Storage of Hollow Metal Doors and Frames.

.2 NAAMM HMMA 841-07, Tolerances and Clearance for Commercial Hollow Metal Doors and Frames.

.3 NAAMM HMMA 863-04, Guide Specification for Detention Security Hollow Metal Doors and Frames.

.5 Owner’s Door and Frame Shop Drawings

.1 ‘Hollow Metal Door & Pressed Steel Frame Shop Drawings’ are appended to provide supplementary detailed requirements for sliding cell doors. In the event of conflict with these specifications the appended Shop Drawings will govern.

1.3 ACTION AND INFORMATIONAL SUBMITTALS

.1 Submit proof of manufacturer's written certification in accordance with requirements of NAAMM HMMA 863 and ASTM F1450 for static load, rack, impact load and removable glazing stop tests.

.2 Provide performance testing data prior to fabrication. Failure to provide required testing data or submission of misrepresented testing data would result in disqualification. In the event of disqualification substitute an acceptable alternate manufacturer or subcontractor, at no additional cost to the Departmental Representative.

.3 Provide product data: in accordance with Section 01 33 00 - Submittal Procedures.

.4 Provide shop drawings: in accordance with Section 01 33 00 - Submittal Procedures.

.1 Indicate each type of door, material, internal reinforcement, mortise reinforcements, anchor types, closure methods, fastener locations, location of cut-outs for hardware, location of cut-outs for glazing, and finishes.

.2 Indicate each type frame material, core thickness, reinforcements, glazing stops, location of anchors, and finishes.

.3 Include schedule identifying each unit, with door marks and numbers relating to numbering on drawings and door schedule.

.4 Submit test and engineering data, and installation instructions.

1.4 MAINTENANCE DATA

.1 Provide maintenance data for incorporation into manual in accordance with Section 01 78 00 - Closeout Submittals.

.2 Provide documentation including:

.1 Hardware identification including part numbers, manufacturer, and source of supply.

.2 Provide to the Departmental Representative a recommended spare parts list for maintenance purposes.

.3 Complete operation, adjustment, maintenance, and repair procedures.

.4 Name, address, and telephone numbers of product supplier and installing Subcontractor.

.3 Provide two sets of Special Tools for installation and removal of each type of security screws in accordance with Section 01 78 00 - Closeout Submittals.

.4 Sign off and verification of the detention door and hardware system is required during the Commissioning process.

1.5 QUALITY ASSURANCE

.1 Perform Work to requirements of CSDMA (Canadian Steel Door Manufacturers Association) and HMMA (Hollow Metal Manufacturers Association) standards.

.2 Manufacturer:

.1 Minimum 5 years documented experience designing and manufacturing detention hollow metal door assemblies.

1.6 MOCK-UP

.1 Provide a full size mock-up in accordance with Section 01 45 00 – Quality Control for one sliding cell door.

.2 Show complete installation including door, frame, glazing, hardware and operating system. Door and controls to be indicative of final installation in every aspect with all functions operable for inspection.

1.7 DELIVERY, STORAGE AND HANDLING

.1 Deliver, store and handle materials in accordance with Section 01 61 00 - Common Product Requirements.

.2 Comply with HMMA 840.

.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.

1.8 WARRANTY

.1 Provide Manufacturer's five (5) year warranty from date of substantial completion, covering material and workmanship.

Part 2 Products

2.1 MATERIALS

.1 Face Sheet Steel:

.1 Commercial grade steel to ASTM A568/A568M, Class 1, hot dipped galvanized to ASTM A568/A568M, commercial quality coating designation to ASTM A924/A924M, ZF075.

.2 Steel plate, shapes and bars:

.1 Structural quality to CAN/CSA-G40.20/G40.21, type 230G or 260W; free of scale, pitting and other surface blemishes.

.3 Accessories:

.1 Floor anchors, channel spreaders, tee anchors, and wall stud anchors zinc coated to ASTM A1008M, coating designation ZF075, drill stud anchors to wire tie to studs, lag bolts, shields , and bushings for existing openings.

.4 Guard boxes:

.1 ZF075 coating designation zinc finish, 1.6 mm core thickness steel unless noted otherwise.

.5 Door insulation:

.1 Fibre board insulation for sound deadening, minimum 24 kg/m density.

.6 Filler: Polyester type automotive body spot filler compound.

.7 Isolation coating: Alkali resistant bituminous paint.

2.2 DETENTION DOORS

.1 Conforming to Level 3 requirements of ANSI/NAAMM/HMMA 863 and ASTM F1450.

.2 Galvanized Steel

.1 Steel sheet faces: 2.0 mm thick (14ga.), wipecoat, flush design.

.2 Core: 2.75mm (12ga.) stiffened core in conformance with HMMA 863 standards.

.3 Epoxy primed.

.4 Mortised to accept deadlatch hardware.

.3 Fabrication Tolerances: To HMMA 841.

.4 Lexan View Lite complete with Operable Viewport Shutter

.1 In accordance with appended Owner's Door and Frame Shop Drawings.

.2 Lexan View Lite:

.1 Size: 192 x 524mm,

.2 Material: one layer of 6.35mm mar-resistant Lexan flush with inmate side of door sandwiched to one layer of 19mm Lexan on corridor side, nylon gaskets behind, and set into steel frame

.3 Operable Viewport Shutter:

.1 Material: 2.78mm (12ga.) stainless steel plate complete with 25 x 51 x 12.7mm thick stainless steel plate handle, set in 2.54mm thick steel tracks with plastic U-channel, tamper resistant screws fastened to steel door.

.2 Locate as close to door hinge side as possible.

.5 Food Pass Flap

.1 In accordance with appended Owner's Door and Frame Shop Drawings.

.2 Size: 309 x 120mm clear opening,

.3 Material: 1.99mm (14ga.) steel plate welded to 2.75mm (12ga.) steel plate reinforcement on guard side of door steel.

.4 Fabricate food pass assembly and latch, flush with inmate side of door.

2.3 DETENTION FRAMES

.1 Galvanized Steel

.1 Steel sheet: 2.75mm thick (12ga.), wipecoat.

.2 Epoxy primed.

.3 Prepared to accept heavy- weight track and hardware as indicated in appended Owner's Door and Frame Shop Drawings.

.4 Frame must be prepared for correct anchoring system compatible with the wall type.

.2 Fabrication Tolerances: To HMMA 841.

2.4 SLIDING DETENTION DOOR LOCKSET

.1 Conforming to ASTM F1643.

.2 Mechanical Detention Lockset:

.1 Five Tumbler Paracentric Mechanical Deadbolt, combination spring and deadlock, keyed one side.

.2 Heavy duty, maximum security, paracentric keyed, lever tumbler deadlock, locks and unlocks by key only.

.3 The lock must NOT automatically latch upon closing. Lock shall unlock with a half turn of the key and deadlock the latchbolt with a full turn of the key.

.4 The locks must come complete with mounting plate, strike and escutcheon.

.1 Sliding cell door: double wing escutcheon, 3 mm thick stainless steel

.5 All fasteners must be Torx Tamperproof, flat head machine screws.

.6 Sliding Door acceptable manufacturers and model numbers:

.1 Chubb 1030D-1

.2 Folger Adams 32D

.3 Southern Steel 1030D-1

.4 RR Brick 7030D.

2.5 ACCESSORIES

.1 All screws must be flathead undercut Torx Tamperproof screws. Screws must be supplied compatible with the material they are fastening, as well as the material they are securing into.

2.6 DETENTION DOORS FABRICATION

.1 Door Edge Construction: Longitudinal edges welded, filled and sanded with no visible edge seams.

.2 Door Core Construction: Stiffened with continuous steel sections, spaced with interior webs not more than 152mm apart, which upon assembly span the full thickness of the interior of the door.

.3 Top and Bottom Channels: Inverted, recessed, welded steel channels.

.4 Reinforce doors where surface mounted hardware is required

.5 Drill and tap for mortised, templated hardware.

.6 Fabricate doors with hardware reinforcement plates welded in place.

2.7 DETENTION FRAMES FABRICATION

.1 Welding in accordance with CSA W59.

.2 Welded type construction, mitred corners, securely weld on inside of profile.

.3 Grind welded joints and corners to a flat plane, fill with metallic paste and sand to a uniform smooth finish.

.4 Factory assemble and weld frames.

.5 Fabricate frames with hardware reinforcement plates welded in place.

.6 Reinforce frames wider than 1200 mm with roll formed steel channels fitted tightly into frame head, flush with top.

2.8 FINISHES

.1 Galvanized Steel Finish: Factory applied epoxy primer to be applied to all exposed surfaces. Touch-up only, where product has been welded and ground smooth.

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 DOOR INSTALLATION

.1 Install doors and hardware in accordance with hardware templates and manufacturer's instructions and Section 08 71 63 – Detention Door Hardware.

.2 Provide even margins between doors and jambs and doors and finished floor

.1 Sliding detention doors:

.1 Hinge side, latch side, and head: 3.0 mm maximum.

.2 Finished floor: 19 mm maximum.

.3 Adjust operable parts for correct function.

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 Epoxy caulk perimeter of frames. Install caulking at a 45 degree angle with a consistent width and height.

3.4 ERECTION TOLERANCES

.1 Installation tolerances of installed frame for squareness, alignment, twist and plumbness are to be no more than ± 1.5mm in compliance with HMMA 841.

3.5 FINISH REPAIRS

.1 Touch up with primer finishes damaged during installation.

.2 Fill exposed frame anchors surfaces with imperfections with metallic paste filler and sand to a uniform smooth finish.

.3 Remove all burrs and sharp edges after installation.

END OF SECTION

Hollow Metal Door & Pressed Steel Frame Shop Drawings

Project: SLIDING AND SWINGING CELL DOORS
LEVEL 3 NAAMM 863-98 ASTM F1450-97 PERFORMANCE CRITERIA

Prepared By: CATRIONA L JOHNSON

Date: SEPTEMBER 26, 2007

FINAL

GENERAL NOTES: PLEASE READ

1) FABRICATION OF HOLLOW METAL DOORS & FRAMES WILL NOT COMMENCE UNTIL THE FOLLOWING IS RECEIVED:
   A) APPROVED HARDWARE SCHEDULE
   C) ALL NECESSARY HARDWARE TEMPLATES
   NOTE: LEAD TIMES VARY SO THIS INFORMATION IS CRITICAL

2) THESE DRAWINGS ARE FOR THE RCMP USE ONLY. RCMP WILL NOT ACCEPT ANY RESPONSIBILITY DUE TO ERRORS CAUSED BY THE USE OF THESE DRAWINGS BY OTHER TRADES.

3) DOORS AND FRAMES TO BE REINFORCED FOR SURFACE MOUNTED HARDWARE AS REQUIRED. DRILLING AND TAPPING FOR ATTACHING OF SURFACE MOUNTED HARDWARE BY OTHERS. DOORS AND FRAMES WILL BE BLANKED, REINFORCED, DRILLED AND TAPPED FOR MORTISED TEMPLATED HARDWARE. TRIM MOUNTING HOLES AND ALL HOLES Ø1/2" [13 mm] & LESS, BY OTHERS.

4) MAXIMUM ALLOWABLE DISTANCE BETWEEN THE SLIDING DOOR AND THE FRAME MUST BE LIMITED TO 1/8" [3 mm]. FIELD SHIMMING MAY BE REQUIRED ON SITE BY THE INSTALLATION CONTRACTOR TO OBTAIN THE DESIRED CLEARANCES.

5) ALL DOORS AND FRAMES TO BE MARKED WITH THE DOOR MANUFACTURER'S NAME AND PRODUCT NUMBER ON THE SECOND HINGE FROM THE TOP UNLESS SPECIFIED OTHERWISE.

6) ALL HOLLOW METAL FRAMES SHALL BE OF WELDED CONSTRUCTION UNLESS NOTED OTHERWISE.

7) ALL SWING TYPE FRAMES TO BE PREPARED FOR PUSH-IN TYPE SILENCERS, 3 PER STRIKE JAMB FOR SINGLE FRAMES OR 2 PER HEAD FOR DOUBLE FRAMES.

8) ALL HARDWARE LOCATIONS ON THE DOORS & FRAMES TO BE AS PER THE FOLLOWING DRAWINGS, UNLESS ADVISED OTHERWISE.

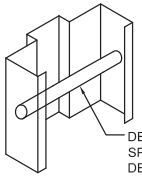
9) GENERAL CONTRACTOR IS RESPONSIBLE TO ENSURE THAT FRAMES AND DOORS ARE SET PLUMB, SQUARE, LEVEL AND THAT WALLS AND FRAME ARE FULLY GROUTED. THE MANUFACTURER OF HOLLOW METAL DOORS AND/OR PRESSED STEEL FRAMES CAN NOT CONTROL THE QUALITY OF EITHER THE HARDWARE, THE FIELD INSTALLATION OF HARDWARE, OR THE PROPER ERECTION OF FRAMES IN THE WALL.

10) ALL BURRS AND SHARP EDGES MUST BE REMOVED AFTER INSTALLATION.

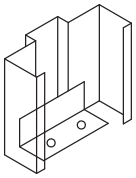
11) THE FOLLOWING SHOP DRAWINGS REFLECT A STANDARD 195 mm BLOCK WALL CONSTRUCTION, SITE CONDITIONS MAY VARY.

REVISIONS:	NOTES:		JOB:		
REVISION AS PER THE MEETING ON JULY 20, 2006		FINAL	CONTRACTOR:		
			DRAWN BY: CL JOHNSON	DATE: 9/26/2007	
			W.O.#:	FILE NUMBER:	PG.#: 2

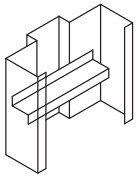
A-3 ANCHOR TYPES



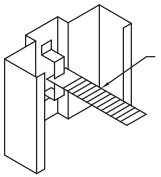
WELDED ROD ANCHOR



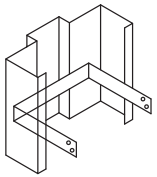
STANDARD FIXED BASE ANCHOR



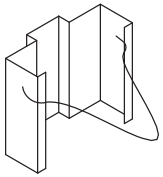
STEEL STUD ANCHOR



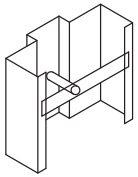
CORRUGATED TAIL ANCHOR



WOOD STUD ANCHOR



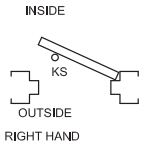
CONCRETE BLOCK WALL WIRE ANCHOR



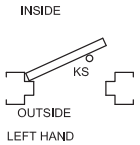
EXISTING WALL ANCHOR

B-3 DOOR AND FRAME HANDING CHART

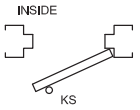
TO DETERMINE HAND(SWING) OF DOOR AND FRAME
STAND OUTSIDE - FACING DOOR



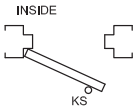
RIGHT HAND



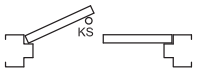
LEFT HAND



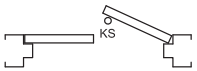
OUTSIDE
RIGHT HAND REVERSE



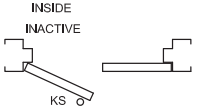
OUTSIDE
LEFT HAND REVERSE



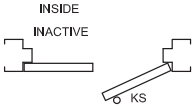
OUTSIDE
PAIR OF DOORS
LH ACTIVE



OUTSIDE
PAIR OF DOORS
RH ACTIVE



OUTSIDE
PAIR OF DOORS
LHR ACTIVE



OUTSIDE
PAIR OF DOORS
RHR ACTIVE

* KS IS THE KEY SIDE OF DOOR (PLEASE CHECK ALL SWINGS TO ENSURE KEY IS ON PROPER SIDE OF DOOR)

FIRE RATING LABELS

A - 3 HOUR
B - 1 1/2 HOUR
C - 45 MINUTE
20M - 20 MINUTE

DOOR MATERIALS

HM - HOLLOW METAL DOOR - HONEYCOMB
IHM - INSULATED HOLLOW METAL DOOR - POLYSTYRENE
SLH - STEEL STIFFENED (LAMINATED-HONEYCOMB)
SLP - STEEL STIFFENED (LAMINATED-POLYSTYRENE)
SWF - STEEL STIFFENED (WELDED-FIBREGLASS)
SCW - SOLID CORE WOOD DOOR
HCW - HOLLOW CORE WOOD DOOR
PLM - PLASTIC LAMINATED

REMOVABLE STOPS

PL - PULL SIDE OF DOOR
PS - PUSH SIDE OF DOOR

ANCHOR TYPES

SS - STEEL STUD ANCHOR
CT - CORRUGATED TAIL ANCHOR
WS - WOOD STUD ANCHOR
EWA - EXISTING WALL ANCHOR
CB - CONCRETE BLOCK WIRE ANCHOR
BA - BASE ANCHOR
WR- WELDED ROD ANCHOR

HARDWARE

PP - PUSH & PULL
RIM - RIM PANIC
VR - VERTICAL ROD
FB - FLUSH BOLT
R/F - REINFORCE
CVR - CONCEALED VERTICAL ROD

DOOR SWINGS

LH - LEFT HAND
LHR - LEFT HAND REVERSE
RH - RIGHT HAND
RHR - RIGHT HAND REVERSE

REVISIONS:

REVISION AS PER THE MEETING ON JULY 20, 2006

NOTES:

FINAL

JOB:

CONTRACTOR:

DRAWN BY: CL JOHNSON

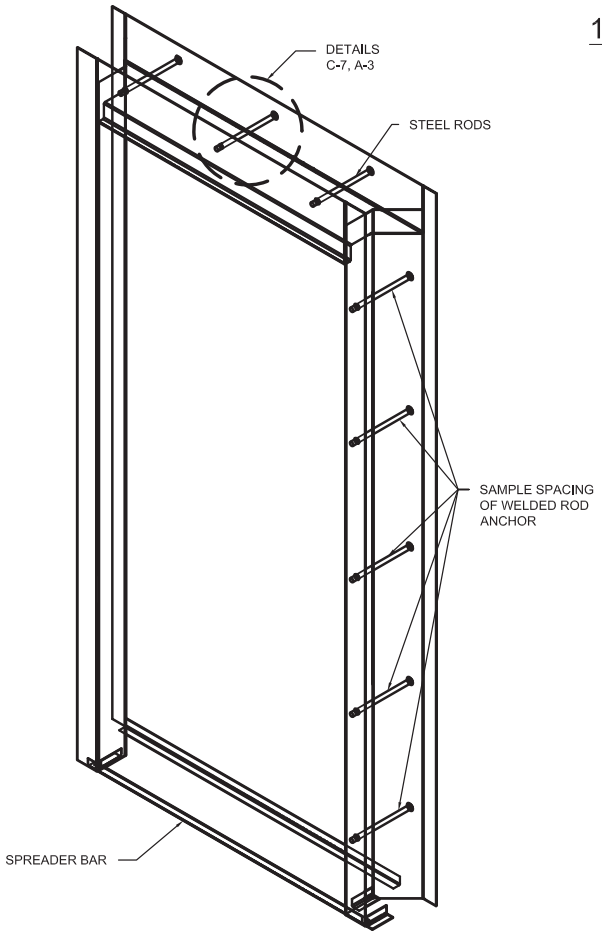
DATE: 9/26/2007

W.O.#:

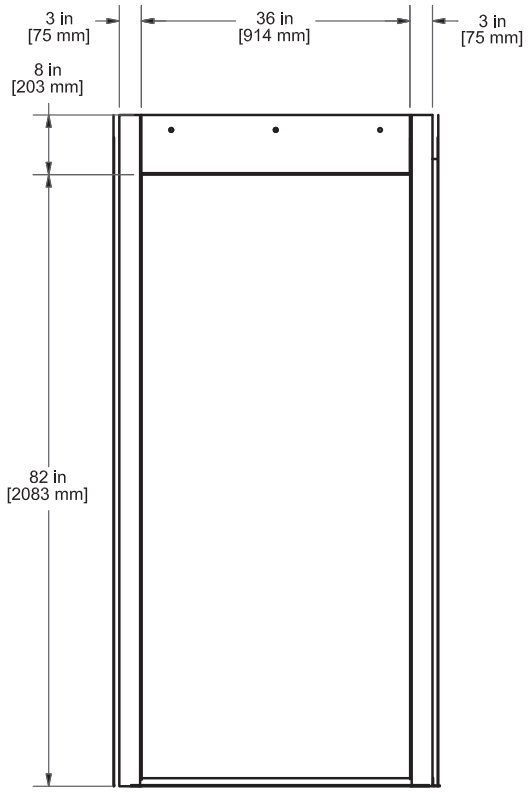
FILE NUMBER:

PG.#: 3

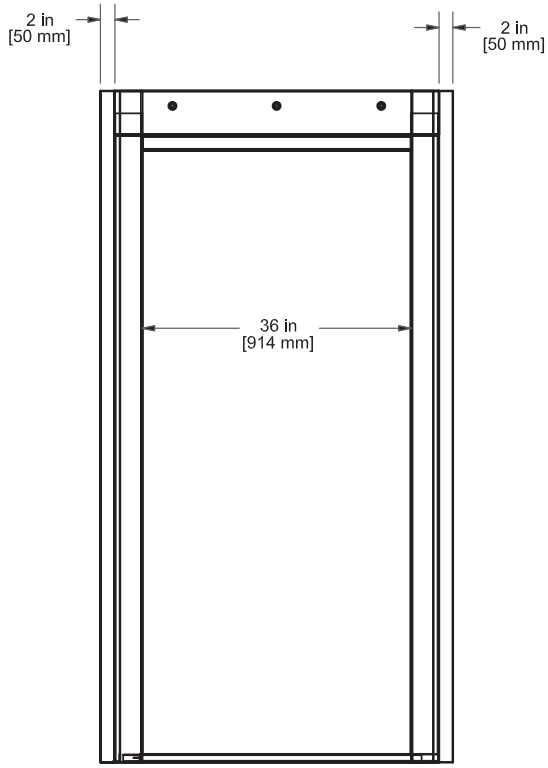
12GA. FRAME FOR SLIDING DOOR



A-4 ISOMETRIC VIEW



B-4 CORRIDOR SIDE

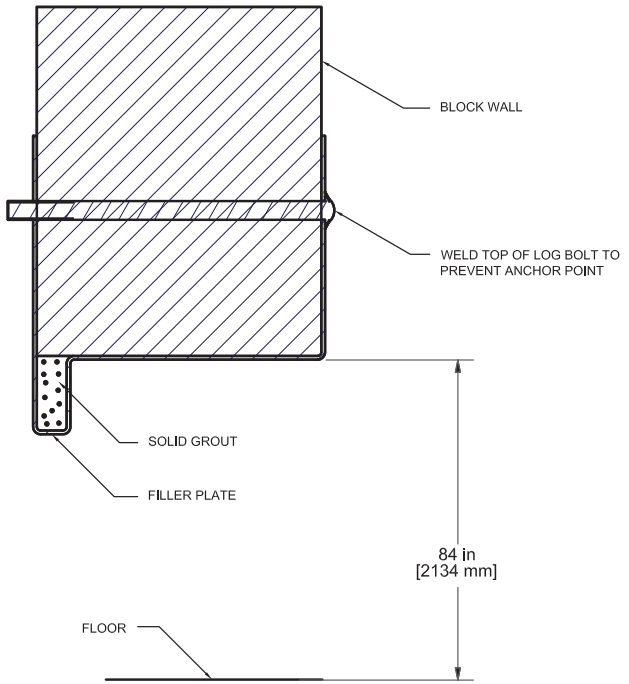


C-4 DETAINEE SIDE

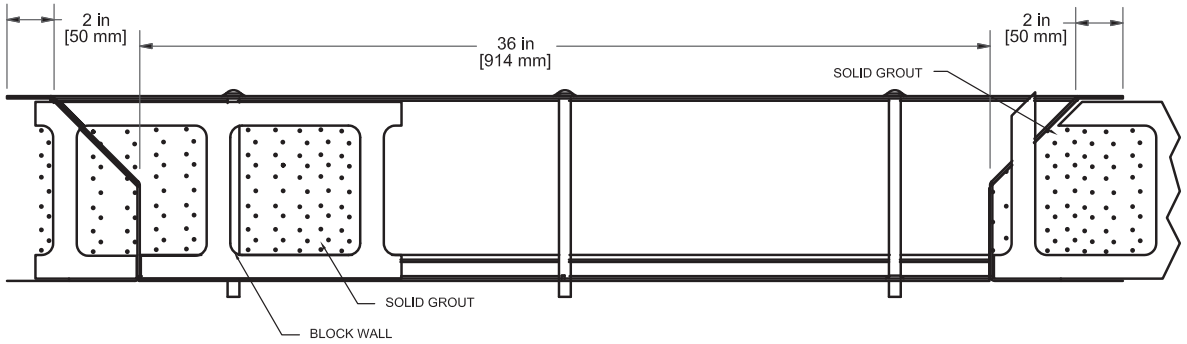
REVISIONS:	NOTES:		JOB:		
REVISION AS PER THE MEETING ON JULY 20, 2006	THIS DRAWING IS THE EXCLUSIVE PROPERTY OF THE RCMP. NO USE WHATSOEVER OF THE INFORMATION CONTAINED HEREON, NOR REPRODUCTION IN WHOLE OR IN PART MAY BE MADE WITHOUT EXPRESSED WRITTEN PERMISSION. THIS DRAWING REMAINS THE PROPERTY OF THE RCMP AND MUST BE RETURNED ON DEMAND.	FINAL	CONTRACTOR:		
			DRAWN BY: CL JOHNSON	DATE: 9/26/2007	
			W.O.#:	FILE NUMBER:	PG.#: 4

NOTE: FRAME MUST BE FULLY GROUTED FOR PROPER SLIDING ASSEMBLY INSTALLATION

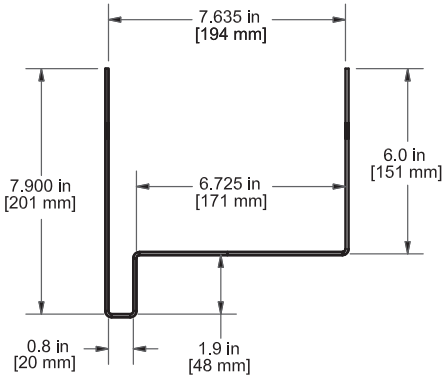
NOTE: OPTIONAL 2" LENGTH X 3/16" [51 x 5 mm] FILLER PLATE CONTINUALLY WELDED TO HEADER AND SIDES OF FRAME.

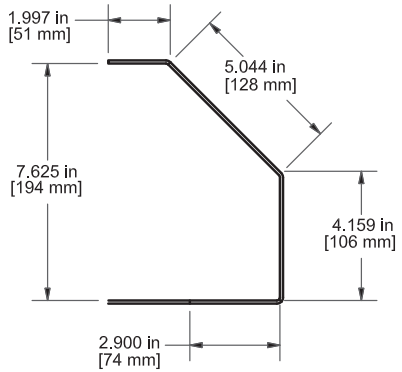


A-5 SECTION THROUGH FRAME



B-5 CROSS SECTION THROUGH JAMBS & HEADER



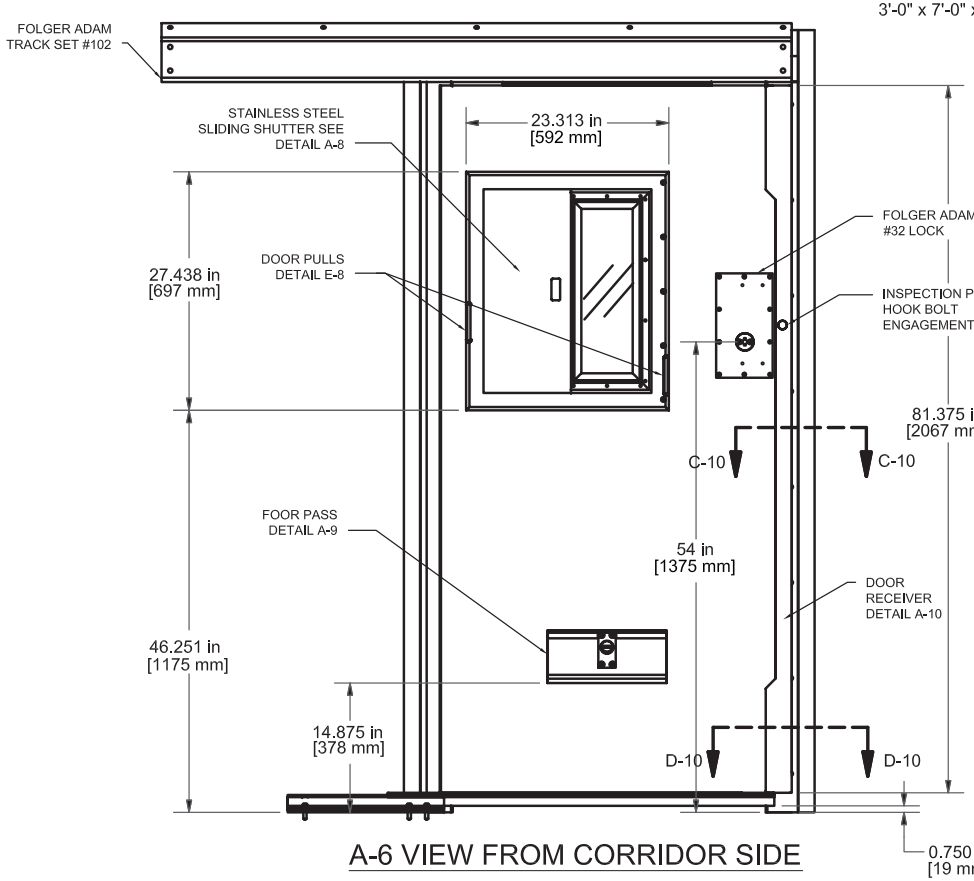


C-5 JAMB PROFILES FOR BENDING

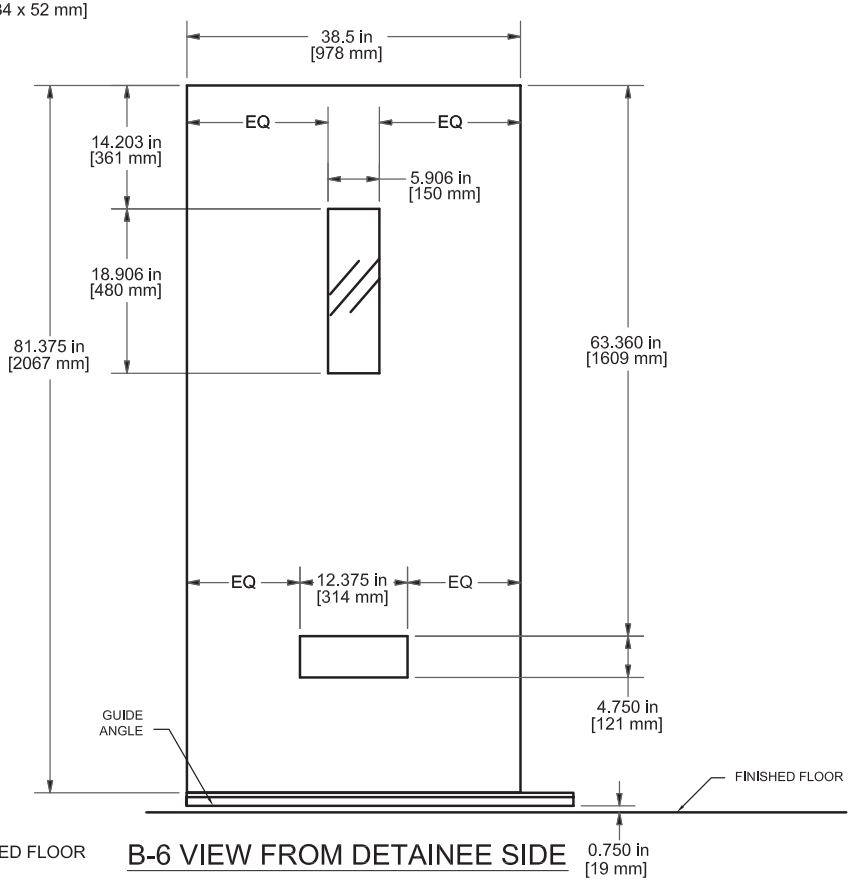
REVISIONS:	NOTES:		JOB:		
REVISION AS PER THE MEETING ON JULY 20, 2006	THIS DRAWING IS THE EXCLUSIVE PROPERTY OF THE RCMP. NO USE WHATSOEVER OF THE INFORMATION CONTAINED HEREON, NOR REPRODUCTION IN WHOLE OR IN PART MAY BE MADE WITHOUT EXPRESSED WRITTEN PERMISSION. THIS DRAWING REMAINS THE PROPERTY OF THE RCMP AND MUST BE RETURNED ON DEMAND.	FINAL	CONTRACTOR:		
			DRAWN BY: CL JOHNSON	DATE: 9/26/2007	
			W.O.#:	FILE NUMBER:	PG.#: 5

TYPE A CELL DOOR (SLIDING)

12GA. FRAME & 14GA. STEEL STIFFENED DETENTION DOOR
LEVEL 3 NAAMM 863-98 AND ASTM - F1450-97 PERFORMANCE CRITERIA
FOR STATIC LOAD, RACK, IMPACT, & EDGE CRUSH TESTS
3'-0" x 7'-0" x 2" [914 x 2134 x 52 mm]

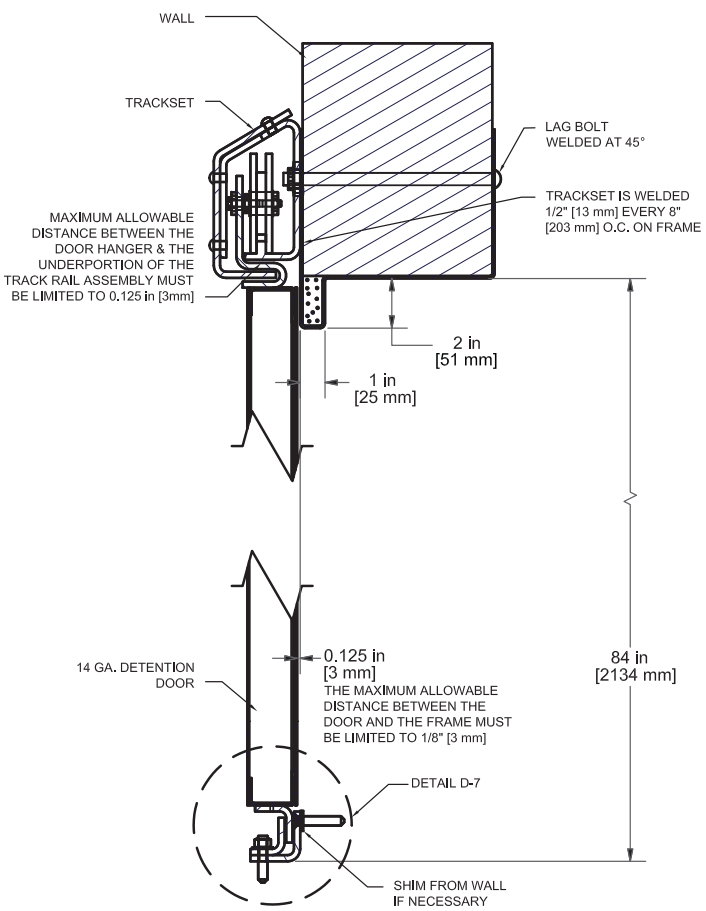


A-6 VIEW FROM CORRIDOR SIDE



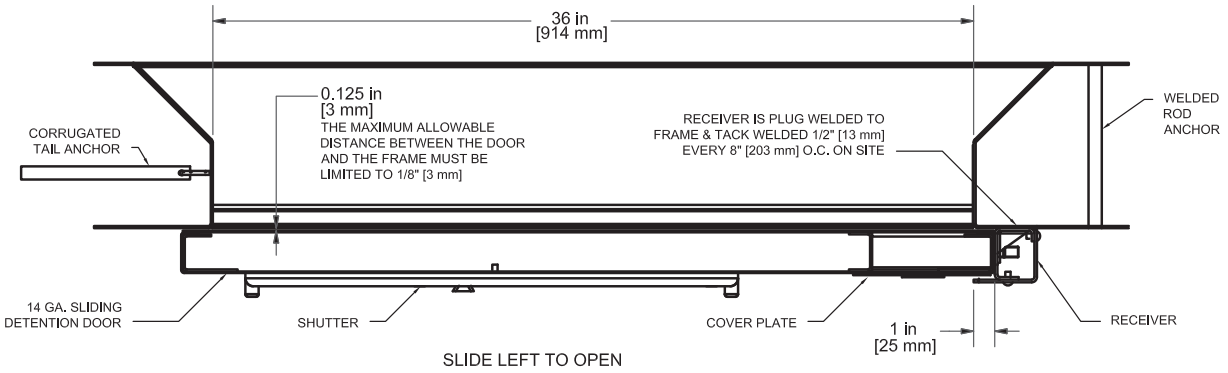
B-6 VIEW FROM DETAINEE SIDE

REVISIONS:	NOTES:		JOB:	
REVISION AS PER THE MEETING ON JULY 20, 2006	THIS DRAWING IS THE EXCLUSIVE PROPERTY OF THE RCMP. NO USE WHATSOEVER OF THE INFORMATION CONTAINED HEREON, NOR REPRODUCTION IN WHOLE OR IN PART MAY BE MADE WITHOUT EXPRESSED WRITTEN PERMISSION. THIS DRAWING REMAINS THE PROPERTY OF THE RCMP AND MUST BE RETURNED ON DEMAND.	FINAL	CONTRACTOR:	
			DRAWN BY: CL JOHNSON	DATE: 9/26/2007
			W.O.#:	FILE NUMBER: / PG.#: 6



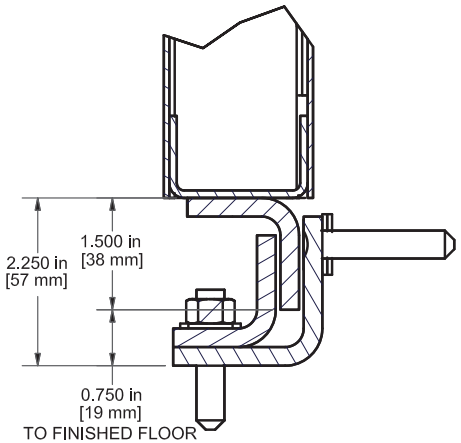
A-7 SECTION THROUGH TRACKSET AND DOOR

CROSS SECTION THROUGH DOOR AND RECEIVING ENCLOSURE

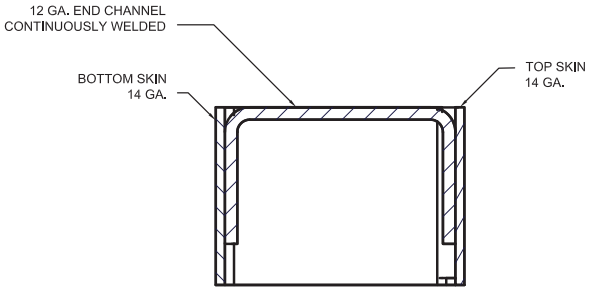


B-7 CT ANCHOR

C-7 WR ANCHOR

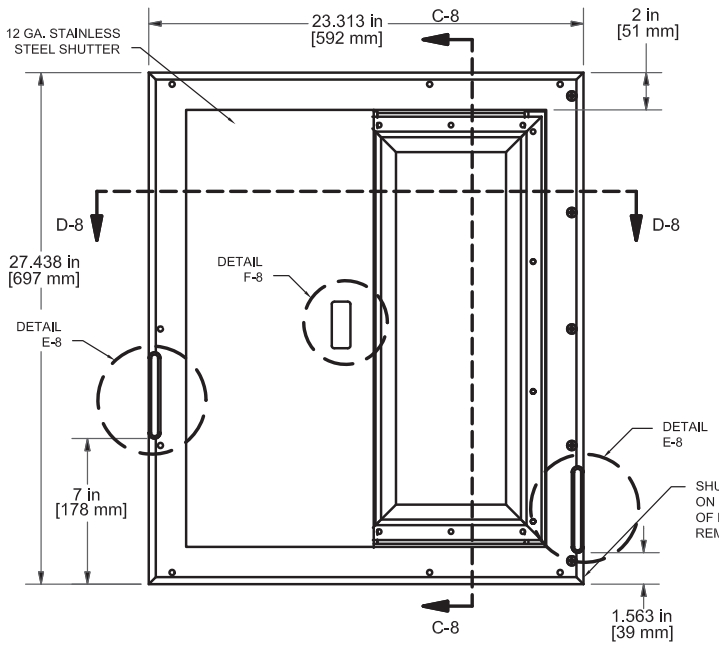


D-7 DETAIL

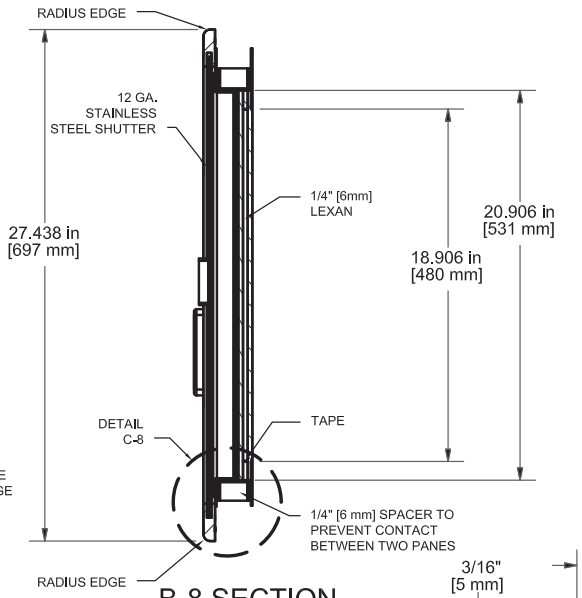


E-7 DETAIL TOP &
BOTTOM END CHANNEL

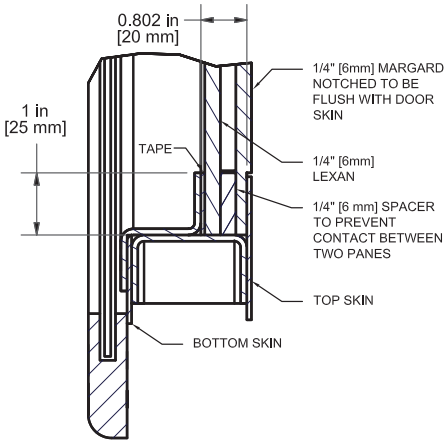
REVISIONS:	NOTES:		JOB:		
	SEE A-3 FOR ADDITIONAL ANCHOR OPTIONS		CONTRACTOR:		
REVISION AS PER THE MEETING ON JULY 20, 2006		FINAL	DRAWN BY: CL JOHNSON	DATE: 9/26/2007	
			W.O.#:	FILE NUMBER:	PG.#: 7



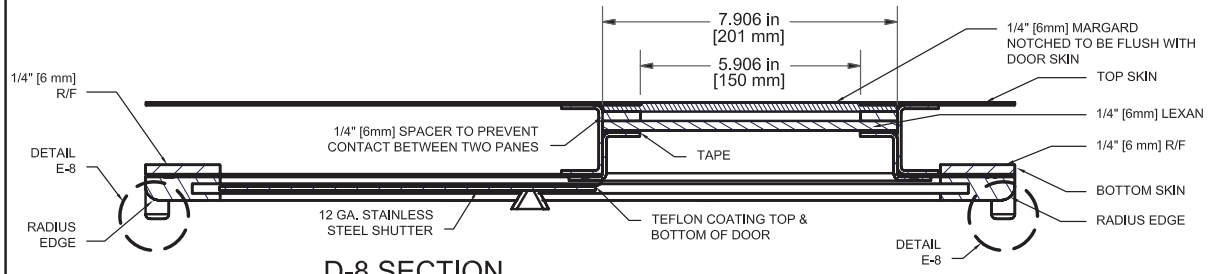
A-8 SLIDING SHUTTER



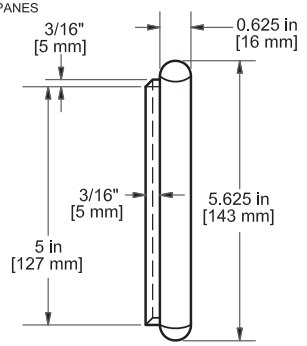
B-8 SECTION



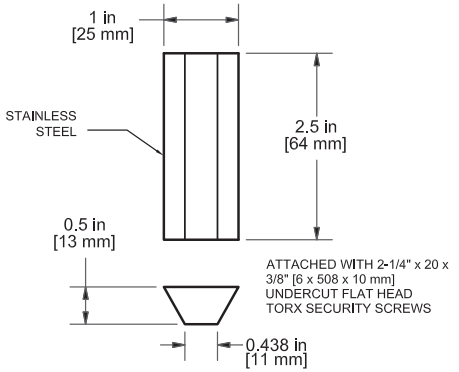
C-8 GLAZING DETAIL



D-8 SECTION

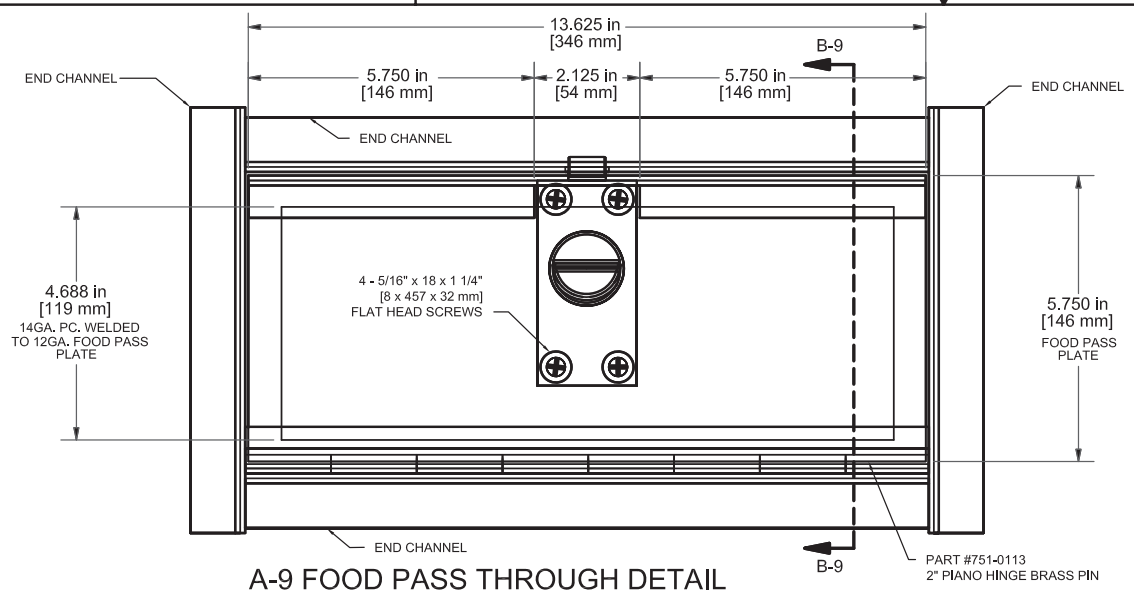


E-8 SLIDING DOOR HANDLE DETAIL

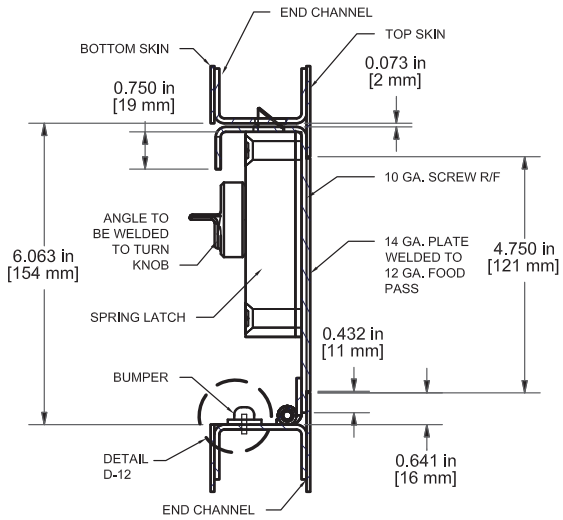


F-8 SHUTTER HANDLE DETAIL

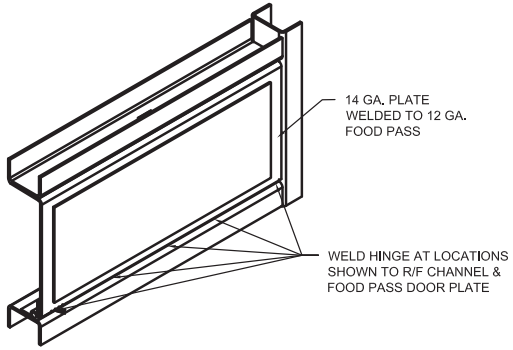
REVISIONS:	NOTES:		JOB:	
REVISION AS PER THE MEETING ON JULY 20, 2006	THIS DRAWING IS THE EXCLUSIVE PROPERTY OF THE RCMP. NO USE WHATSOEVER OF THE INFORMATION CONTAINED HEREON, NOR REPRODUCTION IN WHOLE OR IN PART MAY BE MADE WITHOUT EXPRESSED WRITTEN PERMISSION. THIS DRAWING REMAINS THE PROPERTY OF THE RCMP AND MUST BE RETURNED ON DEMAND.	FINAL	CONTRACTOR:	
			DRAWN BY: CL JOHNSON	DATE: 9/26/2007
			W.O.#:	FILE NUMBER: / PG.#: 8



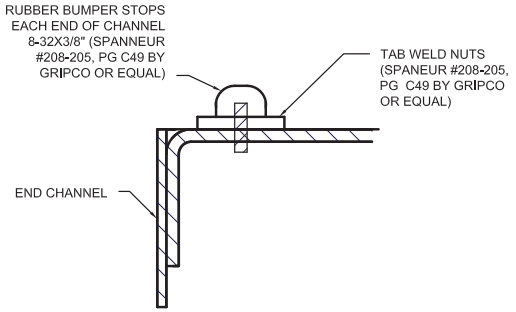
A-9 FOOD PASS THROUGH DETAIL



B-9 SECTION

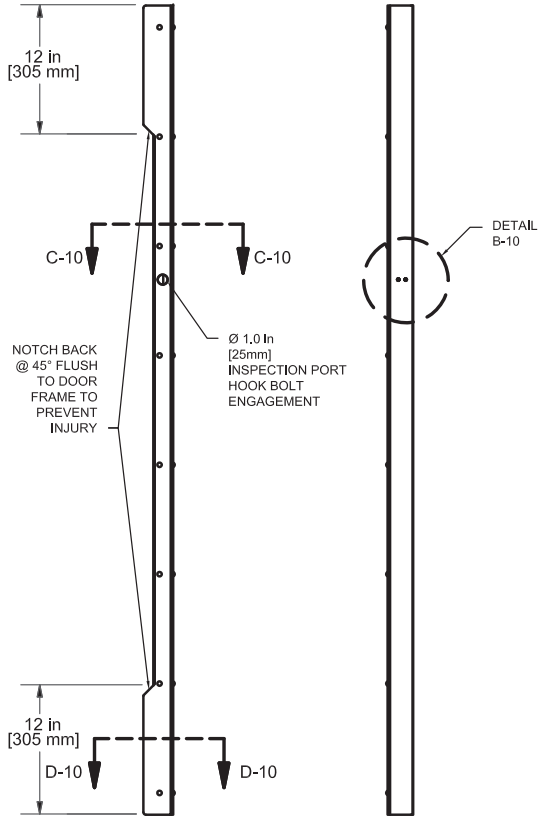


C-9 FOOD PASS THROUGH DETAIL

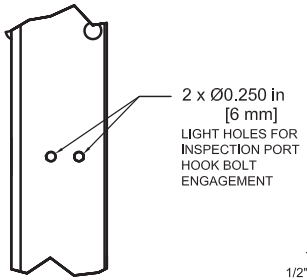


D-12 BUMPER DETAIL

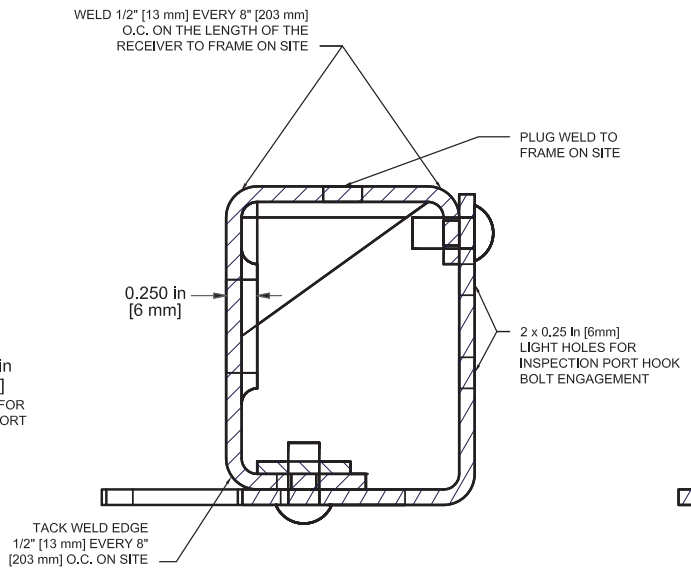
REVISIONS:	NOTES:		JOB:		
REVISION AS PER THE MEETING ON JULY 20, 2006	THIS DRAWING IS THE EXCLUSIVE PROPERTY OF THE RCMP. NO USE WHATSOEVER OF THE INFORMATION CONTAINED HEREON, NOR REPRODUCTION IN WHOLE OR IN PART MAY BE MADE WITHOUT EXPRESSED WRITTEN PERMISSION. THIS DRAWING REMAINS THE PROPERTY OF THE RCMP AND MUST BE RETURNED ON DEMAND.	FINAL	CONTRACTOR:		
			DRAWN BY: CL JOHNSON	DATE: 9/26/2007	
			W.O.#:	FILE NUMBER:	PG.#: 9



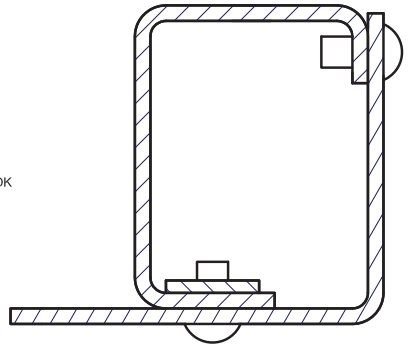
A-10 DOOR RECEIVER



B-10 DETAIL



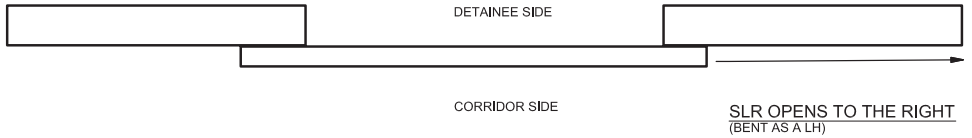
C-10 SECTION THROUGH DOOR RECEIVER



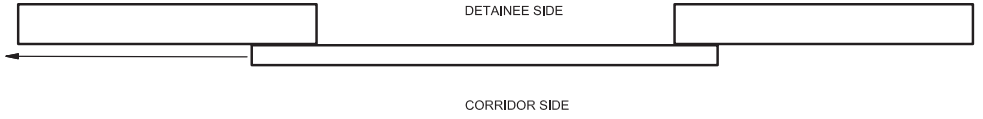
D-10 SECTION THROUGH DOOR RECEIVER

REVISIONS:	NOTES:		JOB:		
REVISION AS PER THE MEETING ON JULY 20, 2006	REMOVE ALL BURRS AND SHARP EDGES AFTER WELDING	FINAL	CONTRACTOR:		
			DRAWN BY: CL JOHNSON	DATE: 9/26/2007	
			W.O.#:	FILE NUMBER:	PG.#: 10

A-11 SLIDING HANDING SHEET



SLR OPENS TO THE RIGHT
(BENT AS A LH)

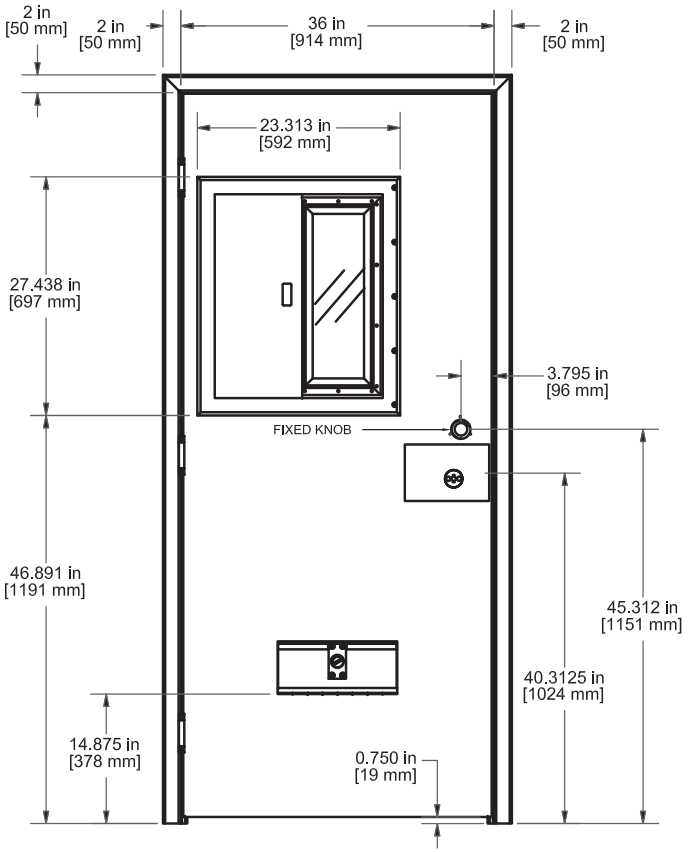


SLL OPENS TO THE LEFT
(BENT AS A RH)

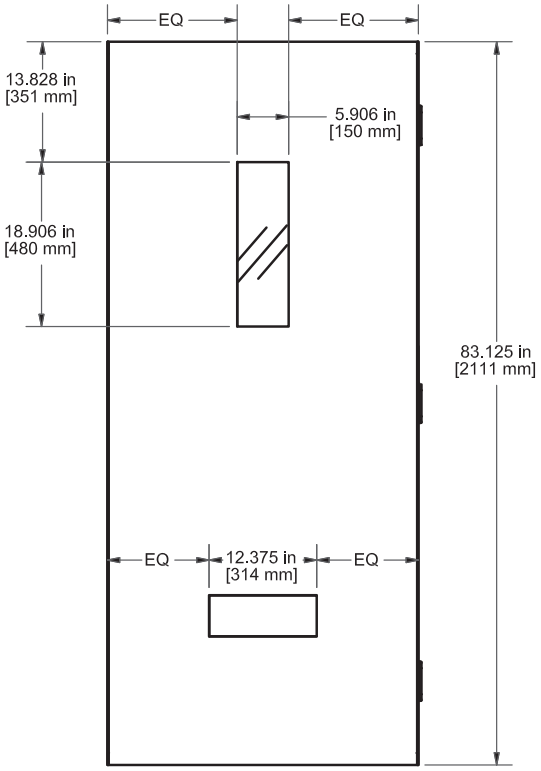
REVISIONS:	NOTES:		JOB:		
REVISION AS PER THE MEETING ON JULY 20, 2006		FINAL	CONTRACTOR:		
			DRAWN BY: CL JOHNSON	DATE: 9/26/2007	
			W.O.#:	FILE NUMBER:	PG.#: 11

TYPE B CELL DOOR (SWINGING)

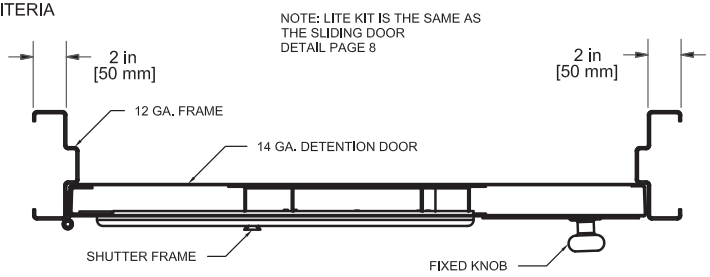
(MAY ALSO BE INSTALLED IN TYPE A CELLS)
12GA. FRAME & 14GA. STEEL STIFFENED DETENTION DOOR
LEVEL 3 NAAMM 863-98 AND ASTM - F1450-97 PERFORMANCE CRITERIA
FOR STATIC LOAD, RACK, IMPACT, & EDGE CRUSH TESTS
3'-0" x 7'-0" x 2" [914 x 2134 x 51 mm]



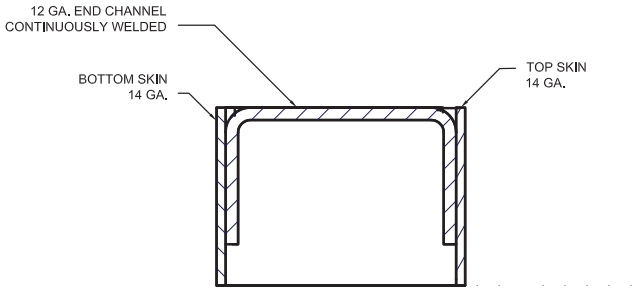
A-12 VIEW FROM CORRIDOR SIDE



B-12 VIEW FROM DETAINEE SIDE

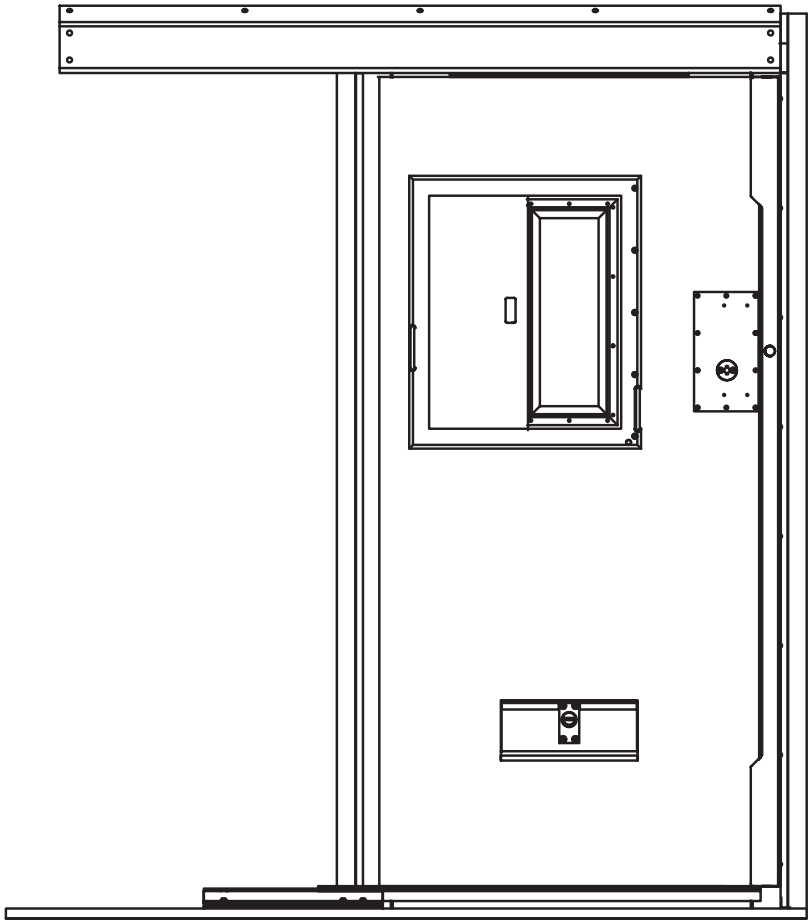


C-12 CROSS SECTION THROUGH
DOOR & FRAME

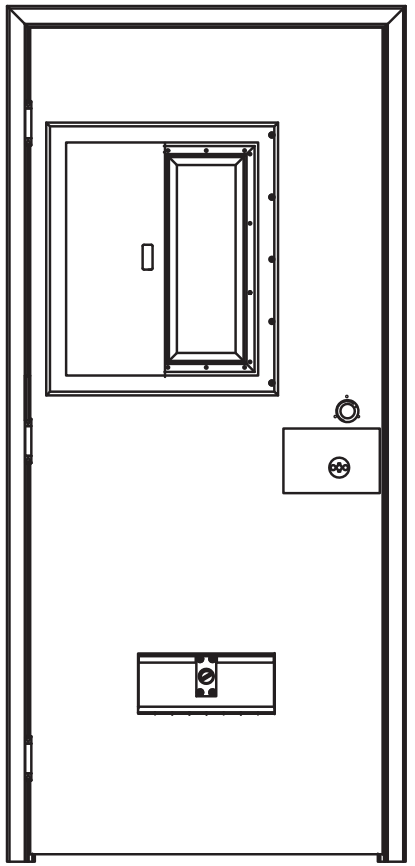


D-12 DETAIL TOP &
BOTTOM END CHANNEL

REVISIONS:	NOTES:		JOB:		
REVISION AS PER THE MEETING ON JULY 20, 2006		FINAL	CONTRACTOR:		
			DRAWN BY: CL JOHNSON	DATE: 9/26/2007	
			W.O.#:	FILE NUMBER:	PG.#: 12



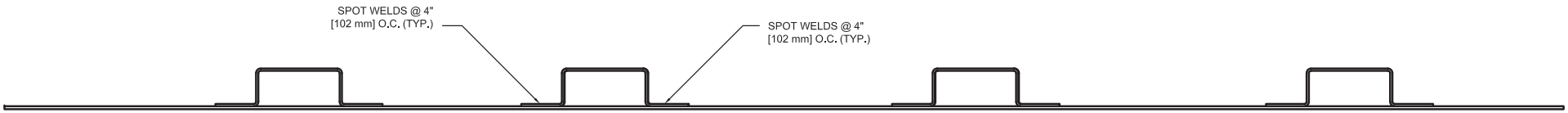
A-13 RCMP SLIDING DOOR



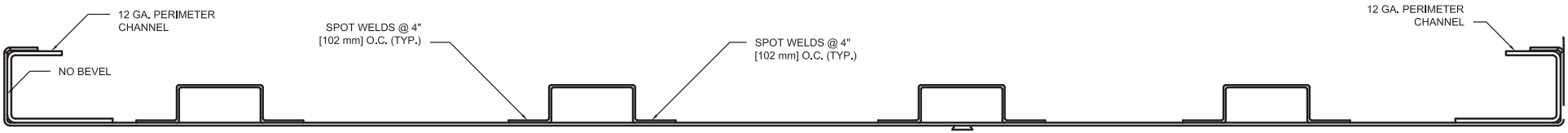
B-13 RCMP SWINGING DOOR

REVISIONS:	NOTES:		JOB:		
REVISION AS PER THE MEETING ON JULY 20, 2006	THIS DRAWING IS THE EXCLUSIVE PROPERTY OF THE RCMP. NO USE WHATSOEVER OF THE INFORMATION CONTAINED HEREON, NOR REPRODUCTION IN WHOLE OR IN PART MAY BE MADE WITHOUT EXPRESSED WRITTEN PERMISSION. THIS DRAWING REMAINS THE PROPERTY OF THE RCMP AND MUST BE RETURNED ON DEMAND.	FINAL	CONTRACTOR:		
			DRAWN BY: CL JOHNSON	DATE: 9/26/2007	
			W.O.#:	FILE NUMBER:	PG.#: 13

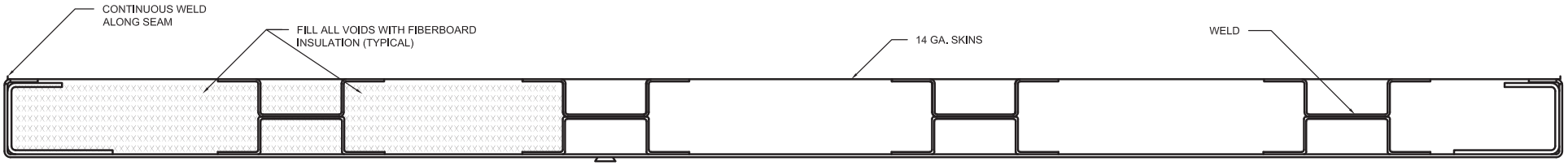
TYPE A CELL DO0R (SLIDING)



A-14 TOP SKIN PROFILE



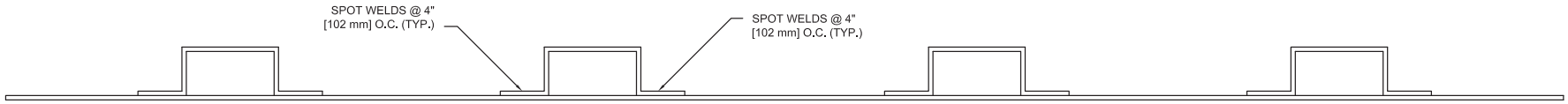
B-14 BOTTOM SKIN PROFILE



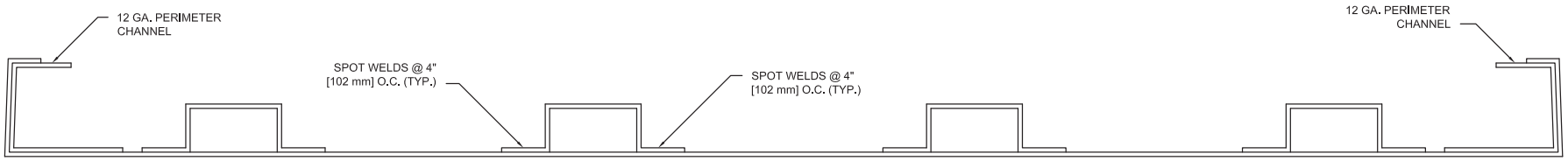
C-14 TOP & BOTTOM SKIN ASSEMBLY PROFILE

REVISIONS:	NOTES:		JOB:		
REVISION AS PER THE MEETING ON JULY 20, 2006	THIS DOOR IS A SQUARE EDGE AS IT IS SLIDING	FINAL	CONTRACTOR:		
			DRAWN BY: CL JOHNSON	DATE: 9/26/2007	
			W.O.#:	FILE NUMBER:	PG.#: 14

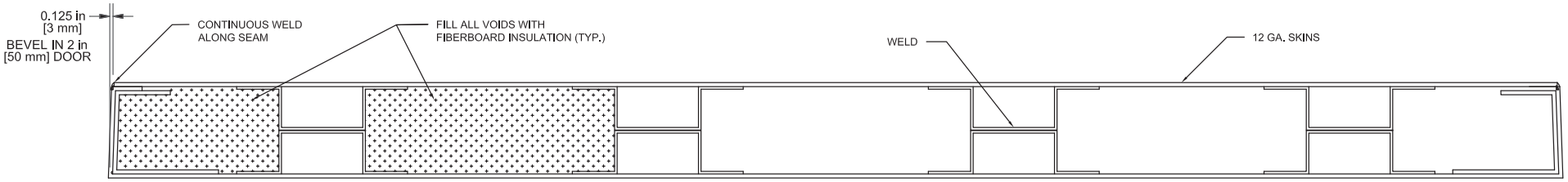
TYPE B CELL DOOR (SWINGING)



A-15 TOP SKIN PROFILE



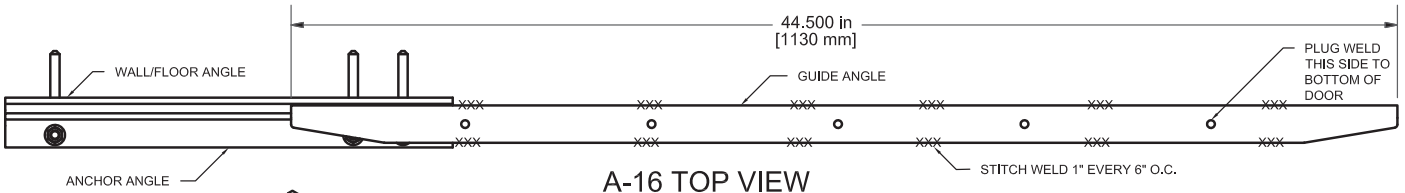
B-15 BOTTOM SKIN PROFILE



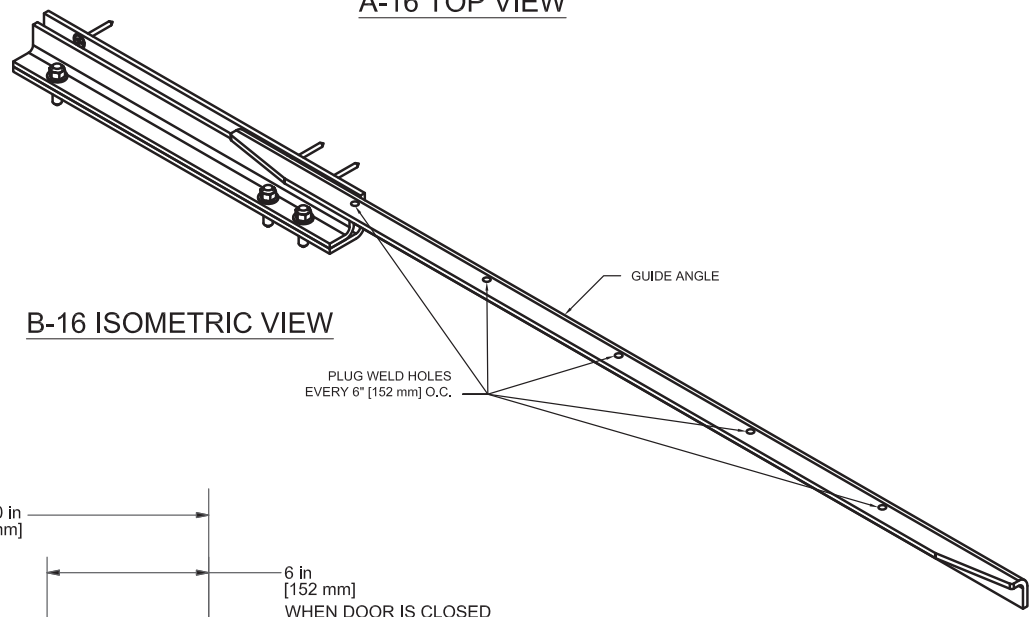
C-15 TOP & BOTTOM SKIN ASSEMBLY PROFILE

REVISIONS:	NOTES:		JOB:		
REVISION AS PER THE MEETING ON JULY 20, 2006	THIS DRAWING IS THE EXCLUSIVE PROPERTY OF THE RCMP. NO USE WHATSOEVER OF THE INFORMATION CONTAINED HEREON, NOR REPRODUCTION IN WHOLE OR IN PART MAY BE MADE WITHOUT EXPRESSED WRITTEN PERMISSION. THIS DRAWING REMAINS THE PROPERTY OF THE RCMP AND MUST BE RETURNED ON DEMAND.	FINAL	CONTRACTOR:		
			DRAWN BY: CL JOHNSON	DATE: 9/26/2007	
			W.O.#:	FILE NUMBER:	PG.#: 15

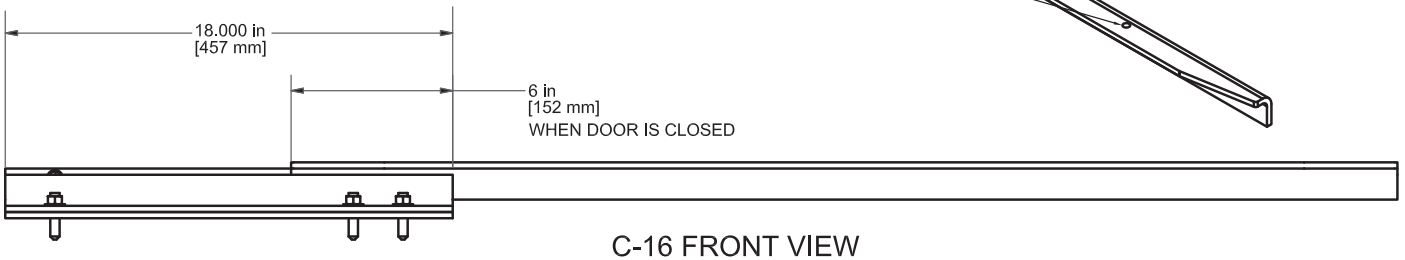
INSTALLATION OF WALL/FLOOR & ANCHOR ANGLE & GUIDE ANGLE



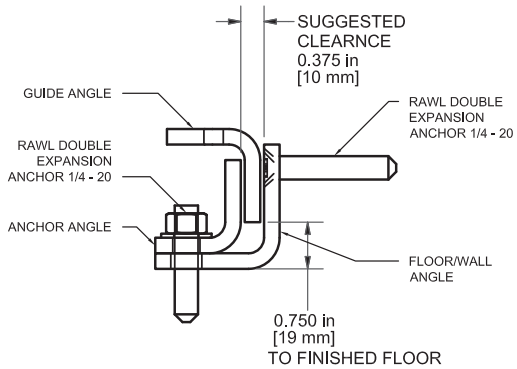
A-16 TOP VIEW



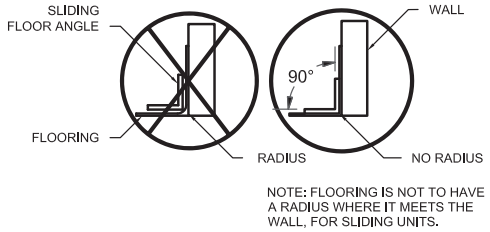
B-16 ISOMETRIC VIEW



C-16 FRONT VIEW



D-16 DETAIL



NOTE: FLOORING IS NOT TO HAVE A RADIUS WHERE IT MEETS THE WALL, FOR SLIDING UNITS.

E-16 FLOORING DETAIL

REVISIONS:	NOTES:		JOB:		
REVISION AS PER THE MEETING ON JULY 20, 2006		FINAL	CONTRACTOR:		
			DRAWN BY: CL JOHNSON	DATE: 9/26/2007	
			W.O.#:	FILE NUMBER:	PG.#: 16

Part 1 General

1.1 REFERENCES

.1 American Society for Testing and Materials International (ASTM)

- .1 ASTM A653/A653M-11, Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.
- .2 ASTM E90-09 – Standard Test Method for Laboratory Measurement of Airborne Sound Transmission Loss of Building Partitions and Elements.
- .3 ASTM E413-11 – Classification for Rating Sound Insulation

.2 Canadian General Standards Board (CGSB)

- .1 CAN/CGSB-1.181-99, Ready-Mixed Organic Zinc-Rich Coating.
- .2 CGSB 41-GP-19Ma-84, Rigid Vinyl Extrusions for Windows and Doors.

.3 Canadian Standards Association (CSA International)

- .1 CSA-G40.20-13/G40.21-13, General Requirements for Rolled or Welded Structural Quality Steel/Structural Quality Steel.
- .2 CSA W59-13, Welded Steel Construction (Metal Arc Welding).

.4 Canadian Steel Door Manufacturers' Association (CSDMA)

- .1 CSDMA, Recommended Specifications for Commercial Steel Doors and Frames, 2006.
- .2 CSDMA, Selection and Usage Guide for Commercial Steel Doors, 2009.

.5 National Fire Protection Association (NFPA)

- .1 NFPA 80-2013, Standard for Fire Doors and Fire Windows.
- .2 NFPA 252-2013, Standard Methods of Fire Tests of Door Assemblies.

.6 Underwriters' Laboratories of Canada (ULC)

- .1 CAN/ULC S104-10, Standard Method for Fire Tests of Door Assemblies.

1.2 SYSTEM DESCRIPTION

.1 Design Requirements:

- .1 Acoustic Performance: Minimum Sound Transmission Class (STC) 46 tested to ASTM E90. Label indicating sound transmission class shall be applied to the door and door frame.
- .2 Steel fire rated doors and frames: labelled and listed by an organization accredited by Standards Council of Canada in conformance with CAN/ULC S104 for ratings specified or indicated.
- .3 Provide fire labelled frames for openings requiring fire protection ratings. Test products in conformance with CAN/ULC S104, ASTM E152 or NFPA 252 and listed by nationally recognized agency having factory inspection services.

1.3 SUBMITTALS

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

.2 Provide product data: in accordance with Section 01 33 00 - Submittal Procedures.

.3 Provide shop drawings: in accordance with Section 01 33 00 - Submittal Procedures.

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

.2 Indicate each type of door, material, steel core thicknesses, mortises, reinforcements, location of exposed fasteners, openings, glazed, louvred, arrangement of hardware and fire rating and finishes.

.3 Indicate each type frame material, core thickness, reinforcements, glazing stops, location of anchors and exposed fastenings and reinforcing, fire rating, and finishes.

.4 Include schedule identifying each unit, with door marks and numbers relating to numbering on drawings and door schedule.

.5 Test Data:

.1 Submit test data indicating compliance with the Sound Transmission Class (STC) requirements. Include laboratory name, test report number, and date of test.

.2 Submit certification from test laboratory qualified under the National Voluntary Accreditation Program (NVLAP) of the U.S. Bureau of Standards.

1.4 DELIVERY, STORAGE AND HANDLING

.1 Deliver, store and handle materials in accordance with Section 01 61 00 - Common Product Requirements.

1.5 WARRANTY

.1 Manufacturer’s Limited Warranty: Five (5) years from date of supply, covering material and workmanship.

Part 2 Products

2.1 MATERIALS

.1 Hot dipped galvanized steel sheet: to ASTM A653M, ZF75, minimum base steel thickness in accordance with CSDMA Table 1 - Thickness for Component Parts.

.2 Reinforcement channel: to CSA G40.20/G40.21, Type 44W, coating designation to ASTM A653M, ZF75.

2.2 ACCESSORIES

.1 Hinges: Heavy weight butt type as recommended by the manufacturer.

.2 Primer: Rust inhibitive zinc chromate.

.3 Threshold: Smooth and flush, to provide a seal for door on closed position.

.4 Perimeter acoustic seals: Primary and secondary perimeter acoustic seals to provide a seal for door in closed position to meet specified STC rating.

.5 Head seal: Acoustic neoprene at header.

.6 Bottom acoustic seals: Acoustic mortised drop door bottom to provide a seal for door in closed position to meet specified STC rating.

2.3 STEEL DOORS

.1 Sheet steel faces, thickness, design, and core suitable to achieve specified STC performance.

.2 Acoustic core construction, longitudinal edges, mechanically interlocked with visible edge seams.

.3 Reinforce doors where hardware is required.

.4 Drill and tap for mortised, templated hardware.

.5 Top and Bottom Channels: Inverted, recessed, welded steel channels.

2.4 STEEL FRAMES

.1 Sheet steel, metal thickness appropriate to maintain door STC ratings, mitred corners, fully welded seams.

.2 Factory assemble and weld frames.

.3 Affix permanent metal nameplates to frame indicating manufacture’s name, door tag, and STC rating where is shall be clearly visible.

2.5 PRIMER

.1 Touch-up prime CAN/CGSB-1.181.

.1 Maximum VOC limit 50 g/L.

2.6 PAINT

.1 Field paint steel doors and frames in accordance with Sections 09 91 13 - Exterior Painting and 09 91 23 - Interior Painting. Protect weatherstrips from paint. Provide final finish free of scratches or other blemishes.

2.7 FRAME ANCHORAGE

.1 Provide appropriate anchorage to floor and wall construction.

.2 Locate each wall anchor immediately above or below each hinge reinforcement on hinge jamb and directly opposite on strike jamb.

.3 Provide 2 anchors for rebate opening heights up to 1520 mm and 1 additional anchor for each additional 760 mm of height or fraction thereof.

Part 3 Execution

3.1 MANUFACTURER'S INSTRUCTIONS

.1 Compliance: comply with manufacturer's written recommendations or specifications, including product technical bulletins, handling, storage and installation instructions, and datasheets.

3.2 INSTALLATION GENERAL

.1 Install doors and frames to CSDMA Installation Guide.

.2 Install components to manufacturer’s written instructions.

.3 Utilize welders certified by Canadian Welding Bureau (CWB).

3.3 FRAME INSTALLATION

.1 Set frames plumb, square, level and at correct elevation.

.2 Coordinate with masonry and gypsum board wall construction for anchor placement.

.3 Brace frames rigidly in position while building-in. Install temporary horizontal wood spreader at third points of door opening to maintain frame width. Provide vertical support at centre of head for openings over 1200 mm wide. Remove temporary spreaders after frames are built-in.

.4 Make allowances for deflection of structure to ensure structural loads are not transmitted to frames.

.5 Caulk perimeter of frames between frame and adjacent material.

.6 Maintain continuity of air barrier and vapour retarder.

3.4 DOOR INSTALLATION

.1 Install doors and hardware in accordance with hardware templates and manufacturer's instructions and Section 08 71 00 - Door Hardware.

.2 Provide even margins between doors and jambs and doors and finished floor and thresholds to allow easy operation and proper function of seals.

.3 Adjust operable parts for correct function.

3.5 FINISH REPAIRS

.1 Touch up with primer finishes damaged during installation.

.2 Fill exposed frame anchors and surfaces with imperfections with metallic paste filler and sand to a uniform smooth finish.

3.6 FIELD QUALITY CONTROL

.1 Provide qualified manufacturer's representative to instruct installers on the proper installation and adjustment of door assemblies.

.2 Provide manufacturer's representative to inspect door installation, and test minimum ten (10) cycles of operation. Correct any deficient doors.

END OF SECTION

Part 1 General

1.1 RELATED SECTIONS

.1 Section 04 22 00 – Concrete Unit Masonry.

.2 Section 05 50 00 Metal Fabrication

.3 Section 08 06 01 – Door, Frame and Hardware Schedule

.4 Division 26 - Electrical

1.2 REFERENCES

.1 American Society for Testing and Materials International, (ASTM).

.1 ASTM A1008/A1008M-[06a], Standard Specification for Steel, Sheet, Cold-Rolled, Carbon, Structural, High-Strength Low-Alloy and High-Strength Low-Alloy with Improved Formability.

.2 ASTM A653/A653M-[06a], Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.

.2 Canadian Standards Association (CSA International).

.1 CSA G164-M92 (R1998), Hot Dip Galvanizing of Irregularly Shaped Articles.

1.3 SYSTEM DESCRIPTION

.1 Design Requirements.

.1 Design exterior door assembly to withstand windload of 1 kPa with a maximum horizontal deflection of 1/240 of opening width.

.2 Design door panel assemblies with minimum thermal insulation factor 3.0 RSI (R17).

.3 Design door assembly to withstand minimum 75,000 cycles.

1.4 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 Shop Drawings

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

.1 Indicate sizes, service rating, types, materials, operating mechanisms, hardware and accessories and required clearances.

.2 Indicate electrical requirements including motor size, voltage, amperage. and electrical connections Include low voltage wiring diagram.

.3 Provide written verification that door is designed to withstand designated minimum required cycles.

1.5 PRE-INSTALLATION MEETING

.1 Prior to the casting of the concrete grade beam and floor slab organize a site meeting to discuss the requirements of the overhead door wiring including conduit required to be cast into the concrete.

1.6 CLOSEOUT SUBMITTALS

.1 Provide operation and maintenance data for overhead door hardware for incorporation into manual specified in Section 01 78 00 - Closeout Submittals.

1.7 WARRANTY

.1 Provide five-year manufacturer's warranty for doors and all components and ten year for delamination.

Part 2 Products

2.1 MATERIALS

.1 Galvanized steel sheet: commercial quality to ASTM A653/A653M with Z275 zinc coating.

.2 Steel sheet: commercial quality to ASTM A1008/A1008M,.

.1 Exterior face sheet thickness 1.6 mm (16 gauge).

.2 Interior face sheet thickness 1.2 mm (18 gauge).

.3 Prefinished steel with factory applied, two coat baked on polyester, primer and finish coat.

.1 Coating thickness: recommended by manufacturer.

.2 Resistance to accelerated weathering for chalk rating of 8, colour fade 5units or less and erosion rate less than 20 % to ASTM D822 as follows:

.1 Outdoor exposure period 2500 hours.

.2 Humidity resistance exposure period 5000hours.

.4 Insulation: Non-CFC foamed in place, polyurethane to meet design requirements.

2.2 DOORS

.1 Door Movement:

.1 Doors are high lift and standard lift as noted.

.2 Fabricate 50 mm thick insulated, textured panel doors of interlocking, roll formed steel sections, with thermal break between skins.

.3 Extend doors 100 mm minimum past both sides of door opening.

.4 Vertical steel stiffeners 305 mm on centre.

.5 Assemble components by means of spot or arc welding or coated rivet system or adhesive and self tapping screws to manufacturer's recommendations.

.6 Finish shall be factory applied, two-coat baked on polyester. Colour:

.1 Interior: White.

.2 Exterior: White

2.3 HEAVY DUTY INDUSTRIAL HARDWARE

.1 Track: standard hardware with 75 mm size 2.75 mm core thickness galvanized steel track. Track to suit specified door movements.

.2 Track Supports: 3.1 mm core thickness continuous galvanized steel angle track supports.

.3 Spring counter balance: heavy duty oil tempered torsion spring with manufacturers standard brackets.

.4 Top roller carrier: galvanized Steel 3.04mm thick adjustable.

.5 Rollers: full floating grease packed hardened steel, ball bearing 75mm diameter solid steel tire.

.6 Roller brackets: adjustable, minimum 3.1mm galvanized steel.

.7 Hinges: heavy duty, galvanized as recommended by manufacturer.

.8 Cable: 6 mm diameter galvanized steel aircraft cable.

2.4 ACCESSORIES

.1 Overhead horizontal track and operator supports: galvanized steel, type and size to suit installation.

.2 Track guards: 5 mm thick formed sheet 1500 mm high track guards.

.3 Pusher springs.

.4 Door Handles.

.1 No exterior handles.

.2 Handle interior side only on Outbuilding 157. No interior handle on room 148.

.3 Interior handle: flat bar door latch with hole in flat bar at overhead door track for installation of padlock for manual locking of door.

.5 Weather stripping.

.1 Sills: bulb type full width extruded neoprene weatherstrip.

.2 Jambs and head: extruded aluminum and arctic grade vinyl weatherstrip to manufacturer's standard.

.3 Two dual finned seals between sections.

.6 Finish ferrous hardware items with minimum zinc coating of 300 g/m^2 to CSA G164.

2.5 ELECTRICAL OPERATOR

.1 Electrical jack shaft operator to suit door size.

.2 Electrical motors, controller units, remote pushbutton stations, relays and other electrical components: to CSA approval.

.3 Electric Motor: 120/208 V

.1 Size motor to suit type and weight of door. Electrical division will provide 120/208 wiring to motor locations.

.1 Electrical division to provide final connection to motor and local disconnect.

.2 Door provider to provide any additional wiring and connections required for operation of door. All wiring to be installed in suitable sized steel conduit.

.4 Controller units with integral motor reversing starter, solenoid operated brake, heater elements for overload protection, including pushbuttons and control relays as applicable.

.5 Operation:

.1 Door 148B (Room 148):

.2 Refer to Section 28 22 00 Building Security Access Control

.3 "OPEN-STOP-CLOSE" designations on pushbuttons in English.

.4 Interior wall mounted station:

.1 Provide key operated lockout capability on interior wall mounted station.

.1 Key wall mounted station to match building cylinders and keying.

.5 Exterior door controller station (exterior pedestal):

.1 Provide 1 wired, card operated, exterior door operator, Overhead door operation is locked out until activated by electronic card reader unless otherwise noted.

.6 Door 157B (Outbuilding 157)

.1 "OPEN-STOP-CLOSE" designations on pushbuttons in English.

.2 Interior wall mounted station:

.1 Provide key operated lockout capability on interior wall mounted station.

.2 Key wall mounted station to match building cylinders and keying.

.6 Location:

.1 Interior and exterior pushbutton stations to be located as noted in drawings. Refer to architectural and electrical drawings.

.7 Wiring and Conduit

.1 Section Metal Door section is responsible to provide all low voltage wiring and connections for operation of doors.

.2 Provide conduit and wiring for each door control location. All wiring will be installed in conduit.

.3 Door provider is responsible for connection of each wall station.

.4 Door provider is responsible for final connection of safety equipment to low voltage wiring.

.5 Provide underground conduit for connection between overhead door operator pedestal and overhead door.

.8 Safety switch: combination roll rubber with limit switches for full length of bottom rail of bottom section of door, to reverse door to open position when coming in contact with object on closing cycle.

.1 Sensing edge cord to be self retracting.

.9 Emergency Release

.1 Attach operator to door with quick release device to disconnect door from operator in event of power failure. Provide chain for manual operation.

.2 Provide steel bracket on wall to allow chain to be bolted to the wall.

.10 Mounting brackets: galvanized steel, size and gauge to suit conditions.

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 Install doors and hardware in accordance with manufacturer's instructions.

.2 Rigidly support rail and operator and secure to supporting structure.

.3 Touch-up steel doors with primer where galvanized finish damaged during fabrication.

.4 Install operator including electrical motors, controller units, pushbutton stations, relays and other electrical equipment required for door operation.

.5 Lubricate and adjust door operating components to ensure smooth opening and closing of doors.

.6 Adjust weatherstripping to form a weather tight seal.

.7 Adjust doors for smooth operation.

.8 Install metal conduit as required for installation of low voltage wiring.

.9 Coordinate installation of conduit to be buried and cast in concrete for exterior pedestal with General Contractor.

.10 Install and make final connections of low voltage wiring.

3.3 CLEANING

.1 Perform cleaning after installation to remove construction and accumulated environmental dirt.

.2 Remove traces of primer, caulking; clean doors and frames.

.3 Clean glass and glazing materials with approved non-abrasive cleaner.

.4 Upon completion of installation, remove surplus materials, rubbish, tools and equipment barriers.

END OF SECTION

Part 1 General

1.1 REFERENCES

.1 Underwriters Laboratories

.1 UL325 - Door, Drapery, Gate, Louver, and Window Operators and Systems

.2 Canadian General Standards Board (CGSB)

.1 CAN/CGSB-1.40-97, Anticorrosive Structural Steel Alkyd Primer.

.2 CAN/CGSB-12.20-M89, Structural Design of Glass for Buildings.

.3 CAN/CGSB-79.1-M91, Insect Screens.

.3 Canadian Standards Association (CSA) International

.1 CSA A440-11, NAFS - North American Fenestration Standard/Specification for Windows, Doors, and Skylights.

.2 CAN/CSA G164-M92(R2003), Hot Dip Galvanizing of Irregularly Shaped Articles.

.3 CAN/CSA-C22.2 NO. 0-10 - General requirements - Canadian electrical code, part II.

1.2 PERFORMANCE REQUIREMENTS

.1 Design and size components to withstand dead and live loads caused by pressure and suction of wind, acting normal to plane of system as calculated in accordance with NBC to a design pressure windload per 30 year occurrence.

.2 Limit mullion deflection to L/175; with full recovery of glazing materials.

.3 Size glass units and glass dimensions to limits established in CAN/CGSB-12.20.

.4 Drain water entering joints, condensation occurring in glazing channels, or migrating moisture occurring within system, to the exterior by a weep drainage network.

.5 Maintain continuous air barrier and vapour retarder throughout assembly, primarily in line with inside pane of glass and heel bead of glazing compound.

.6 Overall Thermal Resistance of:

.1 Total system maximum U-value: 1.60 W/m²K.

1.3 SUBMITTALS

.1 Shop drawings:

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

.2 Indicate materials and details in full size scale for head, jamb and sill, profiles of components, interior and exterior trim junction between combination units elevations of unit, anchorage details, location of isolation coating, description of related components and exposed finishes fasteners, and caulking. Indicate location of manufacturer's nameplates.

.2 Samples:

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

.2 Submit samples from manufacture’s standard range of colours.

.3 Submit one representative cross-section of each type window frame (operable and fixed).

.4 Include frame, sash, sill, glazing and weatherproofing method, insect screens, surface finish and hardware. Show location of manufacturer's nameplates.

1.4 QUALITY ASSURANCE

.1 Mock-ups:

.1 Construct mock-ups in accordance with Section 01 45 00 - Quality Control.

.2 Construct mock-up to including window frame, glass glazing, and perimeter air barrier and vapour retarder.

.3 Mock-up will be used:

.1 To judge workmanship, substrate preparation, operation of equipment and material application.

.2 For testing to determine compliance with performance requirements (testing will be at the discretion of the Departmental Representative).

.4 Locate where directed.

.5 Allow 48 hours for inspection of mock-up before proceeding with work.

.6 When accepted, mock-up will demonstrate minimum standard of quality required for this work. Approved mock-up may remain as part of finished work.

.2 Pre-installation Meetings: conduct pre-installation meeting to verify project requirements, manufacturer's installation instructions and manufacturer's warranty requirements.

1.5 CLOSEOUT SUBMITTALS

.1 Provide operation and maintenance data for windows for incorporation into manual specified in Section 01 78 00 - Closeout Submittals.

1.6 MANUFACTURER'S WARRANTY

.1 Provide manufacturer's written warranty that frame will not warp, shrink, dent, twist, bow or rot under normal conditions and use for a period of 25 years and against aging and maintenance of window finish for a period of 10 years from date of acceptance of installation.

.2 Sealed glazing units shall be warranted against failure of the air seal due to defects in material or workmanship for a period of 20 years from date of acceptance of installation.

Part 2 Products

2.1 MATERIALS

.1 Materials: to CSA A440 supplemented as follows:

.2 All windows by same manufacturer.

.3 Fibreglass frame and sash shall be made from 60 to 85% glass fibres and 15 t0 35% resin.

.1 Main frame: pultruded fiberglass thermally broken and insulated with expanded polystyrene (Type 1) insulation. To sizes indicated on drawings. Finish shall be non-chalking and non-yellowing, U/V resistant.

.1 Colour “Black”. Provide samples for selection.

.2 Sash: pultruded fiberglass thermally broken and insulated with expanded polystyrene (Type 1) insulation. To sizes indicated on drawings. Finish shall be non-chalking and non-yellowing, U/V resistant. Colour to match window frame.

.3 Counter balance hinge to allow proper operation of motorized window operator.

.4 Glazing: Refer to Section 08 50 00 Glazing.

.5 Screens: to CAN/CGSB-79.1.

.1 Insect screening mesh: count 18 x 16, glassfibre mesh. (black)

.2 Fasteners: tamper proof.

.3 Screen frames: aluminum colour to match window frames.

.4 Mount screen frames for interior replacement.

.6 Interior jambs/sills: provide jamb/sill extension on interior as indicated and to suit conditions. Colour to match window frames.

.7 Interior trim: Refer to Section 06 40 00 Architectural Woodwork for window sills.

.8 Brickmould and brickmould extensions: by window manufacturer, profile and sizes as indicated. Minimum 65mm depth and minimum 1 mm wall thickness.

.1 Colour to match window frame.

.9 Isolation coating: alkali resistant bituminous paint.

.10 Fasteners: all fasteners are to be stainless steel and are to be concealed.

2.2 WINDOW TYPE AND CLASSIFICATION

.1 Types:

.1 Opening sash: bottom projected with triple glazing insulating glass.

.1 Motorized sash with remote wall mounted control.

.2 Integral limiter to prevent sash from opening beyond 100mm beyond sill.

.3 All operable windows to have restricted operation, so that no object larger than a 100 mm diameter sphere may pass through.

.2 Fixed sash: with triple glazing insulating glass.

.3 Screens: on ventilating portion of windows.

.2 Classification rating: to CSA A440.

.1 Air tightness: A3.

.2 Water tightness: B6.

.3 Wind load resistance: C3.

.4 Condensation resistance: Temperature Index, I 55.

.5 Forced Entry: F1

.6 Insect Screens: S1 (Heavy Duty)

2.3 FABRICATION

.1 Fabricate in accordance with CSA 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 shop coat primer to CAN/CGSB-1.40; 380 g/m^2 zinc coating to CAN/CSA G164.

2.4 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.

2.5 GLAZING

.1 Refer to Section 08 80 50 - Glazing

2.6 HARDWARE

.1 Hardware: stainless steel or bronze sash locks and aluminum handles to provide security and permit easy operation of units. Colour to match window frames.

.2 Locks: provide operating sash with spring loading locking device, to provide automatic locking in closed position.

.3 Power window operator:

.1 Meeting ANSI/UL 325 and CAN/CSA C22.2

.2 Sill mounted operator. Provide mounting and operating hardware to suit installation.

.3 Wall mounted manual control switch. One switch controls all power window operators. Refer to drawings for location.

.4 Electronic limit switch allowing window to open to a preset maximum.

.5 Size motor to suit window size and weight.

.6 Windows to automatically close if power is lost.

.7 Voltage: 110V.

.8 Section 25 90 00 EMCS: Sequence of Operations will provide a contact on the window control that the building management system will use to monitor the

location of the operable window. This Section will coordinate with Section 25 90 00 for installation and operation of contact.

.4 Provide special keyed opening device for windows normally locked.

.5 Equip projected units with roto operators with locking handle.

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 width: adequate to provide required air tightness and vapour diffusion control to building air barrier and vapour retarder from interior.

.2 Ensure continuity of air barrier and vapour retarder with adjacent construction.

.3 Refer to drawings for arrangement of air barrier.

2.8 LOW EXPANSION FOAM

.1 Low pressure polyurethane expanding foam, closed cell structure.

.2 Foam remains flexible after curing.

.3 Insulation value: R-5 per inch of cured foam.

Part 3 Execution

3.1 WINDOW INSTALLATION

.1 Install in accordance with CSA A440.

.2 Attach to structure to permit sufficient adjustment to accommodate existing building conditions and other irregularities.

.3 Install products specified square, plumb and level. Center window unit in opening and secure window unit as indicated in manufacturer's written instructions. Provide alignment attachments and shims to permanently fasten system to building structure.

.4 Arrange components to prevent abrupt variation in colour.

.5 All fasteners are to be stainless steel and are to be concealed. Exposed heads will not be permitted.

.6 Verify proper operation of all opening windows.

.7 Allow for deflection of structure at head of window so structure will not impact window.

3.2 SILL INSTALLATION

.1 Provide profile of sill as indicated on drawings for each condition.

.2 Fabricate sills to suit opening sizes.

.3 Secure sills in place with concealed anchoring clips located at ends and mid-point; space no more than 600 mm on centre in between.

3.3 POWER OPERATED WINDOW

.1 Install motor according to manufacturer's written instructions.

.2 Locate remote operator control for windows as per drawings.

.3 Coordinate electrical installation with electrical contractor.

.4 Coordinate integration of window control with buildings automated control system.

.5 Adjust window for smooth operation.

.6 Adjust window preset for maximum window opening.

3.4 CAULKING

.1 Seal joints between windows and window sills with sealant. Bed sill expansion joint cover plates and drip deflectors in bedding compound. Provide backer rod in gap and install sealant to thickness recommended by manufacturer for proper performing joint. Generally 1:3 thickness to width.

.2 Seal perimeter joints of window to adjoining finish material.

.3 Seal ends of sills at finish material.

3.5 LOW EXPANSION FOAM

.1 Ensure compatibility between foam and adjacent materials.

.2 Fill gap between window frame and adjacent rough opening with low expansion foam.

.3 Do not overfill cavity.

3.6 ADJUSTING

.1 Adjust units for smooth operation without binding or racking.

.2 Adjust operating hardware and screens for correct operation.

3.7 CLEANING

1. Clean interior and exterior surfaces free of labels, mortar, plaster, paint, joint sealers and other foreign mater to prevent damage to weatherstripping and to prevent interference with operation or hardware.

2. Wash down surfaces with a solution of mild detergent in warm water, applied with soft, clean wiping cloths. Take care to remove dirt from corners. Wipe surfaces clean.

3. Remove excess sealant by moderate use of mineral spirits or other solvent acceptable to sealant manufacturer.

3.8 PROTECTION

.1 Protect window unit from damage. Protect ventilators and operating parts from dirt and damage caused by subsequent construction activities. Repair or replace damages units.

.2 Protect finished Work from damage.

3.9 SCHEDULE

1. Refer to drawings for window locations and sizes.

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-69.19-93/ANSI/BHMA A156.3-1989, Exit Devices.

.3 CAN/CGSB-69.20-M90/ANSI/BHMA A156.4-1986, Door Controls (Closers).

.4 CAN/CGSB-69.21-M90/ANSI/BHMA A156.5-1984, Auxiliary Locks and Associated Products.

.5 CAN/CGSB-69.22-M90/ANSI/BHMA A156.6-1986, Architectural Door Trim.

.6 CAN/CGSB-69.24-M90/ANSI/BHMA A156.8-1982, Door Controls - Overhead Holders.

.7 CAN/CGSB-69.26-96/ANSI/BHMA A156.10-1991, Power-operated Pedestrian Doors.

.8 CAN/CGSB-69.28-M90/ANSI/BHMA A156.12-1986, Interconnected Locks and Latches.

.9 CAN/CGSB-69.29-93/ANSI/BHMA A156.13-1987, Mortise Locks and Latches.

.10 CAN/CGSB-69.32-M90/ANSI/BHMA A156.16-1981, Auxiliary Hardware.

.11 CAN/CGSB-69.35-M89/ANSI/BHMA A156.19-1984, Power Assist and Low Energy Power Operated Doors.

1.2 SUBMITTALS

.1 Product Data:

.1 Submit manufacturer's printed product literature, specifications and data sheet in accordance with Section 01 33 00 - Submittal Procedures.

.2 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.

.2 Remove from site and dispose of packaging materials at appropriate recycling facilities.

.3 Dispose of corrugated cardboard, polystyrene, plastic, and packaging material in appropriate on-site bin for recycling in accordance with site waste management program.

1.6 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 Interconnected locks and latches: to CAN/CGSB-69.28, series 5000 interconnected lock, grade 1, designed for function and keyed as stated in Hardware Schedule.

.2 Mortise locks and latches: to CAN/CGSB-69.29, series 1000 mortise lock, grade 1, designed for function as stated in Hardware Schedule.

.3 Knobs: Corbin Russwin “Global” design.

.4 Lever handles: Corbin Russwin “Lustra” design.

.5 Escutcheons: Solid stainless steel

.6 Normal strikes: box type, lip projection not beyond jamb.

.7 Cylinders: Corbin-Russwin,0 bitted.

.8 Finish: BHMA 626 Satin Chrome.

.9 Acceptable manufacturer: Corbin Russwin.

.2 Padlocks

.1 Refer to Section 08 36 13 – Sectional Metal Doors.

.2 Keyed heavy duty brass padlocks with hardened steel shackle, with six-pin key.

.3 Core cylinders to match locksets and keying system specified.

.4 Provide two (2) padlocks per overhead door.

.3 Storage Lockers and Gun

.1 Refer to Section 10 51 13 – Metal Lockers

.2 Cylinder locks for metal storage lockers.

.3 Key cylinders to match building keying.

.4 Butts and hinges:

.1 Butts and hinges: to CAN/CGSB-69.18, listed in Hardware Schedule.

.2 Hinges on selected doors to be "NRP" Type (non-removable-pin) as scheduled.

.3 List of hinges:

a) FBB 168 114 x 114.

b) FBB 168 114 x 144 NRP.

.4 Acceptable manufacturers: Stanley, Hager, Monthard, McKimmey or approved alternate.

.5 Door Closers and Accessories: (heavy duty a) and normal b))

.1 Door controls (closers): to CAN/CGSB-69.20, size in accordance with CAN/CGSB-69.20, table A1, finished to 630.

.1 Grade 1, heavy duty, adjustable hydraulic back check, separate regulation of closing speed and latching speed, rack and pinion action.

.2 List of closers:

.1 LCN 4040 with delayed action function.

.2 LCN 4040H with integral hold-open function

.3 Acceptable manufacturers: LCN, Sargent, Norton, Rixson or approved alternate.

.6 Auxiliary locks and associated products: to CAN/CGSB-69.21, as listed in Hardware Schedule, finished to 26D.

.7 Architectural door trim: to CAN/CGSB-69.22, as listed in Hardware Schedule, finish as noted

.1 Door protection plates: kick plate type, 1.27 mm thick stainless steel, bevelled edges, 300 mm high by 25 mm less than door width, 32D finish.

.2 Push plates: 1.27 mm thick stainless steel, bevelled edges, 125 mm wide by 400 mm high, finished to 32D.

.3 Pulls: 19 mm diameter “D” style, projecting 35 mm from door, height 300 mm, without rose.

.1 Latch guard: Heavy gauge formed steel plate cover to protect lock strike area, 300 mm high, through bolt mounting formed to suit mortised locksets with standard strikes.

.2 Auxiliary hardware: to CAN/CGSB-69.32, as 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.

.2 Wall stop: concave wall stop with concealed mounting, 62 mm diameter, 30 mm projection, cast brass with rubber bumper, 26D finish.

.1 Acceptable products: Hager 234 or Richelieu 2205.

.3 Floor stop: to ANSI A156.16, low dome stop, 45 mm diameter, 3.2 mm thick base, cast brass, 26D finish.

.1 Acceptable products: Hager 241, or Richelieu 218.

.3 Thresholds:

a) 127 mm wide x full width of door opening, 12.7mm height, 3.8 mm wall. stainless steel mill finish, plain surface.

b) 127 mm wide x full width of door opening, extruded aluminum mill finish, serrated surface, with lip and vinyl door seal insert. Pemko 2005_T or approved alternate.

c) 127 mm wide x full width of door opening, 12.7 mm height, extruded stainless steel, mill finish, serrated surface, with thermal break of rigid PVC.

.4 Weatherstripping:

.1 Head and jamb seal:

.1 Extruded aluminum frame and solid closed cell neoprene insert, clear anodized finish.

.2 Door bottom seal:

.1 Heavy duty, extruded aluminum frame and closed cell neoprene weather seal, surface mounted, closed ends, adjustable, clear anodized finish.

.5 Barrier Free Door Operator and Actuators:

.1 To ANSI/BHMA A165.19.

.2 Operator supplier shall include transformer for power for actuators. Include two push plate operators, mounted on push and pull side of doors. Tie operation of door operator to release electric strike where electric strike is provided with hardware on door. Operator shall be able to be adjusted to reduce force required to open manually from 66 N to 40 N.

.3 Control boxes: complete with electric strike relay and ability to be connected to the building security system..

.4 Power operator door switches with 150 x 150 mm #4 satin finish stainless steel face plate and push button with engraved "barrier free" symbol and mounted in tamper resistant assembly installed by Factory Certified Personnel.

.5 Wall mounted switches: recess mounted switch and box, hard wired to operator housing. Mount operators on push and pull sides of doors as indicated.

.6 Provide one push button on each side of each power operated door

.7 Operation: to

.1 In conjunction with ANSI F13 lockset.

.2 Public hours: Push button operates electric strike in door frame to release electric strike and activate power operator to open door.

.3 Secure hours: Push button is deactivated, electric strike is locked.

.4 Provide switch in operator housing to deactivate door operators when doors are locked by deadbolt.

.8 Provide switched line voltage to control box. Locate switch adjacent to box.

.9 Operator supplier shall be responsible for wiring of all low voltage wiring for controlling door. Electrical Division will provide 120V.

.10 Mount control box in location as directed by Departmental Representative.

.11 Acceptable manufacturers: Gyrotech 500, Horton, Stanley, or approved alternate.

.6 Sound Seals:

.1 Head and jamb seal:

.1 Self-adhesive silicone perimeter gasketing.

.2 Acceptable Manufacturer: Pemko S773, DraftSeal DS340CS or approved alternate.

.7 Electric strike: SDC Model 55 Uni-flex electric strike complete with ABCDU trim for the electric strike. No substitutions.

.1 Strike edge plate to match ANSI function of electric strike.

.8 Card reader: provided by Owner.

.9 Door Viewer

.1 Mount 1.57m above floor level.

.2 Acceptable manufacturer:

.1 VSI Hardware Industries, Loxem 180.

.2 Madison Products Company Limited, Madison No. 20 R35.

.3 Leigh Metal Products Ltd., Ives No. 698B3

2.3 FASTENINGS

.1 Use only fasteners provided by manufacturer. Failure to comply may void warranties and applicable licensed labels.

.2 Supply screws, bolts, expansion shields and other fastening devices required for satisfactory installation and operation of hardware.

.3 Exposed fastening devices to match finish of hardware.

.4 Where pull is scheduled on one side of door and push plate on other side, supply fastening devices, and install so pull can be secured through door from reverse side. Install push plate to cover fasteners.

.5 Use fasteners compatible with material through which they pass.

2.4 KEYING

.1 Construction keying:

.1 Provide construction cores. Contractor to install construction cores and perform operation verification for all locks. Construction cylinders to be “0” bitted Corbin-Russwin L4 cylinders. Perimeter doors may have random bitting.

.2 Permanent keying:

.1 Provide 000000 bitted for keying by Owner.

.2 Provide two blank keys, in duplicate, for every lock in this Contract.

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 and as specified.

.2 Where door stop contacts door pulls, mount stop to strike bottom of pull.

.3 Use only manufacturer's supplied fasteners. Use of "quick" type fasteners, unless specifically supplied by manufacturer, is unacceptable.

.4 Coordinate door and frame preparation with Section 08 11 00 Metal Doors and Frames to ensure the proper installation and operation of hardware.

.5 Remove construction cores and locks when directed by Departmental Representative; install permanent cores and check operation of locks.

3.3 ADJUSTING

.1 Adjust door hardware, operators, closures and controls for optimum, smooth operating condition, safety and for weather tight closure.

.2 Lubricate hardware, operating equipment and other moving parts.

.3 Adjust door hardware to provide tight fit at contact points with frames.

3.4 TESTING

.1 All locks must be tested by the Contractor with the installed permanent cores for proper installation. All doors and locks not installed and operating correctly will be rejected.

3.5 CLEANING

.1 Perform cleaning after installation to remove construction and accumulated environmental dirt.

.2 Clean hardware with damp rag and approved non-abrasive cleaner, and polish hardware in accordance with manufacturer's instructions.

.3 Remove protective material from hardware items where present.

.4 Upon completion of installation, remove surplus materials, rubbish, tools and equipment barriers.

3.6 DEMONSTRATION

.1 Maintenance Staff Briefing:

.1 Brief maintenance staff regarding:

.1 Proper care, cleaning, and general maintenance of projects complete hardware.

.2 Description, use, handling, and storage of keys.

.3 Use, application and storage of wrenches for door closers, locksets, and fire exit hardware.

.2 Demonstrate operation, operating components, adjustment features, and lubrication requirements.

3.7 SCHEDULE

Door 101A

1 lockset:
- Full Mortise
- Model: ML2065-LWR-626
- “0” Bitted L4 Cylinder
- ANSI No.: F13

3 butts (non-removable pins)
1 weatherstripping

Door 101B

1 lockset:
- Full Mortise
- Model: ML2065-LWR-626
- “0” Bitted L4 Cylinder
- ANSI No.: F13

3 butts
1 closer

1 door sweep
1 closer
1 auto operator
1 electric strike (w/ deadbolt retainer)
1 floor stop
1 door viewer
Comment: Handicap Assist Door. See Note 2 below.

1 auto operator
1 electric strike (w/ deadbolt retainer)
1 wall stop
Comment: Handicap Assist Door. See Note 2 below.

Door 102

1 lockset:
- Full Morise
- ML2029-LWR-626
- "0" Bitted L4 Cylinder
- ANSI No.: F15

3 butts (non-removable pins)
1 closer
1 electric strike
1 wall stop
1 kickplate
1 door viewer
Comment: Card Access Controlled Door. See Note 1 below.

Door 103

1 lockset:
- Full Mortise
- Model: ML2057-LWR-626
- "0" Bitted L4 Cylinder
- ANSI No.: F07

3 butts
1 closer
1 wall stop
1 kickplate

Door 104A

1 lockset:
- Full Mortise
- Model: ML2029-LWR-626
- "0" Bitted L4 Cylinder
- ANSI No.: F15

3 butts
1 closer
1 weatherstripping
1 drop seal (coordinate w/ Section 08 34 74)
1 wall stop
1 kickplate

Door 104B

1 lockset:
- Full Mortise
- Model: ML2029-LWR-626
- "0" Bitted L4 Cylinder
- ANSI No.: F15

3 butts
1 closer w/ integral hold open
1 weatherstripping
1 door sweep
1 wall stop
1 kickplate

Door 105

1 lockset:
- Full Mortise
- Model: ML2051-LWR-626
- "0" Bitted L4 Cylinder
- ANSI No.: F04

3 butts
1 wall stop
1 kickplate

Door 106

1 lockset:
- Full Mortise
- Model: ML2051-LWR-626
- "0" Bitted L4 Cylinder
- ANSI No.: F04

3 butts
1 closer
1 weatherstripping
1 drop seal (coordinate w/ Section 08 34 74)
1 wall stop
1 kickplate

Door 107A

1 lockset:
- Full Mortise
- Model: ML2029-LWR-626
- "0" Bitted L4 Cylinder
- ANSI No.: F15

3 butts (non-removable pins)
1 weatherstripping
1 door sweep
1 closer
1 electric strike
1 latch guard
1 door viewer
Comment: Card Access Controlled Door. See Note 1 below.

Door 107B

1 lockset:
- Full Mortise
- Model:
- ML2010-LWR-626
- ANSI No.: F01

3 butts (non-removable pins)
1 closer
1 wall stop
1 kickplate

Door 108

1 lockset:
- Full Mortise
- Model: ML2029-LWR-626
- "0" Bitted L4 Cylinder
- ANSI No.: F15

3 butts (non-removable pins)
1 closer
1 wall stop
1 electric strike
1 kickplate
1 door viewer

Comment: Card Access Controlled Door. See Note 1 below.

Door 109

1 lockset:
- Full Mortise
- Model: ML2060-LWR-626
- ANSI No.: F22

3 butts
1 wall stop
1 kickplate

Door 114A

1 lockset:
- Full Mortise
- Model: ML2057-LWR-626
- "0" Bitted L4 Cylinder
- ANSI No.: F07

3 butts
1 closer
1 weatherstripping
1 drop seal (coordinate w/ Acoustic Doors)
1 wall stop
1 kickplate

Door 114B

1 lockset:
- Full Mortise
- Model: ML2029-LWR-626
- "0" Bitted L4 Cylinder
- ANSI No.: F15

3 butts
1 closer
1 weatherstripping
1 drop seal (coordinate w/ Section 08 34 74)
1 wall stop
1 kickplate

Door 115

1 lockset:
- Full Mortise
- Model: ML2051-LWR-626
- "0" Bitted L4 Cylinder
- ANSI No.: F04

3 butts
1 weather stripping
1 door sweep
1 wall stop
1 kickplate

Door 116

1 lockset:
- Full Mortise
- Model: ML2010-LWR-626
- ANSI No.: F01

3 butts
1 closer
1 wall stop
1 kickplate

Door 117

1 lockset:
- Full Mortise
- Model: ML2029-LWR-626
- "0" Bitted L4 Cylinder
- ANSI No.: F15

3 butts
1 closer
1 wall stop
1 kickplate

Door 118

1 lockset:
- Full Mortise
- Model: ML2057-LWR-626
- "0" Bitted L4 Cylinder
- ANSI No.: F07

3 butts
1 closer
1 kickplate

Door 119

1 push plate
1 pull plate
3 butts
1 closer
1 wall stop
1 kickplate

Door 121

1 lockset:
- Full Mortise
- Model: ML2060-LWR-626
- ANSI No.: F22

3 butts
1 wall stop
1 kickplate

Door 122

1 push plate
1 pull plate
3 butts
1 closer
1 wall stop
1 kickplate

Door 124

1 lockset:
- Full Mortise
- Model: ML2060-LWR-626
- ANSI No.: F22

3 butts
1 wall stop
1 kickplate

Door 125

1 lockset:
- Full Mortise
- Model: ML2029-LWR-626
- "0" Bitted L4 Cylinder
- ANSI No.: F15

3 butts (non-removable pins)
1 weatherstripping
1 door sweep
1 closer
1 latch guard
1 kickplate
1 door viewer

Door 126

1 lockset:
- Full Mortise
- Model: ML2051-LWR-626
- "0" Bitted L4 Cylinder
- ANSI No.: F04

3 butts
1 weatherstripping
1 drop seal (coordinate w/ Section 08 34 74)
1 wall stop
1 kickplate

Door 127

1 lockset:
- Full Mortise
- Model: ML2029-LWR-626
- "0" Bitted L4 Cylinder
- ANSI No.: F15

3 butts
1 closer
1 wall stop
1 electric strike
1 kickplate
Comment: Card Access Controlled Door. See Note 1 below.

Door 128

1 lockset:
- Full Mortise
- Model: ML2010-LWR-626
- ANSI No.: F01

3 butts
1 floor stop
1 kickplate

Door 129

1 lockset:
- Full Mortise
- Model: ML2029-LWR-626
- "0" Bitted L4 Cylinder
- ANSI No.: F15

3 butts
1 closer
1 wall stop
1 electric strike
1 kickplate
Comment: Card Access Controlled Door. See Note 1 below.

Door 130

1 lockset:
- Full Mortise
- Model: ML2029-LWR-626
- "0" Bitted L4 Cylinder
- ANSI No.: F15

3 butts
1 closer
1 wall stop
1 electric strike
1 kickplate
Comment: Card Access Controlled Door. See Note 1 below.

Door 131A

1 lockset:
- Full Mortise
- Model: ML2029-LWR-626
- "0" Bitted L4 Cylinder
- ANSI No.: F15

3 butts (non-removable pins)
1 weatherstripping
1 door sweep
1 closer
1 floor stop
1 electric strike
1 kickplate
1 door viewer
Comment: Card Access Controlled Door. See Note 1 below.

Door 131B

1 lockset:
- Full Mortise
- Model: ML2010-LWR-626
- ANSI No.: F01

3 butts
1 closer
1 wall stop
1 kickplate

Door 132B

1 lockset:
- Full Mortise
- Model: ML2065-LWR-626
- “0” Bitted L4 Cylinder
- ANSI No.: F13

3 butts
1 closer
1 wall stop
1 kickplate

Door 133

1 lockset:
- Full Mortise
- Model: ML2029-LWR-626
- "0" Bitted L4 Cylinder
- ANSI No.: F15

3 butts
1 closer
1 electric strike
1 kickplate
Comment: Card Access Controlled Door. See Note 1 below.

Door 134

1 lockset:
- Full Mortise
- Model: ML2057-LWR-626
- "0" Bitted L4 Cylinder
- ANSI No.: F07

3 butts
1 closer
1 wall stop
1 electric strike
1 kickplate
Comment: Card Access Controlled Door. See Note 1 below.

Door 135

1 lockset:
- Full Mortise
- Model: ML2029-GSR-626
- "0" Bitted L4 Cylinder
- ANSI No.: F15(K)

3 butts (non-removable pins)
1 closer
1 wall stop
1 kickplate
Comment: This lock has knob trim.

Door 136

1 lockset:
- Full Mortise
- Model: ML2057-GSR-626
- "0" Bitted L4 Cylinder
- ANSI No.: F07(K)

3 butts
1 closer
1 wall stop
1 electric strike
1 kickplate
Comment: Card Access Controlled Door. See Note 1 below. This lock has knob trim.

Door 137

1 lockset:
- Full Mortise
- Model:ML2029-GSR-626
- "0" Bitted L4 Cylinder
- ANSI No.: F15(K)

3 butts (non-removable pins)
1 closer
1 wall stop
1 kickplate
Comment: This lock has knob trim.

Door 138

1 lockset:
- Full Mortise
- Model:ML2029-GSR-626
- "0" Bitted L4 Cylinder
- ANSI No.: F15(K)

3 butts (non-removable pins)
1 closer
1 wall stop
1 kickplate
Comment: This lock has knob trim.

Door 139

1 lockset:
- Full Mortise
- Model: ML2057-LWR-626
- “0” Bitted L4 Cylinder
- ANSI No.: F07

3 butts
1 closer
1 wall stop
1 kickplate

Door 140

1 lockset:
- Full Mortise
- Model: ML2029-GSR-626
- "0" Bitted L4 Cylinder
- ANSI No.: F15(K)

3 butts (non-removable pins)
1 closer
1 kickplate
Comment: This lock has knob trim.

Door 141

1 lockset:
- Full Mortise
- Model: ML2057-LWR-626
- "0" Bitted L4 Cylinder
- ANSI No.: F07

3 butts (non-removable pins)
1 closer
1 kickplate

Door 142A

1 lockset:
- Full Mortise
- Model: ML2022-GSR-626
- "0" Bitted L4 Cylinders
- ANSI No.: F14(K)

3 butts (non-removable pins)
1 closer
1 weatherstripping
1 door sweep
1 latch guard
1 door viewer
Comment: This lock has knob trim.

Door 142.1

1 lockset (no trim on the inside):
- Full Mortise
- Model: ML2011-626
- "0" Bitted L4 Cylinders
- ANSI No.: F18

3 butts
Comment: Include cylinder pull.

Door 142.2

1 lockset (no trim on the inside):
- Full Mortise
- Model: ML2011-626
- "0" Bitted L4 Cylinders
- ANSI No.: F18

3 butts
Comment: Include cylinder pull.

Door 142B

1 lockset:
- Full Mortise
- Model: ML2022-GSR-626
- "0" Bitted L4 Cylinder
- ANSI No.: F14(K)

3 butts
1 closer
1 wall stop
1 electric strike
1 kickplate
2 door viewers (both sides)
Comment: Card Access Controlled Door. See Note 1 below. This lock has knob trim.

Door 143

SEE DETENTION DOOR AND FRAMES
08 34 63

Door 144

SEE DETENTION DOOR AND FRAMES
08 34 63

Door 145

1 lockset :
- Full Mortise
- Model: ML2057-GSR-626
- "0" Bitted L4 Cylinder
- ANSI No.: F07(K)

3 butts
1 closer
1 kickplate
Comment: This lock has knob trim.

Door 146

SEE DETENTION DOOR AND FRAMES
08 34 63

Door 147

SEE DETENTION DOOR AND FRAMES
08 34 63

Door 148A

1 lockset:
- Full Mortise
- Model: ML2022-GSR-626
- "0" Bitted L4 Cylinders
- ANSI No.: F14(K)

3 butts
1 weatherstripping
1 door sweep
1 closer
1 latch guard
1 kickplate
1 door viewer

Door 148B

SEE SECTIONAL METAL DOORS
08 36 12

Door 148C

1 lockset:
- Full Mortise
- Model: ML2022-GSR-626
- "0" Bitted L4 Cylinder
- ANSI No.: F14(K)

3 butts
1 closer
1 wall stop
1 electric strike
1 kickplate
2 door viewers (both sides)
Comment: Card Access Controlled Door. See Note 1 below. This lock has knob trim.

Door 149

1 lockset:
- Full Mortise
- Model: ML2022-GSR-626
- "0" Bitted L4 Cylinder
- ANSI No.: F14(K)

3 butts
1 closer
1 weatherstripping
1 drop seal (coordinate w/ Section 08 34 74)
1 wall stop
1 kickplate
Comment: This lock has knob trim.

Door 151

1 lockset (no trim on the inside):
- Full Mortise
- Model: ML2011-626
- "0" Bitted L4 Cylinders
- ANSI No.: F18

3 butts
1 kickplate
Comment: Include cylinder pull.

Door 152

1 lockset:
- Full Mortise
- Model: ML2057-GSR-626
- "0" Bitted L4 Cylinder
- ANSI No.: F07(K)

3 butts
1 closer
1 wall stop
1 kickplate
Comment: This lock has knob trim.

Door 153A

1 lockset (no trim on the inside):
- Full Mortise
- Model: ML2011-626
- "0" Bitted L4 Cylinders
- ANSI No.: F18

3 butts
1 weatherstripping
1 drop seal (coordinate w/ Section 08 34 74)
1 kickplate
Comment: Include cylinder pull.

Door 153B

1 lockset:
- Full Mortise
- Model: ML2057-LWR-626
- "0" Bitted L4 Cylinder
- ANSI No.: F07

3 butts
1 closer
1 weatherstripping
1 drop seal (coordinate w/ Acoustic Doors)
1 wall stop
1 kickplate

Door 154

1 lockset:
- Full Mortise
- Model: ML2057-GSR-626
- "0" Bitted L4 Cylinder
- ANSI No.: F07(K)

3 butts
1 wall stop
1 kickplate
Comment: This lock has knob trim.

Door 155

1 lockset:
- Full Mortise
- Model: ML2057-GSR-626
- "0" Bitted L4 Cylinder
- ANSI No.: F07(K)

3 butts
1 wall stop
1 kickplate
Comment: This lock has knob trim.

Door 156

1 lockset (no trim on the inside):
- Full Mortise
- Model: ML2011-626
- "0" Bitted L4 Cylinders
- ANSI No.: F18

3 butts
1 weatherstripping
1 drop seal (coordinate w/ Acoustic Doors)
1 kickplate
Comment: Include cylinder pull.

Door 157A

1 lockset:
- Full Mortise
- Model: ML2029-LWR-626
- "0" Bitted L4 Cylinder
- ANSI No.: F15

3 butts (non-removable pins)
1 weatherstripping
1 door sweep
1 closer

Door 157B

SEE SECTIONAL METAL DOORS
08 36 12

Door 201A

1 lockset:
- Full Mortise
- Model: ML2057-LWR-626
- "0" Bitted L4 Cylinder
- ANSI No.: F07

3 butts
1 closer
1 wall stop
1 kickplate

Door 201B

1 lockset:
- Full Mortise
- Model: ML2029-LWR-626
- "0" Bitted L4 Cylinder
- ANSI No.: F15

6 butts
1 flush bolts
2 chain stops
2 kickplates

Door 201C

1 lockset:
- Full Mortise
- Model: ML2022-LWR-626
- "0" Bitted L4 Cylinders
- ANSI No.: F14

1 closer
1 weatherstripping (all 4 sides)

Note 1: Prepare frame for installation of SDC Model 55 Uni-flex electric strike. Ensure Deadbolt keepers are installed and aligned in door frame where there are lock sets with deadbolts.

Note 2: Prep door with SDC 55 series electric strike specified for handicap assist door latch release.

END OF SECTION

PART 1 General

1.1 RELATED SECTIONS

.1 Section 07 92 00 – Joint Sealing.

.2 Section 08 11 16 – Aluminum Doors and Frames.

.3 Section 08 14 10 - Flush Wood Doors.

.4 Section 08 11 14 - Metal Doors and Frames.

1.2 REFERENCES

.1 Canadian General Standards Board (CGSB).

.1 CAN/CGSB-12.1-M90, Tempered or Laminated Safety Glass.
.2 CAN/CGSB-12.3-M91, Flat, Clear Float Glass.
.3 CAN/CGSB-12.4-M91 Heat Absorbing Glass
.4 CAN/CGSB-12.11-M90, Wired Safety Glass.
.5

.2 Flat Glass Manufacturers Association (FGMA).

.1 FGMA Glazing Manual - 1997.

.3 International Window Film Association (IWFA)

.1 IWFA Visual Quality Standard for Applied Window Film 1999.

1.3 SYSTEM DESCRIPTION

.1 Performance Requirements:

.1 Provide 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.

1.4 SUBMITTALS

.1 Product Data:

.1 Submit manufacturer's printed product literature, specifications and data sheet in accordance with Section 01 33 00 - Submittal Procedures.

.2 Submit test data substantiating triple glazed sealed units meets specified maximum centre-of-glazing U-factor.

.2 Shop Drawings:

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

.3 Samples:

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

.2 Sealed Units: Submit duplicate 300 x 300 mm size samples of sealed units.

.4 Manufacturer's Instructions:

.1 Submit manufacturer's installation instructions in accordance with Section 01 33 00 - Submittal Procedures.

.5 Closeout Submittals:

.1 Provide maintenance data including cleaning instructions for incorporation into manual specified in Section 01 78 00 - Closeout Submittals.

1.5 WARRANTY

.1 Contractor's Warranty –Contractor shall warrant the work in accordance with the General Conditions.

.2 Product Warranty – Provide a TEN (10) year manufacturer's warranty for sealed glazing units. Include coverage for sealed glass units from seal failure, interpane dusting or misting and replacement of same.

PART 2 Products

2.1 MATERIALS: FLAT GLASS

.1 Float glass: to CAN/CGSB-12.3, Glazing quality.

.2 Safety (tempered) glass: to CAN/CGSB-12.1, transparent.

.1 Type 2-tempered.

.2 Class B-float.

.3 Heat absorbing glass: to CAN/CGSB-12.4.

.1 Type: Insulating glass unit.

.2 Class: Heat strengthened.

.4 Silvered mirror glass: thickness to suit mirror dimensions.

.1 Type 3A-tempered.

2.2 MATERIALS: EXTERIOR SEALED INSULATING TRIPLE UNITS

.1 Refer to Section 08 54 13 Fiberglass Windows and drawings.

.2 Refer to Section 08 90 10 Door, Frame and Hardware Schedule and drawings.

.3 Performance: Maximum centre-of-glazing U-factor:

.1 0.79 W/m²K (0.14 Btu/hour ft²F)

.4 Insulating glass units: to CAN/CGSB 12.8, triple glazed unit; 44 mm overall thickness.

.1 Glass: to CAN/CGSB 12.1 and 12.3.

.2 Glass thickness: sized to in CAN/CGSB-12.20 and National Building Code to 1 in 50 hourly wind pressure level of 0.75 kPa – Open Terrain.

.1 Minimum lite thickness 6mm

.3 Exterior lite:

.1 Heat strengthened.

.2 Colour clear.

.4 Inter cavity space thickness: 12.5 mm

.5 Interior Lites:

.1 Heat strengthened.

.2 Low-E Glass coating: PPG “Solar Ban 60” soft coat low ‘e’

.3 Colour: clear.

.4 Coating surface #2 and surface #5.

.6 Inert gas fill: argon.

.7 Spacer: warm edge spacer PPG “Intercept” Black colour.

.8 U-value of sealed unit 0.18

.9 Solar Heat Gain Coefficient: 0.24

.10 Visible Transmittance: 0.41

2.3 LAMINATED GLASS UNIT

.1 Laminated glass: to ASTM C-1172

.1 Type: Full surface layer of 0.762 mm polyvinyl butyral (PVB) interlayer compressed between two panes of 6 mm tempered glass unless noted otherwise.

2.4 SAFETY (TEMPERED) GLASS:

.1 Safety glass: to CAN/CGSB-12.1, transparent, thickness as indicated.

.1 Type 2-tempered.

.2 Class B-float.

.3 Category 1 and 2 as applicable.

.4 Square edge.

2.5 POLYCARBONATE (Window frames only)

.1 Single 12.7 mm overall thickness polycarbonate sheet, clear colour.

.2 Ballistic performance: to ASTM F1233.

.3 Flexural strength: to ASTM D790.

.4 Surface burning characteristics for flame and smoke spread: to ASTM E84.

.5 Self ignition characteristics: to ASTM D1929.

.6 Acceptable product:

.1 Lexan

.2 Approved equivalent.

2.6 SPEAKER PORT

.1 Through glass mounted type, consisting of two circular 152 mm outside diameter perforated 14 gauge stainless steel discs, through bolted.

.2 Perforations: 3 mm dia. holes spaced 10 mm apart each way. Holes in back plate offset 4.8 mm from front plate.

.3 Fasteners: No 8 tamper resistant Torx flat head screws on secure side of room.

.4 Finish: exposed surfaces to ANSI No. 4, satin finish.

.5 Acceptable Product:

.1 Model 45-115-01-SD1 available from Securingcosmos.com.

.2 Metal Fab Services Ltd #820-SD.

2.7 DOME MIRROR

.1 457 mm, 90 degree dome mirror: 3 mm polycarbonate.

2.8 WALL MIRROR

.1 Frame: stainless steel.

.2 Fasteners: vandal resistant clips, size and number to suit mirror dimensions.

2.9 ACCESSORIES

.1 Sealant – refer to Section 07 92 00 – Joint Sealing

.2 Setting blocks: Neoprene, 80-90 Shore 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: Preformed butyl compound, 10-15 Shore durometer hardness to ASTM D2240; coiled on release paper; black colour.

.5 Mirror attachment accessories:

.1 Vandal-resistant stainless steel clips.

PART 3 Execution

3.1 MANUFACTURER'S INSTRUCTIONS

.1 Compliance: Comply with manufacturer's written data, including product technical bulletins, product catalogue installation instructions, product carton installation instructions, and data sheets.

3.2 EXAMINATION

.1 Verify that openings for glazing are correctly sized and within tolerance.

.2 Verify that surfaces of glazing channels or recesses are clean, free of obstructions, and ready to receive glazing.

3.3 PREPARATION

.1 Clean contact surfaces with solvent and wipe dry.

.2 Seal porous glazing channels or recesses with substrate compatible primer or sealer.

.3 Prime surfaces scheduled to receive sealant.

3.4 INSTALLATION: INTERIOR - DRY METHOD (TAPE AND TAPE)

.1 Perform work in accordance with FGMA Glazing Manual for glazing installation methods.

.2 Cut glazing tape to length and set against permanent stops, projecting 1.6 mm above sight line.

.3 Place setting blocks at 1/4 points, with edge block maximum 150 mm from corners.

.4 Rest glazing on setting blocks and push against tape for full contact at perimeter of light or unit.

.5 Place glazing tape on free perimeter of glazing in same manner described.

.6 Install removable stop without displacement of tape. Exert pressure on tape for full continuous contact.

.7 Knife trim protruding tape.

3.5 INSTALLATION: EXTERIOR SEALED UNITS

.1 Install to window and steel frame manufacturer’s instructions.

3.6 INSTALLATION: LAMINATED/ TEMPERED GLAZED UNITS

.1 Refer to drawings for glazing configuration and installation.

.2 Install laminated glazing on exterior lite of sealed units.

.3 Perform work in accordance with FGMA Glazing Manual for glazing installation methods.

3.7 INSTALLATION: SAFETY (TEMPERED) GLASS:

.1 Refer to Section 08 06 01 Door Frame and Hardware Schedule and as noted in drawings.

.2 Perform work in accordance with FGMA Glazing Manual for glazing installation methods.

3.8 INSTALLATION: POLYCARBONATE (WINDOW FRAMES ONLY)

.1 Refer to drawings for configuration and installation.

3.9 INSTALLATION: MIRRORS

.1 Set mirrors with clips. Anchor rigidly to wall construction.

.2 Place plumb and level.

.3 Refer to drawings for locations.

3.10 SPEAKER PORT

.1 Cut opening in glass for speaker port.

.2 Install speaker port according to manufacturer’s written instructions.

3.11 CLEANING

.1 Perform cleaning after installation to remove construction and accumulated environmental dirt.

.2 Remove traces of primer, caulking.

.3 Remove glazing materials from finish surfaces.

.4 Remove labels after work is complete.

.5 Clean glass using approved non-abrasive cleaner in accordance with manufacture's instructions.

3.12 PROTECTION OF FINISHED WORK

.1 After installation, mark light with an "X" by using removable plastic tape or paste.

3.13 SCHEDULE

.1 Refer to Specifications and Drawings.

.2 Wall Mirrors

.1 Room 128

END OF SECTION

PART 1 General

1.1 RELATED SECTIONS

.1 Section 07 92 00 – Joint Sealing.

.2 Section 08 11 14 - Metal Doors and Frames.

.3 Section 08 80 50 – Glazing

1.2 REFERENCES

.1 Canadian General Standards Board (CGSB).

.1 CAN/CGSB-12.1-M90, Tempered or Laminated Safety Glass.

.2 Flat Glass Manufacturers Association (FGMA).

.1 FGMA Glazing Manual - 1997.

1.3 SYSTEM DESCRIPTION

.1 Performance Requirements:

.1 Provide 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.

1.4 SUBMITTALS

.1 Product Data:

.1 Submit manufacturer's printed product literature, specifications and data sheet in accordance with Section 01 33 00 - Submittal Procedures.

.2 Submit test data substantiating triple glazed sealed units meets specified maximum centre-of-glazing U-factor.

.2 Shop Drawings:

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

.3 Samples:

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

.2 Sealed Units: Submit duplicate 300 x 300 mm size samples of sealed units.

.4 Manufacturer's Instructions:

.1 Submit manufacturer's installation instructions in accordance with Section 01 33 00 - Submittal Procedures.

.5 Closeout Submittals:

.1 Provide maintenance data including cleaning instructions for incorporation into manual specified in Section 01 78 00 - Closeout Submittals.

1.5 WARRANTY

.1 Contractor's Warranty –Contractor shall warrant the work in accordance with the General Conditions.

.2 Product Warranty – Provide a five (5) year manufacturer's warranty for sealed glazing units. Include coverage for sealed glass units from seal failure, interpane dusting or misting and replacement of same.

PART 2 Products

2.1 STANDARD OF ACCEPTANCE

.1 Sound transmission class for complete unit: minimum STC 46.

.2 Acceptable Product

.1 Vision Control by Unicel Architectural.

2.2 MATERIALS: LAMINATED GLASS UNIT

.1 Laminated glass: to ASTM C-1172

.1 Type: Full surface layer of 0.762 mm polyvinyl butyral (PVB) interlayer compressed between two panes of 6 mm tempered glass for each pane of glazing.

2.3 MATERIALS: LOUVERS, FRAMES AND OPERATORS

.1 Louvers: Hollow extruded aluminum, interlocking profile, 6mm thick x 35mm deep; Duracron K-1285 Gloss White finish.

.2 Manual Operators: Thumb wheel type.

.3 Glass Frame (Trim Kit): Welded metal frame sized to accept 63mm thick glass.

2.4 ACCESSORIES

.1 Sealant – refer to Section 07 92 00 – Joint Sealing

.2 Setting blocks: Neoprene, 80-90 Shore 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: Preformed butyl compound, 10-15 Shore durometer hardness to ASTM D2240; coiled on release paper; black colour.

2.5 FABRICATION

.1 Sealed Insulated Glass Units:

.1 Comply with ASTM E2190,

.2 Fabricate spacer bar frame of tubular aluminum filled with desiccant.

.3 Bond spacer bar frame to glass panes.

.4 Fill space outside frame to glass edge with elastomeric sealant.

PART 3 Execution

3.1 MANUFACTURER'S INSTRUCTIONS

.1 Compliance: Comply with manufacturer's written data, including product technical bulletins, product catalogue installation instructions, product carton installation instructions, and data sheets.

3.2 EXAMINATION

.1 Verify that openings for glazing are correctly sized and within tolerance.

.2 Verify that surfaces of glazing channels or recesses are clean, free of obstructions, and ready to receive glazing.

3.3 PREPARATION

.1 Clean contact surfaces with solvent and wipe dry.

.2 Seal porous glazing channels or recesses with substrate compatible primer or sealer.

.3 Prime surfaces scheduled to receive sealant.

3.4 INSTALLATION: INTERIOR - DRY METHOD (TAPE AND TAPE)

.1 Perform work in accordance with FGMA Glazing Manual 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 CAULKING

.1 Seal full perimeter of both sides of observation control window frame with approved caulking, prior to installation of polycarbonate glazing screen.

3.6 CLEANING

.1 Perform cleaning after installation to remove construction and accumulated environmental dirt.

.2 Remove traces of primer, caulking.

.3 Remove glazing materials from finish surfaces.

.4 Remove labels after work is complete.

.5 Clean glass using approved non-abrasive cleaner in accordance with manufacture's instructions.

3.7 PROTECTION OF FINISHED WORK

.1 After installation, mark light with an "X" by using removable plastic tape or paste.

3.8 SCHEDULE

.1 Refer to Specifications and Drawings.

END OF SECTION

General notes:
.1 This schedule is to be read in conjunction with the Drawings and applicable Specification Sections**.**
.2 Refer to Section 08 71 10, Door Hardware for hardware groups.
.3 Refer to Drawings for door and frame types
.4 Refer to Electrical for Card reader rough-ins, door contacts, power operators and associated power. Hardware manufacturer/installer shall be responsible for making all low voltage connections.
.5 Verify all door and frame sizes prior to ordering.

Door No.	Door				Frame			Rating (Min.)	Glass	Additional Requirements
	Size	Type	Mat'l	Fin.	Type	Mat'l	Fin.			
Main Floor – Refer to Drawing A2.1										
101A	1000 X 2150	A	IMD	PT5	F6*	PS	PT4	-	TG	Electric strike. Door viewer.
101B	1000 X 2150	C	HM	PT5	F7	PS	PT6	-	TG	Electric strike.
102	1000 X 2150	A	HM	PT5	F1*	PS	PT6	-	-	Electric strike. Door viewer.
103	900 X 2150	A	HM	PT5	F1	PS	PT6	-	-	
104A	900 X 2150	A	ASD	PT5	F2	PS	PT6	-	-	
104B	900 X 2150	A	HM	PT5	F1	PS	PT6	-	-	Keyed on Room 104 side.
105	900 X 2150	A	WFD	S/V	F1	PS	PT6	-	-	
106	900 X 2150	A	ASD	PT5	F2	PS	PT6	-	-	
107A	1016 X 2133	A	IMD	PT5	F4*	PS	PT4	-	-	Door viewer.
107B	1016 X 2133	C	HM	PT5	F8	PS	PT6	-	TG	
108	900 X 2150	A	HM	PT5	F1*	PS	PT6	-	-	Keyed on Corridor 108 side. Electric Strike. Door viewer.
109	900 X 2150	A	WFD	S/V	F1	PS	PT6	-	-	
114A	900 X 2150	A	ASD	PT5	F2	PS	PT6	-	-	Keyed on 102 side.
114B	900 X 2150	A	ASD	PT5	F2	PS	PT6	-	-	Keyed on Interview 114 side.
115	900 X 2150	A	WFD	S/V	F8	PS	PT6	-	TG	
116	1000 X 2150	D	WFD	S/V	F1	PS	PT6	-	TG	
117	900 X 2150	A	WFD	S/V	F1	PS	PT6	-	-	
118	900 X 2150	A	WFD	S/V	F1	PS	PT6	-	-	
119	900 X 2150	A	WFD	S/V	F1	PS	PT6	-	-	
121	750 X 2150	A	WFD	S/V	F1	PS	PT6	-	-	Undercut Door 25mm
122	900 X 2150	A	WFD	S/V	F1	PS	PT6	-	-	
124	750 X 2150	A	WFD	S/V	F1	PS	PT6	-	-	Undercut Door 25mm
125	1000 X 2150	A	IMD	PT5	F4*	PS	PT4	-	-	Door viewer.

Door No.	Door				Frame			Rating (Min.)	Glass	Additional Requirements
	Size	Type	Mat'l	Fin.	Type	Mat'l	Fin.			
126	900 X 2150	A	ASD	PT5	F2	PS	PT6	-	-	
127	900 X 2150	A	HM	PT5	F1*	PS	PT6	45 MIN.	-	Electric strike.
128	900 X 2150	D	WFD	S/V	F1	PS	PT6	-	TG	
129	900 X 2150	A	WFD	S/V	F1*	PS	PT6	-	-	Electric strike.
130	900 X 2150	A	ASD	PT5	F2*	PS	PT6	-	-	Electric strike.
131A	1000 X 2150	A	IMD	PT5	F4*	PS	PT4	-	-	Electric strike. Door viewer.
131B	1000 X 2150	D	HM	PT5	F8	PS	PT6	-	-	
132A	NOT USED									
132B	1000 X 2150	A	HM	PT5	F1	PS	PT6	45 MIN.	-	
133	900 X 2150	A	HM	PT5	F1*	PS	PT6	45 MIN.	-	Electric strike.
134	900 X 2150	A	HM	PT5	F1*	PS	PT6	45 MIN.	-	Electric strike.
135	900 X 2150	A	HM	PT5	F1*	PS	PT6	45 MIN.	-	
136	900 X 2150	A	HM	PT5	F1*	PS	PT6	45 MIN.	-	Electric strike.
137	900 X 2150	A	HM	PT5	F1	PS	PT6	45 MIN.	-	
138	900 X 2150	A	HM	PT5	F1	PS	PT6	45 MIN.	-	
139	1000 X 2150	A	HM	PT5	F1	PS	PT6	45 MIN.	-	
140	900 X 2150	A	HM	PT5	F1	PS	PT6	45 MIN.	-	
141	900 X 2150	A	HM	PT5	F1	PS	PT6	45 MIN.	-	
142A	900 X 2150	A	HMI	PT5/ EL	F1	PS	PT4	-	-	Door viewer.
142.1	750 X 2150	A	HM	EL	F1	PS	EL	-	-	
142.2	750 X 2150	A	HM	EL	F1	PS	EL	-	-	
142B	900X2150	A	HM	EL	F1*	PS	EL	1.5 HR.	-	Electric strike. Door viewer both sides.
143	1000 X 2150	E	STL	EL	F9	-	EL	-	LX	Hardware as specified
144	1000 X 2150	E	STL	EL	F9	-	EL	-	LX	Hardware as specified
145	900 X 2150	F	HM	EL	F1	PS	EL	-	LX	
146	1000 X 2150	E	STL	EL	F9	-	EL	-	LX	Hardware as specified
147	1000 X 2150	E	STL	EL	F9	-	EL	-	LX	Hardware as specified
148A	900 X 2150	A	IMD	PT6	F4	PS	PT4	-	-	Door viewer.
148B	3000W X 2400H	G	-	-	F10*	-	PT4	-	-	Sectional Metal Door

Door No.	Door				Frame			Rating (Min.)	Glass	Additional Requirements
	Size	Type	Mat'l	Fin.	Type	Mat'l	Fin.			
148C	900 X 2150	A	HM	EL	F1*	PS	EL	1.5 HR.	-	Electric strike. Door viewer both sides
149	900 X 2150	A	ASD	EL	F2	PS	EL	-	-	
151	900 X 2150	F	HM	EL	F1	PS	EL	-	LX	Undercut Door 25mm
152	900 X 2150	A	HM	EL	F1	PS	EL	-	-	
153A	900 X 2150	A	ASD	EL	F2	PS	EL	-	-	
153B	900 X 2150	A	ASD	PT5	F2	PS	PT6	-	-	
154	900 X 2150	A	HM	EL	F1	PS	EL	-	-	Undercut Door 25mm
155	900 X 2150	A	HM	EL	F1	PS	EL	-	-	
156	900 X 2150	A	HM	EL	F1	PS	EL	-	-	Undercut Door 25mm
157A	900 X 2150	A	IMD	PT6	F1	PS	PT4	-	-	
157B	3000W X 2400H	G	-	-	F11	-	PT4	-	-	Sectional Metal Door
Service Space – Refer to Drawing A2.2										
201A	1000 X 2150	A	HM	PT5	F1*	PS	PT6	45 MIN.	-	
201B	2-900 X 2150	A	HM	PT5	F1	PS	PT6	1 HR.	-	Keyed on Room 201 side.
201C	900 X 1500	A	IMD	PT6	F5*	PS	PT4	-	-	

Abbreviations:

EL – Elastomeric Coating (09 96 53)
HM – Hollow Metal Door (08 11 00)
ASD – Acoustic Steel Door (08 34 74)
IMD – Insulated Metal Door (08 11 00)
LX – Lexan (08 34 63)
PT# – Paint (# Denotes Colour) (09 91 13 & 09 91 23)
PS – Pressed Steel Frame (welded) (08 11 00 & 08 34 74)
WFD – Wood Flush Door (08 14 16)
TG – Tempered Glass (08 80 50)
STL – Steel (08 34 63)
S/V – Stain and Varnish (09 91 23)

Notes:

F# * denotes a frame with special security requirements, refer to electrical, drawings E8.1, E8.2, E8.3

2913This schedule is to be read in conjunction with the Drawings and Specification Sections.

Room No.	Floor	Base	Walls				Ceiling	Notes:
			N	S	E	W		
101	CONC P	RB	PT1	PT1	PT1	BR	MTL	RECESSED ENTRANCE MAT
102	CONC P	RB	PT1	PT1	PT1	PT1	MTL / GB-PT1	
103	FLUF	COV	PT1	PT1	PT1	PT1	GB-PT1	
104	RFF	RB	PT7	PT1	PT1	PT1	ATC	
105	RFF	RB	PT1	PT1	PT1	PT1	ATC	
106	RFF	RB	PT1	PT1	PT1	PT1	ATC	
107	CONC P	RB	PT1	PT1	PT1	PT1	GB-PT1	RECESSED ENTRANCE MAT
108	CONC P	RB	PT1	PT1	PT1	PT1	ATC	
109	FLUF	COV	PT1	PT1	PT1	PT1	GB-PT1	
110	CONC P	RB	PT1	PT1	CER	PT1	GB-PT1	
111	CONC P	RB	PT1	PT1	PT1	PT1	EXP / GB-PT1	STAIN U/ S WOOD DECK
112	CONC P	RB	PT1	PT1	PT1	PT1	EXP	STAIN U/ S WOOD DECK
113	CONC P	RB	PT1/ APT1	PT1 / PT7 / APT1	PT1/ APT1	PT1 / PT7 / APT1	EXP / DCP / ATC	STAIN U/ S WOOD DECK
114	RFF	RB	PT1	PT1	PT1	PT1	ATC	
115	RFF	RB	PT1	PT1	PT1	PT1	ATC	
116	CONC P	RB	EL	PT2	PT2 / EL	PT2	ATC	EL ON CONC. BLOCK WALLS
117	CONC P	RB	PT2	PT2	PT2	PT2	ATC	
118	CONC S	RB	PT2	PT2	PT2	PT2	ATC	
119	CONC P	RB	PT1/CER	PT1 / CER	PT1	PT1	ATC	REFER TO INTERIOR ELEVATIONS FOR LOCATIONS OF CERAMIC TILE ON WALLS
120	CONC P	RB	PT1	PT1	PT1	PT1	ATC/ GB-PT1	
121	CONC P	RB	CER	CER	CER	CER	GB-PT1	
122	CONC P	RB	PT1 / CER	PT1/CER	PT1	PT1	ATC	
123	CONC P	RB	PT1	PT1	PT1	PT1	ATC/ GB-PT1	
124	CONC P	RB	CER	CER	CER	CER	GB-PT1	
125	CONC P	RB	PT1	PT1	PT1	PT1	ATC	
126	CONC P	RB	PT1	PT1	PT1	PT1	ATC	
127	CONC P	RB	PT2	PT2	PT2	PT2	ATC	
128	RSF	RB	PT7	PT1	PT1	PT1	ATC	
129	CONC P	RB	PT2	PT2	PT2	PT2	ATC	

Room No.	Floor	Base	Walls				Ceiling	Notes:
			N	S	E	W		
130	RFF	RB	PT2	PT2	PT2	PT2	ATC	
131	CONC P	RB	PT2	PT2	PT2	PT2	GB-PT1	RECESSED ENTRANCE MAT
132	CONC P	RB	EL	EL	EL	EL	ATC	
133	CONC P	RB	EL	EL	EL	EL	EXP	
134	FLUF	COV	EL	EL	EL	EL	EXP	
135	FLUF	COV	EL	EL	EL	EL	EXP	
136	FLUF	COV	EL	EL	EL	EL	EXP	
137	FLUF	COV	EL	EL	EL	EL	EXP	
138	FLUF	COV	EL	EL	EL	EL	EXP	
139	CONC S	RB	PT2	PT2	PT2	PT2	EXP	
140	CONC S	RB	PT2	PT2	PT2	PT2	EXP	
141	CONC S	RB	PT2	PT2	PT2	PT2	EXP	
142	FLUF	COV	EL	EL	EL	EL	EL	
142.1	CONC S	-	EXP	EXP	EXP	EXP	EXP	
142.2	CONC S	-	EXP	EXP	EXP	EXP	EXP	
143	FLUF	COV	EL	EL	EL	EL	EL	
144	FLUF	COV	EL	EL	EL	EL	EL	
145	FLUF	COV	EL	EL	EL	EL	EL	
146	FLUF	COV	EL	EL	EL	EL	EL	
147	FLUF	COV	EL	EL	EL	EL	EL	
148	FLUF	COV	EL	EL	EL	EL	EXP	
149	FLUF	COV	APT1	APT1	APT1	APT1	APT1	
150	FLUF	COV	EL	EL	EL	EL	EL	
151	FLUF	COV	EL	EL	EL	EL	EL	
152	FLUF	COV	EL	EL	EL	EL	EL	
153	FLUF	COV	EL	EL	EL	EL	EL	
154	FLUF	COV	EL	EL	EL	EL	EL	
155	FLUF	COV	EL	EL	EL	EL	EL	
156	FLUF	COV	EL	EL	EL	EL	EL	
157	CONC S&H	RB	-	-	-	-	GBP	
201	CONC S	RB	PT2	PT2	PT2	PT2	EXP	

List of Abbreviations:

APT1	ACOUSTIC PANEL TYPE 1 (09 84 00)
APT2	ACOUSTIC PANEL TYPE 2 (09 84 00)
ATC	ACOUSTIC TILE CEILING (09 51 13 & 09 53 01)
BR	BRICK MASONRY (04 21 13)
CER	CERAMIC TILE (09 30 13)
CONC P	POLISHED CONCRETE (03 35 43)
CONC S	SEALED CONCRETE (03 35 00)
CONC S&H	SEALED AND HARDENED CONCRETE (03 35 00)
COV	COVED FLOORING BASE (09 67 00)
RFF	RUBBER FLOCKED FLOORING (09 65 18)
DCP	DECORATIVE CEILING PANEL (09 51 13)
EL	ELASTOMERIC COATING (09 96 53)
EXP	EXPOSED
FLUF	FLUID APPLIED FLOORING (09 67 00)
GB	GYPSUM BOARD – PAINTED (09 91 23)
MTL	LINEAR METAL (09 54 23)
PT#	PAINT (# DENOTES COLOUR) (09 91 23)
RB	RUBBER BASE (09 68 00)
RSF	RUBBER SPORT FLOORING (09 65 20)

Part 1 General

1.1 RELATED SECTIONS

.1 Section 06 10 00 – Rough Carpentry.

.2 Section 07 27 00 – Air and Vapour Barriers.

.3 Section 09 06 01 – Room Finish Schedule.

.4 Section 09 22 16 – Non-Structural Metal Framing.

.5 Section 09 51 13 – Acoustical Panel Ceilings.

1.2 REFERENCES

.1 American Society for Testing and Materials International, (ASTM)

.1 ASTM C36/C36M-03e1, Specification for Gypsum Wallboard.

.2 ASTM C475-12, Specification for Joint Compound and Joint Tape for Finishing Gypsum Board.

.3 ASTM C840-11, Specification for Application and Finishing of Gypsum Board.

.4 ASTM C841-03(2008), Standard Specification for Installation of Interior Lathing and Furring.

.5 ASTM C1002-07, Specification for Steel Self-Piercing Tapping Screws for the Application of Gypsum Panel Products or Metal Plaster Bases to Wood Studs or Steel Studs.

.6 ASTM C1047-10a, Specification for Accessories for Gypsum Wallboard and Gypsum Veneer Base.

.7 ASTM C1178/C1178M-11, Specification for Glass Mat Water-Resistant Gypsum Backing Board.

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

.9 ASTM C1629/C1629M-06(2011), Standard Classification for Abuse-Resistant Nondecorated Interior Gypsum Panel Products and Fiber-Reinforced Cement Panels

.2 Association of the Wall and Ceilings Industries International (AWEI)

.3 Canadian General Standards Board (CGSB)

.1 CAN/CGSB-51.34-M86(R1988), Vapour Barrier, Polyethylene Sheet for Use in Building Construction.

.4 Underwriters' Laboratories of Canada (ULC)

.1 CAN/ULC-S102-2007, Surface Burning Characteristics of Building Materials and Assemblies.

1.3 MOCK-UP

.1 Provide mock-up in accordance with Section 01 45 00 – Quality Control.

.2 Provide 1 hydronic access panel mock-up.

.1 Include framed opening, gypsum board paneling around access cover and access cover with gypsum board insert.

.2 Coordinate location of mock-up with Department Representative.

1.4 DELIVERY, STORAGE AND HANDLING

.1 Deliver materials in original packages, containers or bundles bearing manufacturers brand name and identification.

.2 Store materials inside, level, under cover. Keep dry. Protect from weather, other elements and damage from construction operations and other causes.

.3 Handle gypsum boards to prevent damage to edges, ends or surfaces. Protect metal accessories and trim from being bent or damaged.

.4 Waste Management and Disposal:

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

1.5 SITE ENVIRONMENTAL REQUIREMENTS

.1 Maintain temperature minimum 10 degrees C, maximum 21 degrees C for 48 hours prior to and during application of gypsum boards and joint treatment, and for at least 48 hours after completion of joint treatment.

.2 Apply board and joint treatment to dry, frost free surfaces.

.3 Ventilation: Ventilate building spaces as required to remove excess moisture that would prevent drying of joint treatment material immediately after its application.

Part 2 Products

2.1 MATERIALS

.1 Standard board: to ASTM C36/C36M, Type X, 16 mm thick, 1200 mm wide x maximum practical length, ends square cut, edges bevelled.

.2 Moisture-and mold resistant gypsum board: to ASTM C1396/C1396M, regular, thickness as indicated in drawings thickness as indicated in drawings, 1200 mm wide x maximum practical length.

.3 Water-resistant gypsum board (Water-Resistant Fiber-Reinforced Gypsum Backing Panels): to ASTM 1278 regular, thickness as indicated in drawings, 1200 mm wide x maximum practical length

.4 Metal Access doors: frameless, welded construction, push latching door, removable door, accepts 12.7 mm or 15.9 mm gypsum board, exposed frames paintable.

.5 Metal furring runners, hangers, tie wires, inserts, and anchors required for installation to ASTM C841.

.6 Drywall furring channels: 0.5 mm core thickness galvanized steel channels for screw attachment of gypsum board.

.7 Resilient drywall furring: 0.5 mm base steel thickness galvanized steel for resilient attachment of gypsum board.

.8 Metal channel stiffener: 19 x 1.4 mm thick cold rolled steel, coated with rust inhibitive coating.

.9 Steel drill screws: to ASTM C1002.

.10 Casing beads, corner beads, control joints and edge trim: to ASTM C1047, metal, zinc-coated by electrolytic process, 0.5 mm base thickness, perforated flanges, one piece length per location.

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

.12 Acoustic sealant: in accordance with Section 07 92 00 - Joint Sealants.

.13 Polyethylene: to CAN/CGSB-51.34, Type 2.

.14 Insulating strip: rubberized, moisture resistant, 3 mm thick closed cell neoprene strip, 12 mm wide, with self-sticking permanent adhesive on one face, lengths as required.

.15 Joint compound: to ASTM C475, asbestos-free.

Part 3 Execution

3.1 ERECTION

.1 Do application and finishing of gypsum board in accordance with ASTM C840 except where specified otherwise.

.2 Erect hangers and runner channels for suspended gypsum board ceilings in accordance with ASTM C840 except where specified otherwise.

.3 Support light fixtures by providing additional ceiling suspension hangers within 150 mm of each corner and at maximum 600 mm around perimeter of fixture.

.4 Install work level to tolerance of 1:1200.

.5 Frame with furring channels, perimeter of openings for access panels, light fixtures, diffusers, and grilles.

.6 Furr for gypsum board faced vertical bulkheads within and at termination of ceilings.

.7 Install gypsum board fire and sound stops and to form plenum areas to underside of wood roof deck above suspended ceilings as indicated.

.8 Install wall furring for gypsum board wall finishes in accordance with ASTM C840, except where specified otherwise.

.9 Furr openings and around built-in equipment, cabinets, access panels, on four sides. Extend furring into reveals. Check clearances with equipment suppliers.

.10 Frame out wall recess for hydronic access panel. Top of framed opening not to exceed 820 mm above floor slab.

.11 Furr duct shafts, beams, columns, pipes and exposed services where indicated.

.12 Erect drywall resilient furring transversely across studs, spaced maximum 600 mm on centre and not more than 150 mm from ceiling/wall juncture. Secure to each support with 25 mm drywall screw.

3.2 APPLICATION

.1 Do not apply gypsum board until bucks, anchors, blocking, sound attenuation, electrical and mechanical work are approved.

.2 Apply single and double layer gypsum board (as indicated on drawings) to metal furring or framing using screw. Maximum spacing of screws, 300 mm on centre.

.1 Single-Layer Application:

.1 Apply gypsum board on ceilings prior to application of walls in accordance with ASTM C840.

.2 Apply gypsum board vertically or horizontally, providing sheet lengths that will minimize end joints.

.2 Double-Layer Application:

.1 Install gypsum board for base layer and exposed gypsum board for face layer.

.2 Apply base layer to ceilings prior to base layer application on walls; apply face layers in same sequence. Offset joints between layers at least 250 mm.

.3 Apply base layers at right angles to supports unless otherwise indicated.

.4 Apply base layer on walls and face layers vertically with joints of base layer over supports and face layer joints offset at least 250 mm with base layer joints.

.3 Install ceiling boards in direction that will minimize number of end-butt joints. Stagger end joints at least 250 mm.

.4 Install gypsum board on walls vertically to avoid end-butt joints. At stairwells and similar high walls, install boards horizontally with end joints staggered over studs, except where local codes or fire-rated assemblies require vertical application.

.5 Install gypsum board with face side out.

.6 Do not install damaged or damp boards.

.7 Locate edge or end joints over supports. Stagger vertical joints over different studs on opposite sides of wall.

.8 Apply water resistant, fiber-reinforced gypsum board panels where wall tiles to be applied. Apply water-resistant sealant to edges, ends, cut-outs which expose gypsum core and to fastener heads. Do not apply joint treatment on areas to receive tile finish.

.9 Apply moisture and mold resistant panels to interior side of walls in washrooms Room 119 and Room 122 in locations where gypsum board is to be painted. Thickness and type to match gypsum board specified in Wall Type.

3.3 INSTALLATION

.1 Erect accessories straight, plumb or level, rigid and at proper plane. Use full length pieces where practical. Make joints tight, accurately aligned and rigidly secured. Mitre and fit corners accurately, free from rough edges. Secure at 150 mm on centre.

.2 Install casing beads around perimeter of suspended ceilings.

.3 Install casing beads where gypsum board butts against surfaces having no trim concealing junction and where indicated.

.4 Construct control joints of preformed units set in gypsum board facing and supported independently on both sides of joint.

.5 Provide continuous polyethylene dust barrier behind and across control joints.

.6 Apply 12 mm diameter bead of acoustic sealant continuously around perimeter of first layer of multiple layers of gypsum board to seal gypsum board/structure junction where partitions abut fixed building components. Seal full perimeter of cut-outs around electrical boxes, ducts, and penetrations, in partitions where perimeter sealed with acoustic sealant.

.7 Install access doors to electrical and mechanical fixtures specified in respective sections.

.1 Rigidly secure frames to furring or framing systems.

.8 Finish face panel joints and internal angles with joint system consisting of joint compound, joint tape and taping compound installed according to manufacturer's directions and feathered out onto panel faces.

.9 Gypsum Board Finish: finish gypsum board walls and ceilings to following levels in accordance with Association of the Wall and Ceiling Industries (AWCI) International Recommended Specification on Levels of Gypsum Board Finish:

.1 Levels of finish:

.1 Level 0: No tapping, finishing or accessories required.

.2 Level 1: Embed tape for joints and interior angles in joint compound. Surfaces to be free of excess joint compound; tool marks and ridges are acceptable.

.3 Level 2: Embed tape for joints and interior angles in joint compound and apply one separate coat of joint compound over joints, angles, fastener

heads and accessories; surfaces free of excess joint compound; tool marks and ridges are acceptable.

.4 Level 3: Embed tape for joints and interior angles in joint compound and apply two separate coats of joint compound over joints, angles, fastener heads and accessories; surfaces smooth and free of tool marks and ridges.

.5 Level 4: Embed tape for joints and interior angles in joint compound and apply three separate coats of joint compound over joints, angles, fastener heads and accessories; surfaces smooth and free of tool marks and ridges.

.6 Level 5: Embed tape for joints and interior angles in joint compound and apply three separate coats of joint compound over joints, angles, fastener heads and accessories; apply a thin skim coat of joint compound to entire surface; surfaces smooth and free of tool marks and ridges.

.10 Finish corner beads, control joints and trim as required with two coats of joint compound and one coat of taping compound, feathered out onto panel faces.

.11 Fill screw head depressions with joint and taping compounds to bring flush with adjacent surface of gypsum board so as to be invisible after surface finish is completed.

.12 Sand lightly to remove burred edges and other imperfections. Avoid sanding adjacent surface of board.

.13 Completed installation to be smooth, level or plumb, free from waves and other defects and ready for surface finish.

.14 Mix joint compound slightly thinner than for joint taping.

.15 Apply thin coat to entire surface using trowel or drywall broadknife to fill surface texture differences, variations or tool marks.

.16 Allow skim coat to dry completely.

.17 Remove ridges by light sanding or wiping with damp cloth.

.18 Provide protection that ensures gypsum drywall work will remain without damage or deterioration at time of substantial completion.

3.4 CONTROL JOINTS

.1 Provide control joints at not greater than 9 m spacing on continuous gypsum board walls in a single plane and at not greater than 9 m spacing on ceilings and bulkheads except where indicated otherwise in the drawings.

.1 Confirm location of control joints with the Consultant prior to installation of gypsum board

.2 Provide control joints of preformed units set in gypsum board facing and supported independently on both sides of joint. Interrupt top and bottom tracks at location of control joint.

.3 Install control joints straight and true. Finish control joints as required with two coats of joint compound and one coat of taping compound, feathered out onto panel faces.

3.5 HYDRONIC ACCESS PANELS

.1 Coordinate installation with Mechanical.

.2 Secure frames rigidly in place, plumb and level in opening, with plane of door and panel face aligned with adjacent finished surfaces.

.3 Set concealed frame type units flush with adjacent finished surfaces.

.4 Position unit to provide convenient access to concealed work requiring access.

3.6 FINISH SCHEDULES

.1 Levels of finish: Interior partitions;

- .1 Level 1:
  - .1 Plenums above suspended ceilings, inside of duct shafts and other gypsum board wall areas not exposed to view.
- .2 Level 4:
  - .1 Vertical surfaces (walls) exposed to view.
  - .2 Ceilings and underside of bulkheads exposed to view.
- .3 Level 5:
  - .1 As noted in drawings.

END OF SECTION

Part 1 General

1.1 REFERENCES

.1 American Society for Testing and Materials International, (ASTM).

.1 ASTM C645-11a, Specification for Nonstructural Steel Framing Members.

.2 ASTM C754-11, Specification for Installation of Steel Framing Members to Receive Screw-Attached Gypsum Panel Products.

.2 Canadian Standards Association (CSA International)

.1 CSA W59-03(R2008),Welded Steel Construction (Metal Arc Welding).

1.2 QUALITY ASSURANCE

.1 Test Reports: certified test reports showing compliance with specified performance characteristics and physical properties.

.2 Certificates: product certificates signed by manufacturer certifying materials comply with specified performance characteristics and criteria and physical requirements.

Part 2 Products

2.1 MATERIALS

.1 Non-load bearing channel stud framing: to ASTM C645, stud size as noted on drawings and Partition Schedule, roll formed from 0.478 mm steel (25ga) and from 1.146 steel (18ga) as noted on drawings and Partition Schedule; hot dipped galvanized steel sheet, for screw attachment of gypsum board. Knock-out service holes at 460 mm centres.

.2 Floor and ceiling tracks: to ASTM C645, in widths to suit stud sizes, 32 mm flange height. Thickness as noted for studs in Partition Schedule.

.3 Metal channel stiffener: cold rolled steel, coated with rust inhibitive coating.

.4 Acoustical sealant: in accordance with Section 07 92 00 – Joint Sealants.

.5 Insulating strip: rubberized, moisture resistant 3 mm thick closed cell neoprene strip, 12 mm wide, with self sticking permanent adhesive on one face, lengths as required.

.6 Welding materials: to CSA W59.

Part 3 Execution

3.1 ERECTION

.1 Align partition tracks at floor and ceiling and secure at 400 mm on centre maximum.

.2 Install damp proof course under stud shoe tracks of partitions on slabs on grade.

.3 Place studs vertically at 400 mm on centre or as noted on drawings.

.4 Install studs not more than 50 mm from abutting walls, and at each side of openings and corners. Position studs in tracks at floor and ceiling.

.5 Cross brace steel studs as required to provide rigid installation to manufacturer's instructions.

.6 Erect metal studding to tolerance of 1:1000.

.7 Attach studs to bottom track using screws.

.8 Co-ordinate simultaneous erection of studs with installation of service lines. When erecting studs ensure web openings are aligned.

.9 Co-ordinate erection of studs with installation of door/window frames and special supports or anchorage for work specified in other Sections.

.10 Provide two studs extending from floor to ceiling at each side of openings wider than stud centres specified. Weld studs together, placed alongside frame anchor clips.

.11 Do welding work in accordance with CSA W59 unless specified otherwise

.12 Erect track at head of door/window openings and sills of sidelight/window openings to accommodate intermediate studs. Secure track to studs at each end, in accordance with manufacturer's instructions. Install intermediate studs above and below openings in same manner and spacing as wall studs.

.13 Frame openings and around built-in equipment, cabinets, access panels, on four sides. Extend framing into reveals. Check clearances with equipment suppliers.

.14 Install steel studs or furring channel between studs for attaching electrical and other boxes.

.15 Extend partitions to ceiling height except where noted otherwise on drawings.

.16 Maintain clearance under beams and structural slabs to avoid transmission of structural loads to studs. Use double track slip joint.

.17 Install continuous insulating strips to isolate studs from uninsulated surfaces.

.18 Install two continuous beads of acoustical sealant or insulating strip under studs and tracks around perimeter of sound control partitions.

3.2 CLEANING

.1 Upon completion of installation, remove surplus materials, rubbish, tools and equipment barriers.

END OF SECTION

PART 1 General

1.1 RELATED SECTIONS

.1 Section 09 06 01 – Room Finish Schedule.

.2 Section 07 92 00 - Joint Sealants

.3 Section 09 21 16 – Gypsum Board Assemblies

1.2 REFERENCES

.1 American National Standards Institute (ANSI)/Ceramic Tile Institute (CTI)

.1 ANSI A108.1-99, Specification for the Installation of Ceramic Tile (Includes ANSI A108.1A-C, 108.4-.13, A118.1-.10, ANSI A136.1).

.2 CTI A118.3-92, Specification for Chemical Resistant, Water Cleanable Tile Setting and Grouting Epoxy and Water Cleanable Tile Setting Epoxy Adhesive (included in ANSI A108.1).

.3 CTI A118.6-92, Specification for Ceramic Tile Grouts (included in ANSI A108.1).

.2 Canadian General Standards Board (CGSB)

.1 CGSB 71-GP-22M-78 (AMEND.), Adhesive, Organic, for Installation of Ceramic Wall Tile.

.2 CAN/CGSB-75.1-M88, Tile, Ceramic.

.3 Terrazzo Tile and Marble Association of Canada (TTMAC)

.1 Tile Specification Guide 09 30 00 2006/2007, Tile Installation Manual.

.2 Tile Maintenance Guide 2000.

1.3 SUBMITTALS

.1 Provide submittals in accordance with Section

.2 Product Data

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

.2 Include manufacturer's information on:

.1 Ceramic tile, marked to show each type, size, and shape required.

.2 Latex cement mortar and grout.

.3 Provide samples in accordance with Section 01 33 00 - Submittal Procedures.

.1 Metal trim: submit duplicate samples, 150 mm in length, of each metal trim.

.2 Adhere tile samples to 11 mm thick plywood and grout joints to represent project installation.

1.4 QUALITY ASSURANCE

.1 Quality Assurance Submittals:

.1 Manufacturer's Instructions: manufacturer's installation instructions.

1.5 DELIVERY, STORAGE AND HANDLING

.1 Deliver, store and handle materials in accordance with Section 01 61 00 - Common Product Requirements.

1.6 AMBIENT CONDITIONS

.1 Maintain air temperature and structural base temperature at ceramic tile installation area above 12 degrees C for 48 hours before, during, and 48 hours after, installation.

.2 Do not install tiles at temperatures less than 12 degrees C or above 38 degrees C.

.3 Do not apply epoxy mortar and grouts at temperatures below 15 degrees C or above 25 degrees C.

1.7 MAINTENANCE

.1 Extra Materials:

.1 Provide maintenance materials in accordance with Section 01 78 00 - Closeout Submittals.

.2 Provide minimum 2% of each type and colour of tile required for project for maintenance use. Store where directed.

.3 Maintenance material same production run as installed material.

.4 Deliver to Owner and store where directed by Owner.

PART 2 Products

2.1 WALL TILE

.1 Porcelain tile: to ISO 13006, CAN/CGSB-75.1,rectified finish, square edges.

.2 Acceptable Manufacturer/Product:

.1 C & S Tile Distributors: Ceramstone collection, “Stonelab” series or approved equivalent.

.1 CER –Stonelab series 300mm x 600mm, Rectified, Colour:Pietra Basaltina, Texture: Matte.

.2 Approved Alternate

2.2 MORTAR AND ADHESIVE MATERIALS

.1 Latex additive: formulated for use in cement mortar and thin set bond coat.

.2 Water: potable and free of minerals and chemicals which are detrimental to mortar and grout mix.

2.3 BOND COAT

.1 Latex Cement mortar: to ANSI A108.1, two-component universal dry-set mortar.

2.4 GROUT

.1 Colouring Pigments:

.1 Pure mineral pigments, limeproof and nonfading, complying with ASTM C979.

.2 Colouring pigments to be added to grout by manufacturer.

.3 Job coloured grout are not acceptable.

.4 Use in Commercial Cement Grout, Dry-Set Grout, and Latex Cement Grout.

.5 Colour to be selected from manufacturers standard range

.2 Latex Cement Grout: to ANSI A108.1, fast curing, high early strength, polymer-modified, stain resistant, sanded mix for floors, unsanded mix for walls and floors with polished tiles commercial tile grout.

2.5 ACCESSORIES

.1 Finishing and Edge Strips: purpose, made metal

.1 Top edge of ceramic wall tile. Extruded, clear anodized aluminum.

1. Acceptable product: Schluter systems; type “Quadec”.

.2 Outside corners of porcelain tile. Extruded, clear anodized aluminum.

1. Acceptable product: Schluter systems; type “Quadec”.

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

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

2.6 CLEANING COMPOUNDS

.1 Refer to Section 01 00 05 – General Requirements.

.2 Specifically designed for cleaning masonry and concrete and which will not prevent bond of subsequent tile setting materials including patching and levelling compounds and elastomeric waterproofing membrane and coat.

.3 Materials containing acid or caustic material are not acceptable.

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 WORKMANSHIP

.1 Do tile work in accordance with TTMAC Tile Installation Manual 2012-2014, "Ceramic Tile", except where specified otherwise.

.2 Apply tile to clean and sound surfaces.

.3 Fit tile around corners, fitments, fixtures, drains and other built-in objects. Maintain uniform joint appearance. Cut edges smooth and even. Do not split tiles.

.4 Maximum surface tolerance 1:800.

.5 Make joints between tile uniform and approximately 4 mm wide, plumb, straight, true, even and flush with adjacent tile. Ensure sheet layout not visible after installation. Align patterns.

.6 Lay out tiles so perimeter tiles are minimum 1/2 size.

.7 Sound tiles after setting and replace hollow-sounding units to obtain full bond.

.8 Make internal angles square, external angles square.

.9 Use square edged tiles and purpose made metal finishing strip at termination of wall tile panels, except where panel abuts projecting surface or differing plane.

.10 Allow minimum 24 hours after installation of tiles, before grouting.

.11 Clean installed tile surfaces after installation and grouting cured.

.12 Make control joints where indicated on drawings. Make joint width same as tile joints. Fill control joints with sealant in accordance with Section 07 92 00 - Joint Sealants.

3.3 WALL TILE

.1 Tile installed on water-resistant, fiber reinforced gypsum board panel..

.1 Install in accordance with TTMAC detail 305W-2012-2014.

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.

END OF SECTION

Part 1 General

1.1 RELATED SECTIONS

.1 Section 09 06 01 – Room Finish Schedule.

.2 Section 09 53 01 - Acoustical Suspension: Suspension system

.3 Division 23 - Air diffusers within ceiling systems

.4 Division 26 - Lighting fixtures within ceiling system

1.2 REFERENCES

.1 American Society for Testing and Materials International (ASTM)

.1 ASTM C635-00 Standard Specification for the Manufacture, Performance, and Testing of Metal Suspension Systems for Acoustical Tile and Lay-in Panel Ceilings

.2 ASTM E 413-87(1999) Standard Classification for Rating Sound Insulation

.3 ASTM E1264-[98], Standard Classification for Acoustical Ceiling Products.

.4 ASTM E1477-[98a(2003)], Standard Test Method for Luminous Reflectance Factor of Acoustical Materials by Use of Integrating-Sphere Reflectometers.

.5 ASTM E 1414-00a Standard test method for Airborne Sound Attenuation Between Rooms sharing a Common Ceiling Plenum

1.3 ACTION AND INFORMATIONAL SUBMITTALS

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

.2 Submit duplicate full size samples of each type of acoustical tile ceiling lay in panels required for the project

1.4 DELIVERY, STORAGE AND HANDLING

.1 Deliver, store and handle materials in accordance with Section 01 61 00 - Common Product Requirements.

1.5 ENVIRONMENTAL REQUIREMENTS

.1 Permit wet work to dry before beginning to install.

.2 Maintain uniform minimum temperature of 15 degrees C and humidity of 20 to 40% before and during installation.

.3 Store materials in work area 48 hours prior to installation.

1.6 EXTRA MATERIALS

.1 Provide extra materials of acoustic units in accordance with Section 01 78 00 - Closeout Submittals.

.2 Provide acoustical units amounting to 2% of gross ceiling area for each pattern and type required for project.

.3 Ensure extra materials are from same production run as installed materials.

.4 Clearly identify each type of acoustic unit, including colour and texture.

.5 Deliver to Owner and obtain receipt, upon completion of the work of this section.

Part 2 Products

2.1 MATERIALS

.1 To CAN/CGSB-92.1 ASTM E1264.

.2 Flame spread rating in accordance with CAN/ULC-S102 and ASTM E 1264; Class A.

.3 Smoke developed in accordance with CAN/ULC-S102.

.4 Acoustic ceiling tiles for suspended ceiling.

.1 Textures: smooth.
.2 Noise Reduction Coefficient (NRC) designation of 0.70.
.3 Ceiling Attenuation Class (CAC) rating in accordance with ASTM C 1414
.4 Light Reflectance (LR) range of 0.90.
.5 Edge type: beveled tegular.
.6 Colour: White.
.7 Size: 610 x 610 x 19 mm thick.
.8 Shape: flat.
.9 Approved materials:

.1 Armstrong World Industries: Ultima

.2 CGC: Mars ClimaPlus

.3 Celotex: Symphony M

.4 Approved Alternate

Part 3 Execution

3.1 EXAMINATION

.1 Do not install acoustical panels and tiles until work above ceiling has been inspected by Consultant.

3.2 INSTALLATION

.1 Co-ordinate with Section 09 53 01 - Acoustical Suspension.

.2 Co-ordinate ceiling work to accommodate components of other sections, such as light fixtures, diffusers, speakers, sprinkler heads, to be built into acoustical ceiling components.

.3 Install covers and escucheons to trim openings cut into ceiling tiles or panels.

3.3 ACOUSTIC CEILING TILES

.1 Install acoustical tiles in accordance with the manufacturer's instruction, and in compliance with ASTM C 636 and with the authority having jurisdiction.

.2 Install acoustic units to clean, dry and firm substrate.

.3 Install acoustical units parallel to building lines with edge unit not less than 50% of unit width with directional pattern running in same direction. Refer to reflected ceiling plan.

.4 Scribe acoustic units to fit adjacent work. Butt joints tight, terminate edges with moulding.

3.4 DECORATIVE CEILING PANEL

.1 Install decorative panels in accordance with the manufacturer's instruction, and in compliance with ASTM C 636 and with the authority having jurisdiction.

.2 Install acoustic units to clean, dry and firm substrate.

.3 Install acoustical units parallel to building lines. Refer to reflected ceiling plan.

.4 Connect grid directly to the structure using rigid attachments and adjustable hanger brackets.

.5 Install grid components such that they are not visible above the panel.

.6 Touch-up minor surface and edge scratches as recommended by manufacturer.

3.5 CLEANING

.1 Proceed in accordance with Section 01 74 11 – Cleaning Procedures

END OF SECTION

Part 1 General

1.1 RELATED SECTIONS

.1 Section 09 06 01 – Room Finish Schedule.

.2 Section 09 21 16 – Gypsum Board Assemblies.

.3 Section 09 51 13 – Acoustical Panel Ceilings.

1.2 REFERENCES

.1 American Society for Testing and Materials International (ASTM)

.1 ASTM C635-04, Standard Specifications for the Manufacture, Performance and Testing of Metal Suspension Systems for Acoustical Tile and Lay-In Panel Ceilings.

1.3 DESIGN REQUIREMENTS

.1 Maximum deflection: 1/360th of span to ASTM C635 deflection test.

1.4 ACTION AND INFORMATIONAL SUBMITTALS

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

.2 Submit a sample, one 1200mm length of T-bar for each type specified.

1.5 DELIVERY, STORAGE AND HANDLING

.1 Deliver, store and handle materials in accordance with Section 01 61 00 - Common Product Requirements.

Part 2 Products

2.1 MATERIALS

.1 Heavy duty system to ASTM C635.

.2 Basic materials for suspension system: commercial quality cold rolled steel hot dipped galvanized steel.

.3 Exposed tee bar grid components: Components die cut. Main tee with double web, steel construction. Main beams and cross tees shall have rotary stitching.

.4 Suspension systems: non fire rated.

.5 Hanger wire: galvanized soft annealed steel wire: To ASTM A641, Class 1 zinc coating, soft temper, pre-stretched, with a yield stress load of at least three times design load, but not less than:

.1 3.6 mm diameter for access tile ceilings

.2 2.6 mm diameter for other ceilings

.6 Hanger inserts: purpose made.

.7 Carrying channels: thickness to suit, galvanized steel.

.8 Accessories: splices, clips, wire ties, retainers and wall moulding flush reveal, to complement suspension system components, as recommended by system manufacturer.

2.2 ACOUSTICAL SUSPENSION:

.1 Coordinate suspension components with suspended tile and panel requirements.

.2 Components: All main beams and cross tees shall be commercial quality hot-dipped galvanized (galvanized steel, aluminum, or stainless steel) as per ASTM A 653. Main beams and cross tees are double-web steel construction with 15/16 inch type exposed flange design. Exposed surfaces chemically cleansed, capping pre-finished galvanized steel (aluminum or stainless steel) in baked polyester paint. Main beams and cross tees shall have rotary stitching (exception: extruded aluminum or stainless steel).

.1 Structural Classification: ASTM C 635 HD.

.2 Colour: White and match the actual color of the selected ceiling tile, unless noted otherwise.

.3 Attachment Devices: Size for five times design load indicated in ASTM C 635, Table 1, Direct hung unless otherwise indicated.

.4 Wire for Hangers and Ties: ASTM A 641, Class 1 zinc coating, soft temper, pre-stretched, with a yield stress load of at least time three design load, but not less than 12 gauge.

.5 Edge Moldings and Trim: Metal or extruded aluminum of types and profiles indicated or, if not indicated, manufacturer's standard moldings for edges and penetrations, including light fixtures, that fit type of edge detail and suspension system indicated. Provide moldings with exposed flange of the same width as exposed runner.

Part 3 Execution

3.1 MANUFACTURER'S INSTRUCTIONS

.1 Comply with manufacturer's written recommendations or specifications, including product technical bulletins, handling, storage and installation instructions, and datasheets.

3.2 INSTALLATION

.1 Installation: in accordance with ASTM C636 except where specified otherwise.

.2 Do not erect ceiling suspension system until work above ceiling has been inspected by Consultant.

.3 Secure hangers to overhead structure using industry approved attachment methods.

.4 Install hangers spaced at maximum 1200 mm centres and within 150 mm from ends of main tees.

.5 Lay out centre line of ceiling both ways, to provide balanced borders at room perimeter unless otherwise indicated.

.6 Ensure suspension system is co-ordinated with location of related components.

.7 Install wall moulding to provide correct ceiling height.

.8 Completed suspension system to support super-imposed loads, such as lighting fixtures diffusers grilles and speakers.

.9 Support at light fixtures diffusers with additional ceiling suspension hangers within 150 mm of each corner and at maximum 600 mm around perimeter of fixture.

.10 Interlock cross member to main runner to provide rigid assembly.

.11 Frame at openings for light fixtures, air diffusers, speakers and at changes in ceiling heights.

.12 Finished ceiling system to be square with adjoining walls and level within 1:1000.

3.3 CLEANING

.1 Proceed in accordance with Section 01 74 11 – Cleaning Procedures

.2 Touch up scratches, abrasions, voids and other defects in painted surfaces.

END OF SECTION

Part 1 General

1.1 RELATED SECTIONS

.1 Section 09 53 01 - Acoustical Suspension.

1.2 REFERENCES

.1 American Society for Testing and Materials International (ASTM)

.1 ASTM A 641 Standard Specification for Zinc-Coated (Galvanized) Carbon Steel Wire.

.2 ASTM B 209 Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate.

1.3 DESIGN REQUIREMENTS

.1 Maximum deflection: 1/360th of span to ASTM C635 deflection test.

1.4 SUBMITTALS

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

.2 Product Data

.1 Submit manufacturer’s technical data for each type of ceiling unit and suspension system required.

.3 Installation Instructions

.1 Submit manufacturer’s installation instructions.

1.5 DELIVERY, STORAGE AND HANDLING

.1 Deliver, store and handle materials in accordance with Section 01 61 00 – Common Product Requirements.

Part 2 Products

2.1 MATERIALS

.1 Linear Metal Soffits (Exterior)

.1 Material: Electrogalvanized steel.

.2 Finish: Post-production, powder-coat painted.

.3 Thickness: 0.71 mm (0.028 inch).

.4 Size: Nominal 100 mm (4 inch) wide panels including 25 mm (1 inch) reveal, 15.87 mm (5/8 inch) high x 2440 mm (8 feet) long.

.5 Edge Details: Square with extended flange.

.6 Color: selected from manufacturers standard range of colours.

.7 Perforation Option: Unperforated.

.8 Texture: Smooth.

.2 Acceptable Manufacturer/Product:

.1 Armstrong World Industries: Metalworks Linear Exterior or equivalent.

2.2 SUPSPENSION

.1 Exterior: meet wind uplift Class 90.

.2 Carrier: Provide carrier to suit installation as recommended by manufacturer.

.3 Splices as needed for installation.

.4 Hanger Wire: Minimum 12 gauge pre-stretched galvanized steel wire.

.5 Hanger Clip: Provide carrier steel clip to connect carriers to hanger wires.

.6 Accessories: Provide accessories including panel splices, end caps, trim molding and pressure spring as required to suit installation.

Part 3 Execution

3.1 INSTALLATION

.1 Comply with manufacturer's written recommendations or specifications, including product technical bulletins, handling, storage and installation instructions, and datasheets.

.2 Comply with applicable industry standards and local regulations in effect including requirements for wind uplift performance.

.3 Secure hangers to overhead structure using industry approved attachment methods.

.4 Ensure suspension system is co-ordinated with location of related components.

.5 Install wall moulding to provide correct ceiling height.

.6 Completed suspension system to support super-imposed loads, such as lighting fixtures.

.7 Frame at openings for penetrations through metal ceiling such as light fixtures.

.8 Adjust ceiling components to provide a consistent finish and appearance in conformity.

.9 Finished linear metal ceiling system to be square with adjoining walls and level within 1:1000.

3.2 CLEANING

.1 Proceed in accordance with Section 01 74 11 – Cleaning.

.2 Touch up scratches, abrasions, voids and other defects in painted surfaces.

END OF SECTION

Part 1 General

1.1 RELATED SECTIONS

.1 Section 03 35 00 - Concrete Finishing.

.2 Section 09 06 01 – Room Finish Schedule.

.3 Section 09 68 00 – Carpeting.

1.2 REFERENCES

.1 American Society for Testing and Materials (ASTM International)

.1 ASTM F 710 Practice for Preparing Concrete Floors and Other Monolithic Floors to Receive Resilient Flooring.

.2 ASTM F1344-[00], Specification for Rubber Tile..

.2 Canadian General Standards Board (CGSB)

.1 CAN/CGSB-25.20-95, Surface Sealer for Floors.

.2 CAN/CGSB-25.21-95, Detergent-Resistant Floor Polish.

1.3 SUBMITTALS

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

.2 Submit duplicate tile in size and colours specified.

.3 Submit technical data sheets of the flooring product and adhesive product.

1.4 CLOSEOUT SUBMITTALS

.1 Provide maintenance data for rubber sports flooring 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 21 - Construction/Demolition Waste Management And Disposal.

1.6 ENVIRONMENTAL REQUIREMENTS

.1 Maintain air temperature and structural base temperature at flooring installation area above 20^{o}C for 48 hours before, during and for 48 hours after installation.

1.7 EXTRA MATERIALS

.1 Provide maintenance materials of resilient tile flooring, base and adhesive in accordance with Section 01 78 00 - Closeout Submittals.

.2 Provide 5 m^2 of each colour, pattern and type flooring material required for this project for maintenance use.

.3 Extra materials to be from same production run as installed materials.

.4 Clearly identify each container of floor tile and each container of adhesive.

.5 Deliver to Owner, upon completion of the work of this section.

.6 Store where directed by Owner.

1.8 WARRANTY

.1 Five year manufacturer warranty.

Part 2 Products

2.1 MATERIALS

.1 Rubber floor tile: prefabricated rubber sports surfacing, dual durometer vulcanized and calandered with special embossing, including adhesive. Prefabricated rubber surface to be sheet goods, calandered and vulcanized with a base of natural and synthetic rubber, stabilizing agents and pigmentation. To be manufactured in two layers, vulcanized together.

.1 Thickness: 10mm total thickness, with wear layer thickness of 3mm

.2 Tile size: 610 x 610 mm or 915 x 915 mm.

.3 Pattern: smooth textured pattern from manufacture's standard range , solid color field with speckle throughout entire thickness of wear layer

.4 Colour: 2 colours to be selected from standard range.

.5 The shore hardness of the lower layer shall be less than the upper layer within the limits of following table. Field laminated material is not acceptable.

Physical Properties	Standard	Specification
Hardness Shore A	ASTM D-2240	75 (+-5) top layer 55(+-) bottom layer
Tensile strength	ASTM D-412	565 psi (+-50)
Elongation at break	ASTM D-412	226 (+-50)
100% modulus	ASTM D-412	64 psi (+-25)
Taber abrasion H18 wheels 500gr/1000 cycles	STM C-501	0.0001gr
Critical radiant flux	ASTM E-648-94A	Class 1
Water absorption 24hr/23 degree C	ASTM D-570	0.49%
Coefficient of friction	ASTM D-2047	0.91 dry/ 0.94 wet
Static load limit	ASTM F-970	0.003 in
Flame spread	ASTM E-648-94A	0.46 watts/sq.cm, class 1

.2 Resilient base: Refer to Section 09 65 19 Resilient Tile Flooring.

.3 Primers and adhesives: two part polyurethane adhesive suitable for adherence of flooring to concrete substrate. Adhesive to be supplied by or approved by the rubber flooring manufacturer.

.4 Sub-floor filler and leveller: as recommended by flooring manufacturer for use with their product.

.5 Edge transition strips: rubber transition strips, colour: black.

Part 3 Execution

3.1 INSPECTION

.1 Ensure concrete floors are dry, by using test methods recommended by tile manufacturer. Concrete must have cured for a minimum of 30 days. Vapour emission from the substrate must be less than 1.35 kg per 93 Sq.m in 24 hours as per ASTM 1869-98.

.2 Installer must have successfully completed installations of the same scale as this project, within the last three years and be recognized and approved by the sport surfacing manufacturer.

3.2 SUB-FLOOR TREATMENT

.1 Prepare to ASTM F 710 and as recommended by rubber sport floor manufacturer.

.2 Remove sub-floor ridges and bumps. Fill low spots, cracks, joints, holes and other defects with sub-floor filler. Floor must be level to not more than 3mm in 3 metre radius.

.3 Clean floor and apply filler; trowel and float to leave smooth, flat hard surface. Prohibit traffic until filler cured and dry.

.4 General Contractor and installer shall thoroughly inspect subfloor surface prior to proceeding with installation. Report any deficiencies to Consultant.

3.3 FLOORING APPLICATION

.1 Provide a high ventilation rate, with maximum outside air, during installation, and for 48 to 72 hours after installation. Vent directly to the outside. Do not let contaminated air re-circulate through a district or whole building air distribution system. Maintain extra ventilation for at least one month following installation.

.2 To minimize emissions from adhesives, use lowest V.O.C. emitting material that will meet requirements of this specification.

.3 Apply adhesive uniformly using recommended trowel in accordance with flooring manufacturer's instructions. Do not spread more adhesive than can be covered by flooring before initial set takes place.

.4 Install sport flooring in accordance with manufacturer’s printed instructions.

.5 Lay flooring with joints parallel to building lines to produce tile pattern required. Border tiles minimum half tile width. Cut and adjust flooring prior to adhesion.

.6 As installation progresses, and after installation, ensure full adhesion of tiles in adhesive. Hold all seams in place in accordance with manufacturer’s recommendations.

.7 Cut tile and fit neatly around fixed objects.

.8 Terminate flooring at centerline of door in openings where adjacent floor finish or colour is dissimilar.

.9 Install edge transition strips at unprotected or exposed edges where flooring terminates at openings.

3.4 BASE APPLICATION

.1 Refer to Section 09 65 19 - Resilient Tile Flooring.

3.5 INITIAL CLEANING

.1 Remove excess adhesive from floor, base and wall surfaces without damage.

.2 Clean, floor and base surface to flooring manufacturer's instructions.

3.6 PROTECTION OF FINISHED WORK

.1 Protect new floors from time of final set of adhesive until final inspection.

.2 Prohibit traffic on floor for 48 hours after installation.

END OF SECTION

Part 1 General

1.1 RELATED REQUIREMENTS

.1 Section 03 30 00 - Cast-in-Place Concrete.

1.2 REFERENCES

.1 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.

.2 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 fluid-applied 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 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.

1.6 QUALITY ASSURANCE

.1 Manufacturer:

.1 Minimum five (5) years documented experience installation fluid-applied floors.

Part 2 Products

2.1 MATERIALS

.1 In conformance with CGSB 81-GP-4M or CGSB 81-GP-5M.

.2 Primer: epoxy binder pigmented, non-yellowing.

.3 Aggregate: translucent angular quartz coated with a pigmented, inorganic ceramic film.

.4 Binder: epoxy binder.

.5 Grout coats: 100% solids, clear epoxy, non-yellowing, non-flammable.

.6 Top coats: 100% solids clear epoxy non-ambering, non-flammable.

.7 Divider strips: extruded heat treated aluminum having a total height of 3 mm. Divider strips shall be secured in place.

.8 Top of all bases with purpose-made metal angle divider strip.

.9 Non-Slip Aggregate: aluminum oxide or carborundum, size of grit to be medium.

.10 Acceptable Products:

.1 Sikafloor Quartzite Broadcast System by Sika Canada Inc.

.2 Stonshield SLT by Stonhard Stoncor group.

.11 Custom blend sand / tan colour. Colour to be confirmed at time of sample submission.

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 tile manufacturer.

3.3 SUB-FLOOR TREATMENT

.1 Verify that conditions of substrate previously installed under other sections are acceptable for product installation in accordance with manufacturer's written instruction prior to fluid-applied flooring installation.

.2 Concrete surface must be clean and sound. De-grease, chemically clean, remove laitance by wet grind or acid etch , remove foreign matter and rinse thoroughly using clean water. Further preparation to prepare 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 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 and base.

.5 Mask adjacent surfaces and apply seamless flooring and base in accordance with manufacturer's directions.

.6 Install metal divider strips at junctions of seamless flooring and other floorings, at exposed edges of seamless flooring, and at other locations required due to application techniques of system.

.7 Install seamless cove base, as detailed. Coordinate detail with sliding cell doors.

.8 Broadcast or trowel apply flooring, as per manufacturer's written instructions, to a minimum 3 mm and maximum 6 mm thickness, tightly compacted and free from surface holes and depressions. Application consists of prime coat, granular quartz aggregate in epoxy binder, 2 epoxy grout coats and one epoxy top coat.

.9 Allow aggregate, grout and glaze coats to dry to touch between coats. Do not apply more than 2 coats per day.

.10 At completion of work clean up and remove all surplus materials and debris.

.11 Matte finish required for flooring.

.12 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 RELATED SECTIONS

.1 Section 03 35 00 – Concrete finishing.

.2 Section 09 06 01 – Room Finish Schedule.

.3 Section 09 65 19 – Resilient Tile Flooring.

1.2 REFERENCES

.1 American Association of Textile Chemists and Colorists (AATCC)

.1 AATCC 16-1998, Color Fastness to Light.

.2 AATCC 134-2001, Electrostatic Propensity of Carpet.

.2 American Society for Testing and Materials (ASTM International)

.1 ASTM E84-01, Test Method for Surface Burning Characteristics of Building Materials.

.3 Canadian General Standards Board (CGSB)

.1 CAN/CGSB-4.129-93(R1997), Carpets for Commercial Use.

.4 Underwriters' Laboratories of Canada (ULC)

.1 CAN/ULC-S102-2007, Surface Burning Characteristics of Building Materials and Assemblies.

.2 CAN/ULC-S102.2-88(R2000), Surface Burning Characteristics of Flooring, Floor Covering and Miscellaneous Materials and Assemblies.

1.3 SUBMITTALS

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

.2 Submit verification to demonstrate compliance with CAN/ULCS102 and CAN/ULCS102.2.

.3 Submit carpet schedule using same room designations indicated on drawings.

.4 Confirm carpet tile layout pattern to be used.

.5 Submit carpet manufacturer's installation instructions: Indicate special procedures and perimeter conditions requiring special attention.

1.4 PRODUCT DATA

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

.2 Submit product data sheet for each carpet, , adhesive, carpet protection and subfloor patching compound.

.3 Submit data on specified products, describing physical and performance characteristics, sizes, patterns, colours, and methods of installation.

1.5 SAMPLES

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

.2 Submit duplicate 610x610 mm pieces of each type carpet specified.

1.6 CLOSEOUT SUBMITTALS

.1 Submit operation and maintenance data for incorporation into manual specified in Section 01 78 00 - Closeout Submittals.

.2 Submit maintenance data: Include maintenance procedures, recommendations for maintenance materials and equipment, and suggested schedule for cleaning.

1.7 QUALIFICATIONS

.1 Installer Qualifications:

.1 Flooring contractor requirements.

.1 Specialty contractor normally engaged in this type of work, with prior experience in installation of these types of materials.

.2 Be responsible for proper product installation, including floor testing and preparation as specified and in accordance with carpet manufacturers written instructions.

1.8 DELIVERY, STORAGE AND HANDLING

.1 Label packaged materials. For carpet tile products indicate nominal dimensions of tile and indicate installation direction.

.2 Store packaged materials in original containers or wrapping with manufacturer's seals and labels intact.

.3 Prevent damage to materials during handling and storage. Keep materials under cover and free from dampness.

.4 Store materials in area of installation for minimum period of 48 hours prior to installation.

.5 Modular carpet: store on pallet form as supplied by Manufacturer. Do not stack pallets.

1.9 ENVIRONMENTAL REQUIREMENTS

.1 Moisture: Ensure substrate is within moisture limits and alkalinity limits prescribed by manufacturer.

.2 Temperature: Maintain ambient temperature of not less than 18 ^{o}C from 48 hours before installation to at least 48 hours after completion of work.

.3 Relative humidity: Maintain relative humidity between 10 and 65% RH for 48 hours before, during and 48 hours after installation.

.4 Safety: Comply with requirements of Workplace Hazardous Materials Information System (WHMIS) regarding use, handling, storage, and disposal of hazardous materials.

1.10 EXTRA MATERIALS

.1 Provide extra materials of carpet, carpet base, and adhesives in accordance with Section 01 78 00 - Closeout Submittals.

.2 Provide 10 complete modular carpet pieces of each colour and pattern.

.3 Extra materials to be from same production run as installed materials.

.4 Identify each package of carpet and each container of adhesive.

.5 Store where directed by Consultant.

Part 2 Products

2.1 MODULAR CARPET

.1 To ASTM E648/NFPA 253 – Class 1; ASTM E 662/NFPA 258 – 450 or less; ASTM D 2859 – pass.

.2 Carpet: solid vinyl reinforced base, flocked nylon surface.

.3 Gauge: 5.3 mm.

.4 Backing: vinyl cushioned.

.5 Wear layer composition: nylon type 6.6

.6 Wear layer density: approx. 70,000,000 fibers/yd2.

.7 EN1307 (wear class): 4 (heavy duty).

.8 Carpet Tile Dimensions: 500 x 500 mm.

.9 Colourization: multiple colour tones.

.10 Adhesive: as recommended by carpet manufacturer

.11 Acceptable Manufacturer/Product:

.1 Forbox – series: Flotex “Silica”

.2 Approved equivalent.

.12 Colours: As selected from manufacturer’s standard range.

2.2 ACCESSORIES

.1 Binder bars: Stainless steel.

.2 Adhesive:

.1 Recommended by carpet manufacturer for direct glue down installation of modular carpet or speciality backed carpets.

.3 Subfloor patching compound: Portland cement base filler, mix with latex and water to form a cementitious paste.

2.3 BASE MATERIALS

.1 Resilient base: rubber, Type TS vulcanized rubber or Type TP thermoplastic rubber, coved, minimum 1200 mm length and 102 mm high x 3mm thick, including premoulded end stops and external corners, of same material, size and colour as base.

2.4 CONCRETE SEALER

.1 Concrete floor sealer: to CAN/CGSB-25.20, Type 1.

.2 As recommended by access floor manufacturer to seal concrete face of floor panels and ensure proper adhesion of carpet tiles to substrate.

Part 3 Execution

3.1 SUB-FLOOR TREATMENT

.1 Concrete substrates shall be free of paint, dirt, grease, oil, curing or parting agents, and other contaminates, including sealers, that may interfere with the bonding of the adhesive.

.2 Wherever a powdery or porous concrete surface is encountered, a primer compatible with the adhesive shall be used to provide a suitable surface for glue-down installation.

3.2 PREPARATION

.1 Prepare floor surfaces in accordance with CRI 104 Standard for Installation of Commercial Carpet.

.2 Pre-condition carpeting following manufacturer's printed instructions.

3.3 INSTALLATION

.1 Lay tile using a quarter turn pattern. Confirm with Department Representative prior to installation.

.2 Install carpeting using minimum of pieces.

.3 Apply acrylic adhesive and install modular carpet in accordance with manufacturer's written instructions.

.4 Lay modular carpet with butt seams.

.5 Finish installation to present smooth wearing surface free from conspicuous seams, burring and other faults.

.6 Use material from same dye lot. Ensure colour, pattern and texture match within any one visual area. Maintain constant pile direction.

.7 Fit neatly around architectural, mechanical, electrical and telephone outlets, and furniture fitments, around perimeter of rooms into recesses, and around projections.

.8 Extend carpet into toe spaces, door reveals, closets, open-bottomed obstructions, removable flanges, alcoves, and similar openings.

.9 Install carpet smooth and free of bubbles, puckers, and other defects.

.10 Roll modular carpet with appropriate roller for complete contact of carpet with mill-applied adhesive to sub-floor.

3.4 SEAMS

.1 Seal edges of cut-outs with latex.

.2 Carpet visibility of seams and joints to acceptable industry standards.

3.5 CARPET TACKSTRIPS AND BINDER BARS

.1 Install binder bars at exposed carpet edges and centre under doors in door openings.

3.6 CONCRETE SEALER

.1 Seal concrete panel substrate as required to ensure proper adhesion of carpet tiles. Apply sealer recommended by access floor manufacturer. Ensure sealer is compatible with carpet tile. Two coats of sealer may be required to provide suitable substrate.

3.7 PROTECTION OF FINISHED WORK

.1 Vacuum carpets clean immediately after completion of installation. Protect traffic areas.

.2 Prohibit traffic on carpet for a period of 24 hours until adhesive is cured.

.3 Install carpet protection to satisfaction of Engineer Consultant.

END OF SECTION

Part 1 General

1.1 RELATED SECTIONS

.1 Section 09 06 01 – Room Finish Schedule

.2 Section 09 21 16 – Gypsum Board Assemblies (coordinate installation of additional support in gypsum board walls as required for acoustic panels).

1.2 REFERENCES

.1 American Society for Testing and Materials (ASTM International)

.1 ASTM C423-01, Test Method for Sound Absorption and Sound Absorption Coefficients by the Reverberation Room Method.

.2 ASTM E84 – Standard Test Methodfor Surface Burning Characteristics of Building Materials.

.2 Underwriter Laboratories of Canada (ULC)

.1 CAN/ULC-S702-97, Thermal Insulation, Mineral Fibre, for Buildings.

.2 CAN/ULC – S102 Test for Surface Burning Characteristics of Building Materials and Assemblies.

1.3 ACTION AND INFORMATIONAL SUBMITTALS

.1 Product Data

.1 Submit manufacturer's printed product literature, specifications and data sheets.

.2 Shop Drawings

.1 Submit shop drawings indicating panel sizes and configuration.

1.4 DELIVERY, STORAGE AND HANDLING

.1 Deliver, store and handle materials in accordance with Section 01 61 00 - Common Product Requirements.

Part 2 Products

2.1 MATERIALS

.1 Acoustical construction products must:

.1 Not require being labelled as poisonous, corrosive, flammable or explosive under the Consumer Chemical and Container Regulations of the Hazardous Products Act.

.2 Be accompanied by detailed instructions for proper handling and installation so as to minimize health concerns.

2.2 ACOUSTIC PANELS TYPE 1 (VINYL)

.1 Acoustic core material: to CAN/CGSB-92.1.

- .1 NRC designation of 0.50 or greater.
- .2 Panel core: mineral fiber.
- .3 Thickness: 16 mm.
- .4 Edges: standard bevel edge with integral concealed edge reinforcing if required by panel sizes.
- .5 Panels and visible edges to be wrapped with fire retardant material.
  - .1 Flame spread class of 25 or less to CAN/ULC S102.
- .6 Fabric: Vinyl
  - .1 Colour selected from manufacturer's standard range of colours.
- .7 Dimensions: refer to drawings for sizes and locations.
- .8 Acceptable manufacturers:
  - .1 Armstrong "Soundsoak"
  - .2 Approved equivalent.

2.3 ACOUSTIC PANELS TYPE 2 (FABRIC)

.1 Acoustic core material: to CAN/CGSB-92.1.

- .1 NRC designation of 0.80 or greater.
- .2 Panel core: resin edge hardened fibreglass core with 96 – 112 kg/m³ (6-7 lbs/ft²) density. Resin hardened at clip locations.
- .3 Thickness: 25 mm.
- .4 Edges: standard bevel edge with integral concealed edge reinforcing if required by panel sizes.
- .5 Panels and visible edges to be wrapped with fire retardant fabric material.
  - .1 Flame spread class of 25 or less to CAN/ULC S102.
- .6 Fabric: polyester woven fabric, 16.0±0.5 Oz./lineal year. All fabric from same dye lot.
  - .1 Acceptable Manufacturer/product: Guilford of Maine/ FR 701, series 2100 or approved equivalent..
  - .2 Colour selected from manufacturer's standard range of colours.
- .7 Metal support clips: galvanized steel Z-clips to suit acoustic panel requirements.
- .8 Dimensions: refer to drawings for sizes and locations.
- .9 Acceptable manufacturers:
  - .1 Armstrong "Soundsoak"
  - .2 Approved equivalent.

Part 3 Execution

3.1 INSTALLATION

.1 Ensure substrate surface is straight to tolerance of plus or minus 3 mm over 3000 mm.

.2 Install according to manufacturer's written instructions.

.3 Install acoustic units to clean, dry and firm gypsum board substrate using concealed clips.

.4 Fully adhere acoustic units to concrete masonry unit wall substrate and underside of cast-in-place concrete deck.

.5 Install acoustic units plumb and aligned. Arrange units as indicated.

.6 Cut panels to suit electrical and mechanical items mounted to walls and ceilings.

.7 Cut panels around openings in wall.

.8 Wrap fabric back to panels wherever panels are cut, cover exposed panel edges.

3.2 CLEANING

.1 Keep acoustic installation and all components clean. Remove blemishes immediately.

3.3 PROTECTION

.1 Use polyethylene to protect finished acoustical treatment from damage.

.2 Remove prior to substantial completion.

3.4 SCHEDULES

.1 Indicated on drawings.

END OF SECTION

Part 1 General

1.1 RELATED REQUIREMENTS

.1 Section 05 50 00 Metal Fabrications.

.2 Section 08 90 10 – Door, Frame and Hardware Schedule.

1.2 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 – latest edition.

1.3 QUALITY ASSURANCE

.1 Qualifications:

.1 Conform to latest MPI requirements for exterior painting work including preparation and priming.

.2 Materials: in accordance with MPI Painting Specification Manual "Approved Product" listing and from a single manufacturer for each system used.

.3 paint materials such as linseed oil, shellac, and turpentine to be highest quality product of an approved manufacturer listed in MPI Painting Specification Manual and to be compatible with other coating materials as required.

.4 Standard of Acceptance:

.1 Walls: No defects visible from a distance of 1000 mm at 90 degrees to surface.

.2 Soffits: No defects visible from floor at 45 degrees to surface when viewed using final lighting source.

.3 Final coat to exhibit uniformity of colour and uniformity of sheen across full surface area.

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 printed product literature, specifications and datasheet and include product characteristics, performance criteria, physical size, finish and limitations.

.2 Submit WHMIS MSDS - Material Safety Data Sheets in accordance with Section 02 81 01 - Hazardous Materials.

.3 Upon completion, submit records of products used. List products in relation to finish system and include the following:

.1 Product name, type and use.

.2 Manufacturer's product number.

.3 Colour numbers.

.4 MPI Environmentally Friendly classification system rating.

.5 Manufacturer's Material Safety Data Sheets (MSDS).

.4 Provide samples in accordance with Section 01 33 00 - Submittal Procedures.

.1 Submit duplicate 200 x 300 mm sample panels of each paint with specified paint or coating in colours, gloss/sheen and textures required to MPI Painting Specification Manual standards.

1.5 MAINTENANCE

.1 Extra Materials:

.1 Submit maintenance materials in accordance with Section 01 78 00 - Closeout Submittals.

.2 Submit one four litre can of each type and colour of finish coating. Identify colour and paint type in relation to established colour schedule and finish system.

1.6 DELIVERY, STORAGE AND HANDLING

.1 Deliver, store and handle materials in accordance with Section 01 61 00 - Common Product Requirements, supplemented as follows:.

.1 Deliver and store materials in original containers, sealed, with labels intact.

.2 Labels: to indicate:

.1 Manufacturer's name and address.

.2 Type of paint or coating.

.3 Compliance with applicable standard.

.4 Colour number in accordance with established colour schedule.

.3 Remove damaged, opened and rejected materials from site.

.4 Provide and maintain dry, temperature controlled, secure storage.

.5 Observe manufacturer's recommendations for storage and handling.

.6 Store materials and supplies away from heat generating devices.

.7 Store materials and equipment in well ventilated area with temperature range 7 degrees C to 30 degrees C.

.8 Store temperature sensitive products above minimum temperature as recommended by manufacturer.

.9 Remove paint materials from storage only in quantities required for same day use.

.10 Comply with requirements of Workplace Hazardous Materials Information System (WHMIS) regarding use, handling storage, and disposal of hazardous materials.

.11 Fire Safety Requirements:

.1 Provide one 9 kg Type ABC dry chemical fire extinguisher adjacent to storage area.

.2 Store oily rags, waste products, empty containers and materials subject to spontaneous combustion in ULC approved, sealed containers and remove from site on a daily basis.

.3 Handle, store, use and dispose of flammable and combustible materials in accordance with the National Fire Code of Canada.

.2 Waste Management and Disposal:

.1 Place materials defined as hazardous or toxic waste, including used sealant and adhesive tubes and containers, in containers or areas designated for hazardous waste.

.2 To reduce the amount of contaminants entering waterways, sanitary/storm drain systems or into the ground the following procedures shall be strictly adhered to:

.1 Retain cleaning water for water-based materials to allow sediments to be filtered out.

.2 Retain cleaners, thinners, solvents and excess paint and place in designated containers and ensure proper disposal.

.3 Return solvent and oil soaked rags used during painting operations for contaminant recovery, proper disposal, or appropriate cleaning and laundering.

.4 Dispose of contaminants in an approved legal manner in accordance with hazardous waste regulations.

.5 Empty paint cans are to be dry prior to disposal or recycling (where available).

.3 Where paint recycling is available, collect waste paint by type and provide for delivery to recycling or collection facility.

.4 Close and seal tightly partly used sealant and adhesive containers and store protected in well ventilated fire-safe area at moderate temperature.

1.7 AMBIENT CONDITIONS

.1 Temperature, Humidity and Substrate Moisture Content Levels:

.1 Unless specifically pre-approved by specifying body, Paint Inspection Agency and, applied product manufacturer, perform no painting work when:

.1 Ambient air and substrate temperatures are below 10 degrees C.

.2 Substrate temperature is over 32 degrees C unless paint is specifically formulated for application at high temperatures.

.3 Substrate and ambient air temperatures are expected to fall outside MPI or paint manufacturer's prescribed limits.

.4 Relative humidity is above 85 % or when dew point is less than 3 degrees C variance between air/surface temperature.

.5 Rain or snow are forecast to occur before paint has thoroughly cured or when it is foggy, misty, raining or snowing at site.

.2 Perform no painting work when maximum moisture content of substrate exceeds:

.1 12% for concrete and masonry (clay and concrete brick/block).

.2 15% for wood.

.3 Conduct moisture tests using a properly calibrated electronic Moisture Meter, except test concrete floors for moisture using a simple "cover patch test".

.4 Test concrete, masonry and plaster surfaces for alkalinity as required.

.2 Surface and Environmental Conditions:

.1 Apply paint finish in areas where dust is no longer being generated by related construction operations or when wind or ventilation conditions are such that airborne particles will not affect quality of finished surface.

.2 Apply paint to adequately prepared surfaces and to surfaces within moisture limits noted herein.

.3 Apply paint when previous coat of paint is dry or adequately cured.

.4 Apply paint finishes when conditions forecast for entire period of application fall within manufacturer's recommendations.

.5 Do not apply paint when:

.1 Temperature is expected to drop below 10 degrees C before paint has thoroughly cured.

.2 Substrate and ambient air temperatures are expected to fall outside MPI or paint manufacturer's limits.

.3 Surface to be painted is wet, damp or frosted.

.6 Provide and maintain cover when paint must be applied in damp or cold weather. Heat substrates and surrounding air to comply with temperature and humidity conditions specified by manufacturer. Protect until paint is dry or until weather conditions are suitable.

.7 Schedule painting operations such that surfaces exposed to direct, intense sunlight are scheduled for completion during early morning.

.8 Remove paint from areas which have been exposed to freezing, excess humidity, rain, snow or condensation. Prepare surface again and repaint.

Part 2 Products

2.1 MATERIALS

.1 Paint materials listed in latest edition of MPI Approved Products List (APL) are acceptable for use on this project.

.2 Paint materials for paint systems: to be products of single manufacturer.

.3 Use only MPI listed L rated materials.

.4 Water-borne surface coatings must be manufactured and transported in a manner that steps of processes, including disposal of waste products arising therefrom, will meet requirements of applicable governmental acts, by-laws and regulations including, for facilities located in Canada, Fisheries Act and Canadian Environmental Protection Act (CEPA).

.5 Water-borne surface coatings must not be formulated or manufactured with aromatic solvents, formaldehyde, halogenated solvents, mercury, lead, cadmium, hexavelant chromium or their compounds.

.6 Water-borne surface coatings and recycled water-borne surface coatings must have flash point of 61.0 degrees C or greater.

2.2 COLOURS

.1 Selection of colours will be from manufacturers full range of colours.

.2 Where specific products are available in restricted range of colours, selection will be based on limited range.

.3 Second coat in three coat system to be tinted slightly lighter colour than top coat to show visible difference between coats.

2.3 MIXING AND TINTING

.1 Perform colour tinting operations prior to delivery of paint to site.

.2 Mix paste, powder or catalyzed paint mixes in accordance with manufacturer's written instructions.

.3 Add thinner to paint manufacturer's recommendations. Do not use kerosene or organic solvents to thin water-based paints.

.4 Thin paint for spraying according in accordance with paint manufacturer's instructions.

.5 Re-mix paint in containers prior to and during application to ensure break-up of lumps, complete dispersion of settled pigment, and colour and gloss uniformity.

2.4 GLOSS/SHEEN RATINGS

.1 Paint gloss: defined as sheen rating of applied paint, in accordance with following values:

Gloss Level Category/	Units @ 60 Degrees/	Units @ 85 Degrees/
G1 - matte finish	0 to 5	max. 10
G2 - velvet finish	0 to 10	10 to 35
G3 - eggshell finish	10 to 25	10 to 35
G4 - satin finish	20 to 35	min. 35
G5 - semi-gloss finish	35 to 70	
G6 - gloss finish	70 to 85	
G7 - high gloss finish	85	

.2 Gloss level ratings of painted surfaces as specified and asas noted on Finish Schedule.

2.5 EXTERIOR PAINTING SYSTEMS

.1 Asphalt Surfaces: zone/traffic marking for drive and parking areas, etc.

.1 EXT 2.1B - Alkyd zone/traffic marking finish.

.2 Structural Steel and Metal Fabrications: (O/H door Operator Pedestal, Garabage Enclosure and as noted in drawings.)

.1 EXT 5.1M - Waterborne light industrial Gloss level 5 semi-gloss coating (over waterborne primer). Premium grade.

.3 Galvanized Metal: not chromate passivated (Exterior doors)

.1 EXT 5.3L - Pigmented polyurethane over Epoxy Primer

.1 Grade: Premium; Gloss Level: G6

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 Perform preparation and operations for exterior painting in accordance with MPI Maintenance Repainting Manual except where specified otherwise.

.2 Apply paint materials in accordance with paint manufacturer's written application instructions.

.3 Clean and prepare exterior surfaces to be painted in accordance with MPI requirements.

.4 Prevent contamination of cleaned surfaces by salts, acids, alkalis, other corrosive chemicals, grease, oil and solvents before priming and between applications of remaining coats. Touch-up, spot prime, and apply primer, paint, or pretreatment as soon as possible after cleaning and before deterioration occurs.

.5 Sand and dust between coats as required to provide adequate adhesion for next coat and to remove defects visible from a distance up to 1000 mm.

3.3 EXISTING CONDITIONS

.1 Investigate existing substrates for problems related to proper and complete preparation of surfaces to be painted. Report to Consultant damages, defects, unsatisfactory or unfavourable conditions before proceeding with work.

3.4 PROTECTION

.1 Protect existing building surfaces and adjacent structures from paint spatters, markings and other damage by suitable non-staining covers or masking. If damaged, clean and restore such surfaces.

.2 Protect items that are permanently attached such as Fire Labels on doors and frames.

.3 Protect factory finished products and equipment.

.4 Protect passing pedestrians, and general public in and about building.

.5 Remove light fixtures, surface hardware on doors, and other surface mounted equipment, fittings and fastenings prior to undertaking painting operations. Store items and re-install after painting is completed.

.6 As painting operations progress, place "WET PAINT" signs in pedestrian and vehicle traffic areas.

3.5 APPLICATION

.1 Conform to manufacturer's application instructions unless specified otherwise.

.2 Brush and Roller Application:

.1 Apply paint in a uniform layer using brush and/or roller of types suitable for application.

.2 Work paint into cracks, crevices and corners.

.3 Paint surfaces and corners not accessible to brush using spray, daubers and/or sheepskins. Paint surfaces and corners not accessible to roller using brush, daubers or sheepskins.

.4 Brush and/or roll out runs and sags, and over-lap marks. Rolled surfaces shall be free of roller tracking and heavy stipple.

.5 Remove runs, sags and brush marks from finished work and repaint.

.3 Spray Application:

.1 Provide and maintain equipment that is suitable for intended purpose, capable of properly atomizing paint to be applied, and equipped with suitable pressure regulators and gauges.

.2 Keep paint ingredients properly mixed in containers during paint application either by continuous mechanical agitation or by intermittent agitation as frequently as necessary.

.3 Apply paint in a uniform layer, with overlapping at edges of spray pattern.

.4 Brush out immediately runs and sags.

.5 Use brushes to work paint into cracks, crevices and places which are not adequately painted by spray.

.4 Use dipping, sheepskins or daubers when no other method is practical in places of difficult access.

.5 Apply coats of paint as continuous film of uniform thickness. Repaint thin spots or bare areas before next coat of paint is applied.

.6 Allow surfaces to dry and properly cure after cleaning and between subsequent coats for minimum time period as recommended by manufacturer.

.7 Sand and dust between coats to remove visible defects.

.8 Finish surfaces both above and below sight lines as specified for surrounding surfaces, including such surfaces as projecting ledges.

.9 Finish top, bottom, edges and cutouts of doors after fitting as specified for door surfaces.

3.6 MECHANICAL/ELECTRICAL EQUIPMENT

.1 Unless otherwise specified, paint exterior exposed conduits, piping, hangers, duct work, grilles and other mechanical and electrical equipment with colour and finish to match adjacent surfaces, except as noted otherwise.

.2 Touch up scratches and marks on factory painted finishes and equipment with paint as supplied by manufacturer of equipment.

.3 Do not paint over nameplates.

3.7 CLEANING

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

.1 Remove paint where spilled, splashed, splattered or sprayed as work progresses using means and materials that are not detrimental to affected surfaces.

3.8 RESTORATION

.1 Clean and re-install hardware items removed before undertaken painting operations.

.2 Remove protective coverings and warning signs as soon as practical after operations cease.

.3 Remove paint splashings on exposed surfaces that were not painted. Remove smears and spatter immediately as operations progress, using compatible solvent.

.4 Protect freshly completed surfaces from paint droppings and dust.

.5 Restore areas used for storage, cleaning, mixing and handling of paint to clean condition.

END OF SECTION

Part 1 General

1.1 RELATED SECTIONS

.1 Section 05 50 00 - Metal Fabrications

.2 Section 06 40 00 – Architectural Woodwork.

.3 Section 08 06 01 - Door, Frame and Hardware Schedule.

.4 Section 08 14 16 - Flush Wood Doors

.5 Section 09 06 01 – Room Finish Schedule.

.6 Section 09 21 16 – Gypsum board Assemblies.

.7 Section 09 96 53 - Elastomeric Coatings.

.8 Section 12 50 00 Furniture

1.2 REFERENCES

.1 Department of Justice Canada (Jus)

.1 Canadian Environmental Protection Act (CEPA), 1999, c. 33

.2 Environmental Protection Agency (EPA)

.1 EPA Test Method for Measuring Total Volatile Organic Compound Content of Consumer Products, Method 24 - 1995, (for Surface Coatings).

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

.1 Material Safety Data Sheets (MSDS).

.4 Master Painters Institute (MPI)

.1 MPI Architectural Painting Specifications Manual, 2004.

1.3 QUALITY ASSURANCE

.1 Qualifications:

.1 Contractor: minimum of five years proven satisfactory experience. Provide list of last three comparable jobs including, job name and location, specifying authority, and project manager.

1.4 ACTION AND INFORMATIONAL SUBMITTALS

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

.2 Product Data:

.1 Submit product data and instructions for each paint and coating product to be used.

.2 Submit product data for the use and application of paint thinner.

.3 Submit two copies of Workplace Hazardous Materials Information System (WHMIS) Material Safety Data Sheets (MSDS) in accordance with Section 01 33 00 - Submittal Procedures. Indicate VOCs during application and curing.

.3 Samples:

.1 Submit full range colour sample chips to indicate where colour availability is restricted.

.2 Submit three 200 x 300 mm sample panels of each paint, stain and clear coating with specified paint or coating in colours, gloss/sheen and textures required to MPI Architectural Painting Specification Manual standards.

.3 Retain reviewed samples on-site to demonstrate acceptable standard of quality for appropriate on-site surface.

.1 Submit manufacturer's installation application instructions.

.4 Closeout Submittals: submit maintenance data for incorporation into manual specified in Section 01 78 00 - Closeout Submittals include following:

.1 Product name, type and use.

.2 Manufacturer's product number.

.3 Colour numbers.

1.5 MAINTENANCE

.1 Extra Materials:

.1 Deliver to extra materials from same production run as products installed. Package products with protective covering and identify with descriptive labels. Comply with Section 01 78 00 - Closeout Submittals.

.2 Quantity: provide one four litre can of each type and colour of primer, stain and finish coating. Identify colour and paint type in relation to established colour schedule and finish system.

.3 Delivery, storage and protection: comply with Owner requirements for delivery and storage of extra materials.

1.6 DELIVERY, STORAGE AND HANDLING

.1 Packing, Shipping, Handling and Unloading:

.1 Pack, ship, handle and unload materials in accordance with Section 01 61 00 - Common Product Requirements and manufacturer's written instructions.

.2 Acceptance at Site:

.1 Identify products and materials with labels indicating:

.1 Manufacturer's name and address.

.2 Type of paint or coating.

.3 Compliance with applicable standard.

.4 Colour number in accordance with established colour schedule.

.3 Remove damaged, opened and rejected materials from site.

.4 Storage and Protection:

.1 Provide and maintain dry, temperature controlled, secure storage.

.2 Store materials and supplies away from heat generating devices.

.3 Store materials and equipment in well ventilated area with temperature range 7 degrees C to 30 degrees C.

.5 Store temperature sensitive products above minimum temperature as recommended by manufacturer.

.6 Keep areas used for storage, cleaning and preparation clean and orderly. After completion of operations, return areas to clean condition.

.7 Remove paint materials from storage only in quantities required for same day use.

.8 Fire Safety Requirements:

.1 Provide one 9 kg Type ABC dry chemical fire extinguisher adjacent to storage area.

.2 Store oily rags, waste products, empty containers and materials subject to spontaneous combustion in ULC approved, sealed containers and remove from site on a daily basis.

.3 Handle, store, use and dispose of flammable and combustible materials in accordance with National Fire Code of Canada requirements.

.9 Waste Management and Disposal:

.1 Handle and dispose of hazardous materials in accordance with Regional and Municipal, regulations.

.2 Ensure emptied containers are sealed and stored safely.

.3 Paint, stain and wood preservative finishes and related materials (thinners, and solvents) are regarded as hazardous products and are subject to regulations for disposal. Dispose of according to Authorities with Jurisdiction.

.4 Material which cannot be reused must be treated as hazardous waste and disposed of in an appropriate manner.

.5 Place materials defined as hazardous or toxic waste, including used sealant and adhesive tubes and containers, in containers or areas designated for hazardous waste.

1.7 SITE CONDITIONS

.1 Heating, Ventilation and Lighting:

.1 Ventilate enclosed spaces.

.2 Provide heating facilities to maintain ambient air and substrate temperatures above 10 degrees C for 24 hours before, during and after paint application until paint has cured sufficiently.

.3 Provide continuous ventilation for seven days after completion of application of paint.

.4 Coordinate use of existing ventilation system with Consultant and ensure its operation during and after application of paint as required.

.5 Provide temporary ventilating and heating equipment where permanent facilities are not available or supplemental ventilating and heating equipment if ventilation and heating from existing system is inadequate to meet minimum requirements.

.6 Provide minimum lighting level of 323 Lux on surfaces to be painted.

.2 Temperature, Humidity and Substrate Moisture Content Levels:

.1 Perform no painting when:

.1 Ambient air and substrate temperatures are below 10 degrees C.

.2 Substrate temperature is above 32 degrees C unless paint is specifically formulated for application at high temperatures.

.3 Substrate and ambient air temperatures are not expected to fall within MPI or paint manufacturer's prescribed limits.

.4 The relative humidity is under 85% or when the dew point is more than 3 degrees C variance between the air/surface temperature. Paint should not be applied if the dew point is less than 3 degrees C below the ambient or surface temperature. Use sling psychrometer to establish the relative humidity before beginning paint work.

.5 Ensure that conditions are within specified limits during drying or curing process, until newly applied coating can itself withstand 'normal' adverse environmental factors.

.2 Perform painting work when maximum moisture content of the substrate is below:

.1 Allow new concrete and masonry to cure minimum of 28 days.

.2 15% for wood.

.3 12% for plaster and gypsum board.

.3 Test for moisture using calibrated electronic Moisture Meter. Test concrete floors for moisture using "cover patch test".

.4 Test concrete, masonry and plaster surfaces for alkalinity as required.

.3 Surface and Environmental Conditions:

.1 Apply paint finish in areas where dust is no longer being generated by related construction operations or when wind or ventilation conditions are such that airborne particles will not affect quality of finished surface.

.2 Apply paint to adequately prepared surfaces and to surfaces within moisture limits.

.3 Apply paint when previous coat of paint is dry or adequately cured.

Part 2 Products

2.1 MATERIALS

.1 Paint materials listed in the MPI Approved Products List (APL) are acceptable for use on this project.

.2 Provide paint materials for paint systems from single manufacturer.

.3 Only qualified products with E2 or E3 "Environmentally Friendly" rating are acceptable for use on this project.

.4 Conform to latest MPI requirements for interior painting work including preparation and priming.

.5 Materials (primers, paints, coatings, varnishes, stains, lacquers, fillers, thinners, solvents, etc.) in accordance with MPI Architectural Painting Specification Manual "Approved Product" listing.

.6 Linseed oil, shellac, and turpentine: highest quality product from approved manufacturer listed in MPI Architectural Painting Specification Manual, compatible with other coating materials as required.

.7 Provide paint products meeting MPI "Environmentally Friendly" minimumE2 ratings based on VOC (EPA Method 24) content levels.

.8 Formulate and manufacture water-borne surface coatings with no aromatic solvents, formaldehyde, halogenated solvents, mercury, lead, cadmium, hexavalent chromium or their compounds.

.9 Flash point: 61.0 degrees C or greater for water-borne surface coatings and recycled water-borne surface coatings.

.10 Water-borne paints and stains, recycled water-borne surface coatings and water borne varnishes to meet minimum "Environmentally Friendly" E2 rating.

2.2 COLOURS

.1 Consultant will provide Colour Schedule after Contract award

.2 Colour schedule will be based upon the following:

.1 Walls: Maximum SIX field colours and TWO feature wall colours, denoted on drawings and Room Finish Schedule. No more than EIGHT wall colours will be selected for entire project.

.2 Ceilings: TWO near white colours.

.3 Metal Door and Window Frames: ONE colour to be selected for all metal door and window frames throughout.

.3 Selection of colours from manufacturers full range of colours.

.4 Where specific products are available in restricted range of colours, selection based on limited range.

.5 Second coat in three coat system to be tinted slightly lighter colour than top coat to show visible difference between coats.

2.3 MIXING AND TINTING

.1 Perform colour tinting operations prior to delivery of paint to site. Obtain written approval from Departmental Representative DCC Representative Consultant for tinting of painting materials.

.2 Mix paste, powder or catalyzed paint mixes inaccordance with manufacturer's written instructions.

.3 Use and add thinner in accordance with paint manufacturer's recommendations. Do not use kerosene or similar organic solvents to thin water-based paints.

.4 Thin paint for spraying in accordance with paint manufacturer's instructions.

.5 Re-mix paint in containers prior to and during application to ensure break-up of lumps, complete dispersion of settled pigment, and colour and gloss uniformity.

2.4 GLOSS/SHEEN RATINGS

.1 Paint gloss is defined as sheen rating of applied paint, in accordance with following values:

	Gloss @ 60 degrees	Sheen @ 85 degrees
Gloss Level 1 - Matte Finish (flat)	Max. 5	Max. 10
Gloss Level 2 - Velvet-Like Finish	Max.10	10 to 35
Gloss Level 3 - Eggshell Finish	10 to 25	10 to 35
Gloss Level 4 - Satin-Like Finish	20 to 35	min. 35
Gloss Level 5 - Traditional Semi-Gloss Finish	35 to 70	
Gloss Level 6 - Traditional Gloss	70 to 85	
Gloss Level 7 - High Gloss Finish	More than 85	

.2 Gloss level ratings of painted surfaces as indicated as noted on Finish Schedule.

2.5 INTERIOR PAINTING SYSTEMS

.1 Concrete horizontal surfaces: floors.

.1 Refer to Section 09 96 53 Elastomeric Coatings.

.2 INT 3.2F - Concrete floor sealer (confirm requirements for specified floor finishes)

.2 Concrete masonry units:

.1 Refer to Section 09 96 53 Elastomeric Coatings.

.3 Structural steel and metal fabrications: (columns, beams, joists, steel furniture and as indicated on drawings):

.1 INT 5.1Q – Latex, Gloss Level 5 – Semi-Gloss finish (over alkyd primer). Premium grade, 1 coat primer, two top coats.

.4 Galvanized metal: (doors, frames, railings, misc. steel, pipes, overhead decking, ducts and as indicated on drawings).

.1 INT 5.3M - High performance architectural latex Gloss Level 5 – Semi-Gloss finish. Premium grade, 1 coat primer, two top coats.

.5 Dimension lumber: (underside of wood decking and as indicated on drawings):

.1 INT 6.2M - Waterborne clear acrylic Gloss Level 5 – Semi-Gloss finish (over semi-transparent stain). Budget Grade, 1 coat stain, 2 coats varnish.

.6 Dressed lumber: including doors, door and window frames, window sills, casings, mouldings and as indicated on drawings):

.1 INT 6.3W - Waterborne clear acrylic Gloss Level 5 – Semi-Gloss finish (over stain). Premium grade, 1 coat stain, two coats varnish.

.7 Wood paneling and casework: partitions, panels, shelving, millwork:

.1 INT 6.4S - High performance architectural latex Gloss Level 5 – Semi-Gloss finish. Premium grade, 1 coat primer, two top coats.

.8 Plaster and gypsum board: gypsum wallboard, drywall, "sheet rock type material", and textured finishes:

.1 INT 9.2B - High performance architectural latex Gloss Level 3–egg shell finish. Premium grade, 1 coat primer, two top coats.

.1 In Room

Part 3 Execution

3.1 MANUFACTURER'S INSTRUCTIONS

.1 Compliance: comply with manufacturer's written recommendations or specifications, including product technical bulletins, handling, storage and installation instructions, and data sheet.

3.2 GENERAL

.1 Perform preparation and operations for interior painting in accordance with MPI Architectural Painting Specifications Manual except where specified otherwise.

.2 Apply paint materials in accordance with paint manufacturer's written application instructions.

3.3 EXAMINATION

.1 Investigate existing substrates for problems related to proper and complete preparation of surfaces to be painted. Correct damages, defects, unsatisfactory or unfavourable conditions before proceeding with work.

.2 Proceeding with work is acceptance of substrate.

.3 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.

.4 Maximum moisture content as follows:

.1 Stucco, plaster and gypsum board: 12%.

.2 Concrete: 12%.

.3 Clay and Concrete Block/Brick: 12%.

.4 Wood: 15%.

3.4 PREPARATION

.1 Protection:

.1 Protect existing building surfaces and adjacent structures from paint spatters, markings and other damage by suitable non-staining covers or masking. If damaged, clean and restore surfaces.

.2 Protect items that are permanently attached such as Fire Labels on doors and frames.

.3 Protect factory finished products and equipment.

.4 Protect passing pedestrians, building occupants and general public in and about the building.

.2 Surface Preparation:

.1 Remove electrical cover plates, light fixtures, surface hardware on doors, bath accessories and other surface mounted equipment, fittings and fastenings prior to undertaking painting operations. Identify and store items in secure location and re-installed after painting is completed.

.2 Move and cover furniture and portable equipment as necessary to carry out painting operations. Replace as painting operations progress.

.3 Place "WET PAINT" signs in occupied areas as painting operations progress.

.3 Clean and prepare surfaces in accordance with MPI Architectural Painting Specification Manual requirements. Refer to MPI Manual in regard to specific requirements and as follows:

.1 Remove dust, dirt, and other surface debris.

.2 Wash surfaces with a biodegradable detergent and bleach where applicable and clean warm water using a stiff bristle brush to remove dirt, oil and other surface contaminants.

.3 Rinse scrubbed surfaces with clean water until foreign matter is flushed from surface.

.4 Allow surfaces to drain completely and allow to dry thoroughly.

.5 Prepare surfaces for water-based painting, water-based cleaners should be used in place of organic solvents.

.6 Use trigger operated spray nozzles for water hoses.

.7 Many water-based paints cannot be removed with water once dried. Minimize use of mineral spirits or organic solvents to clean up water-based paints.

.4 Prevent contamination of cleaned surfaces by salts, acids, alkalis, other corrosive chemicals, grease, oil and solvents before prime coat is applied and between applications of remaining coats. Apply primer, paint, or pretreatment as soon as possible after cleaning and before deterioration occurs.

.5 Where possible, prime non-exposed surfaces of new wood surfaces before installation. Use same primers as specified for exposed surfaces.

.1 Apply vinyl sealer to MPI #36 over knots, pitch, sap and resinous areas.

.2 Apply wood filler to nail holes and cracks.

.3 Tint filler to match stains for stained woodwork.

.6 Sand and dust between coats as required to provide adequate adhesion for next coat and to remove defects visible from a distance up to 1000 mm.

.7 Clean metal surfaces to be painted by removing rust, loose mill scale, welding slag, dirt, oil, grease and other foreign substances in accordance with MPI requirements. Remove traces of blast products from surfaces, pockets and corners to be painted.

.8 Touch up of shop primers with primer as specified.

3.5 APPLICATION

.1 Conform to manufacturer's application instructions unless specified otherwise.

.2 Brush and Roller Application:

.1 Apply paint in uniform layer using brush and/or roller type suitable for application.

.2 Work paint into cracks, crevices and corners.

.3 Paint surfaces and corners not accessible to brush using spray, daubers and/or sheepskins. Paint surfaces and corners not accessible to roller using brush, daubers or sheepskins.

.4 Brush and/or roll out runs and sags, and over-lap marks. Rolled surfaces free of roller tracking and heavy stipple.

.5 Remove runs, sags and brush marks from finished work and repaint.

.3 Spray application:

.1 Provide and maintain equipment that is suitable for intended purpose, capable of atomizing paint to be applied, and equipped with suitable pressure regulators and gauges.

.2 Keep paint ingredients properly mixed in containers during paint application either by continuous mechanical agitation or by intermittent agitation as frequently as necessary.

.3 Apply paint in uniform layer, with overlapping at edges of spray pattern. Back roll first coat application.

.4 Brush out immediately all runs and sags.

.5 Use brushes and rollers to work paint into cracks, crevices and places which are not adequately painted by spray.

.4 Use dipping, sheepskins or daubers only when no other method is practical in places of difficult access.

.5 Apply coats of paint continuous film of uniform thickness. Repaint thin spots or bare areas before next coat of paint is applied.

.6 Allow surfaces to dry and properly cure after cleaning and between subsequent coats for minimum time period as recommended by manufacturer.

.7 Sand and dust between coats to remove visible defects.

.8 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.

.9 Finish inside of cupboards and cabinets as specified for outside surfaces.

.10 Finish closets and alcoves as specified for adjoining rooms.

.11 Finish top, bottom, edges and cutouts of doors after fitting as specified for door surfaces.

3.6 MECHANICAL/ELECTRICAL EQUIPMENT

.1 Paint finished area exposed conduits, piping, hangers, ductwork and other mechanical and electrical equipment with colour and finish to match adjacent surfaces, except as indicated.

.2 Boiler room, mechanical and electrical rooms: paint exposed conduits, piping, hangers, ductwork and other mechanical and electrical equipment.

.3 Other unfinished areas: leave exposed conduits, piping, hangers, ductwork and other mechanical and electrical equipment in original finish and touch up scratches and marks.

.4 Touch up scratches and marks on factory painted finishes and equipment with paint as supplied by manufacturer of equipment.

.5 Do not paint over nameplates.

.6 Keep sprinkler heads free of paint.

.7 Paint inside of ductwork where visible behind grilles, registers and diffusers with primer and one coat of matt black paint.

.8 Paint fire protection piping red.

.9 Paint disconnect switches for fire alarm system and exit light systems in red enamel.

.10 Paint natural gas piping yellow.

.11 Paint both sides and edges of backboards for telephone and electrical equipment before installation. Leave equipment in original finish except for touch-up as required, and paint conduits, mounting accessories and other unfinished items.

.12 Do not paint interior transformers and substation equipment.

.13 Final coat to exhibit uniformity of colour and uniformity of sheen across full surface area.

3.7 FIELD QUALITY CONTROL

.1 Standard of Acceptance:

.1 Walls: no defects visible from a distance of 1000 mm at 90 degreesto surface.

.2 Ceilings: no defects visible from floor at 45 degrees degrees to surface when viewed using final lighting source.

.3 Final coat to exhibit uniformity of colour and uniformity of sheen across full surface area.

3.8 RESTORATION

.1 Clean and re-install hardware items removed before undertaken painting operations.

.2 Remove protective coverings and warning signs as soon as practical after operations cease.

.3 Remove paint splashings on exposed surfaces that were not painted. Remove smears and spatter immediately as operations progress, using compatible solvent.

.4 Restore areas used for storage, cleaning, mixing and handling of paint to clean condition.

.5 Touch up scratches, abrasions, voids and other defects in painted surfaces.

3.9 CLEANING

.1 Proceed in accordance with Section 01 74 11 – Cleaning Procedures

END OF SECTION

Part 1 General

1.1 RELATED REQUIREMENTS

.1 Section 03 30 00 - Cast-in-Place Concrete.

.2 Section 04 22 00 - Concrete Unit Masonry.

.3 Section 08 34 63 - Detention Doors and Frames

1.2 REFERENCES

.1 ASTM International

.1 ASTM E84-12, Standard Test Method for Surface Burning Characteristics of Building Materials.

.2 Canadian General Standards Board (CGSB)

.1 CAN/CGSB-1.188-96, Emulsion Filler for Masonry Block.

.3 Underwriters' Laboratories of Canada (ULC)

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 elastomeric coating application 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.

.3 Samples:

.1 Submit duplicate 200 x 200 mm samples of each colour and texture of wall coating applied to gypsum board, plywood, and porous concrete block.

.2 Prior to commencing application, prepare wall and apply sample of wall coating of each texture to full wall panels, for Departmental Representative's approval.

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 elastomeric coatings for incorporation into manual.

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 indoors, in dry location and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.

.2 Store and protect elastomeric coating materials.

.3 Replace defective or damaged materials with new.

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

.5 Fire Safety Requirements:

.1 Provide one 9 kg Type ABC fire extinguisher adjacent to storage area.

.2 Store oily rags, waste products, empty containers and materials subject to spontaneous combustion in ULC approved, sealed containers and remove from site on a daily basis.

.3 Handle, store, use and dispose of flammable and combustible materials in accordance with National Fire Code of Canada requirements.

1.6 SITE CONDITIONS

.1 Environmental Requirements:

.1 Temperature: minimum temperature of substrate 10 degrees C. Minimum temperature of air during and for 48 hours before and after coating is applied 15 degrees C.

.2 Ventilation:

.1 Ventilate enclosed spaces in accordance with Section 01 56 00 - Temporary Barriers and Enclosures.

.2 Provide heating facilities to maintain ambient air and substrate temperatures above 10 degrees C for 24 hours before, during and after paint application until paint has cured sufficiently.

.3 Provide continuous ventilation for seven days after completion of application of paint.

.4 Coordinate use of existing ventilation system with Departmental Representative and ensure its operation during and after application of paint as required.

.5 Provide temporary ventilating and heating equipment where permanent facilities are not available or supplemental ventilating and heating equipment if ventilation and heating from existing system is inadequate to meet minimum requirements.

Part 2 Products

2.1 MATERIALS

.1 Coating: elastomeric, catalyst cured thermo-plastic without vinyl resins, semi-gloss surface finish, minimum dry film thickness 6 - 8 mils per coat, colour as selected by Departmental Representative from manufacture's standard range.

.1 Fire hazard classification: 25/35 to ASTM E84.

.2 Coatings: VOC limit 180 g/L maximum.

.2 Substrate filler: epoxy caulk.

.3 Substrate filler: to CAN/CGSB-1.188.

.4 Identify each coating material container with ULC listed markings stating fire hazard classification.

.5 Provide factory-mixed coatings.

.1 Do not thin, reduce, dilute, or add materials to coatings unless described in manufacturer's product literature.

.6 Acceptable material: Amerlock 400.

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 elastomeric coating application in accordance with manufacturer's written instructions.

.1 Visually inspect substrate in presence of Departmental Representative.

.2 Ensure that items penetrating coating are placed before application of coating.

.3 Ensure maximum moisture content of substrate: 12%.

.4 Ensure negative alkalinity of substrate before application of coating.

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

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

3.2 PREPARATION

.1 Protect adjacent surfaces and equipment from damage by over spray, fall-out and dusting.

.2 Clean substrate of matter which would affect bond of applied coating.

.3 Concrete block:

.1 Remove dust, dirt, and other surface debris by vacuuming, or wiping with dry, clean cloths.

.2 Wash surfaces with a biodegradable detergent and clean warm water using a stiff bristle brush to remove dirt, oil and other surface contaminants.

.3 Rinse scrubbed surfaces with clean water until foreign matter is flushed from surface.

.4 Plywood - remove dust, dirt, and other surface debris by vacuuming or wiping with dry or clean cloths.

.5 Steel - Remove all dirt, grease or other contaminants using standard cleaning practices.

.6 Gypsum board - tape and mud all joints, fill all screw holes and sand surface smooth. Remove all dust, and other surface debris by vacuuming or wiping with dry, clean cloths.

.7 Epoxy caulk all joints in new and existing surfaces and prepare entire wall and ceiling surfaces as recommended by manufacturer

3.3 APPLICATION

.1 Manufacturer's Instructions: comply with manufacturer's written application recommendations.

.2 Apply substrate filler coat 0.75 mm minimum thickness over completely dry concrete, concrete masonry, and other coarse surfaces as required to achieve a 100% filled, smooth surface with no pin holes and voids.

.3 Apply substrate filler coat 0.5 mm minimum thickness over gypsum board and plywood surfaces as required to achieve a 100% filled, smooth surface.

.4 Apply primer coat 0.5 mm minimum thickness over metal doors and metal frames as required to achieve a 100% filled, smooth surface.

.5 Prime surfaces according to manufacturer's directions, allow to dry. Ensure primer is compatible with substrate and top coatings.

.6 Apply coating employing trained applicators, using equipment specifically designed for this purpose by brush and roller.

.7 Apply coating to a small test area and allow to set. Notify Departmental Representative to inspect mock-up.

.8 Apply coating in two individual, uniform applications, permitting first to cure at least four hours before applying second coat.

.9 Finished work: to match approved samples, be uniform in thickness, sheen, colour and texture and to be free from marks, dirt particles, runs, crawls, drips, sags, brush marks, curling, holes, air pockets and other defects.

3.4 FIELD QUALITY CONTROL

.1 Inspection of coating application will be carried out Departmental Representative.

3.5 MECHANICAL/ELECTRICAL EQUIPMENT

.1 Finished areas: Unless noted otherwise, paint all exposed grilles, security cages, and other mechanical and electrical equipment with colour and finish as selected by Departmental Representative.

.2 Do not paint over nameplates.

.3 Keep sprinkler heads free of paint.

.4 Paint inside of ductwork where visible behind grilles, registers and diffusers with primer and one coat of matt black paint.

3.6 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.

3.7 PROTECTION

.1 Repair damage to adjacent materials caused by elastomeric coating application..

3.8 SCHEDULES

.1 Concrete block:

.1 One coat epoxy primer.

.2 Two coats (minimum) Amerlock 400.

.2 Plywood:

.1 One coat epoxy primer.

.2 Two coats (minimum) Amerlock 400.

.3 Steel - not primed:

.1 One coat epoxy primer.

.2 Two coats (minimum) Amerlock 400.

.4 Steel - primed:

.1 Touch-up with epoxy primer.

.2 Two coats (minimum) Amerlock 400.

.5 Gypsum board:

.1 One coat epoxy primer.

.2 Two coats (minimum) Amerlock 400.

.6 All colours to be selected by Departmental Representative.

END OF SECTION

PART 1 General

1.1 REFERENCES

.1 Aluminum Association, Inc. (AA)

.1 Designation System for Aluminum Finishes- 1997.

.2 American Society for Testing and Materials (ASTM)

.1 ASTM A653/A653M-[01a], Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.

.3 The Master Painters Institute (MPI)

.1 Architectural Painting Specification Manual – March 1998.

.4 Canadian Standards Association (CSA)

.1 CAN/CSA-B651-95 (R2001), Barrier-Free Design.

1.2 SHOP DRAWINGS

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

.2 Submit shop drawings, catalogue sheets and full size templates.

.3 Indicate materials, thicknesses, sizes, finishes, colours, construction details, removable and interchangeable components, mounting methods and schedule of signs.

.4 Submit drawn-to-scale details for individually fabricated lettering indicating word and letter spacing.

1.3 SAMPLES

.1 Submit samples in accordance with Sections 01 33 00 – Submittal Procedures

.2 Submit representative sample of each type sign, sign image and mounting method.

1.4 QUALITY ASSURANCE

.1 Welding Certification in accordance with Section 01 33 00 – Submittal Procedures

1.5 WASTE MANAGEMENT AND DISPOSAL

.1 Separate and recycle waste materials in accordance with Section 01 74 21 – Construction Waste Management and Disposal.

PART 2 Products

2.1 MATERIAL

.1 Multi-layered acrylic material with low-glare matte finish

.2 Size: 100 x 100 x 1.6mm thick

.3 Adhesives, paints, sealants and solvents: type recommended by material manufacturer for applicable condition.

2.2 SIGN GRAPHICS

.1 Sign graphics to be well defined, arranged for balanced appearance, and properly word and letter spaced.

.2 Apply by engraving at a depth of .30mm using a rotating carbide cutter.

2.3 DOOR SIGNS

.1 Engrave 25mm high, single line three or four digit numerals incised to expose contrasting coloured core. Numbers shall correspond to room numbers on plans.

.2 For interchangeable mounting: supply door signs with approved type, channel holders fabricated from 1.6mm aluminum, clear anodized finish.

.3 For fixed mounting: use self-stick foam tape.

2.4 WASHROOM SIGNS

.1 Each sign to be engraved with international symbol of man and/or woman.

.2 Signs to be complete with drill holes and tamperproof screws for anchoring. Mount at 1500mm height on door.

.3 Correspond signs according to plans.

2.5 HANDICAP SIGNS

.1 Each sign is to be engraved with international symbol of accessibility for the handicapped.

.2 Signs to be complete with drilled holes and tamperproof screws for anchoring. Mount at 1500mm height on door.

.3 Correspond signs according to plans.

2.6 FABRICATION

.1 Fabricate signs in accordance with details, specifications and shop drawings.

.2 Build units square, true, accurate to size, free from visual or performance defects.

.3 Accurately fit and securely join sections to obtain tight, closed joints.

.4 Allow for thermal movement without distortion of components.

.5 Exposed fasteners permitted only where indicated or approved by Engineer and to be inconspicuous and same finish and colour as base material, or as noted.

.6 Polish exposed edges to smooth, slightly convex profile.

.7 Manufacturer's nameplates on sign surface locations visible in completed work not acceptable.

2.7 FINISHES

.1 Low-glare mate acrylic; colours to be selected.

PART 3 Execution

3.1 INSTALLATION

.1 Erect and secure signs plumb and level at elevations indicated.

.2 Comply with sign manufacturer's installation instructions and approved shops drawings.

.3 Mechanical attachment:

.1 To steel use bolts with nut and lock washers, self-tapping screws.

.1 Do steel welding to CSA W59 and aluminum welding to CSA W59.2. Finish exposed welds flush and smooth.

.2 To wood use screws.

.3 Secure into framing members behind stud walls or above ceilings.

.4 Fabricate special fasteners as required for installation conditions.

.5 Mechanical fasteners and methods of attachment subject to Engineer's approval. Obtain Engineer's approval before fixing to structural steel.

3.2 CLEANING

.1 Leave signs clean.

.2 Touch up any damaged finishes.

END OF SECTION

PART 1 General

1.1 RELATED SECTIONS

.1 Section 06 10 00 - Rough Carpentry.

.2 Section 10 28 10 – Toilet and Bath Accessories.

1.2 REFERENCES

.1 American Society for Testing and Materials (ASTM)

.1 ASTM A653/A653M-[02a], Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.

.2 Canadian Standards Association (CSA)

.1 CAN/CSA-B651-95 (R2001), Barrier-Free Design.

1.3 SUBMITTALS

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

.2 Indicate fabrication details, plans, elevations, hardware, and installation details.

.3 Submit 2 colour charts for selection of colours.

1.4 CLOSEOUT SUBMITTALS

.1 Provide maintenance data for incorporation into manual specified in Section 01 78 00 - Closeout Submittals.

1.5 STORAGE AND PROTECTION

.1 Deliver, store, handle and protect materials in accordance with Section 01 61 00 - Common Product Requirements.

.2 Protect finished surfaces during shipment and installation. Do not remove until immediately prior to final inspection.

PART 2 Products

2.1 MATERIAL

.1 Toilet Partitions

.1 Doors and Panels

.1 Minimum base steel thickness: 0.8 mm.

.2 Constructed of 2 sheets Galvanneal steel, cemented to a honeycomb core. Honey comb to have a maximum 25mm cell size. Form and finish doors and panels with continuous self-locking edges with mitred, welded corners, and ground smooth. Height of doors and panels shall be 1460 mm.

.3 Finish: All steel surfaces to be undercoated with an iron phosphate treatment suitable for final finish. Paint finish shall be a high solid polyester baking enamel to approximately 50% gloss. Colour shall be selected from manufacturer's standard range of colours.

.2 Pilasters

.1 Minimum base steel thickness: 0.9 mm.

.2 Floor Braced.

.3 Manufactured from same material and fabrication methods as doors and panels. Pilaster height shall be 2083mm high. Provide stainless steel shoes.

.3 Headrail: Clear anodized alloy and temper 6063T5 with anti-grip design. Outer flanges shall fit over the facing of the pilaster and be supported at the wall.

.4 Components:

.1 Hinges, latch and connecting brackets: heavy-duty manufacturer's standard surface mount type, Type 304 stainless steel.

.2 Latches will have emergency access feature.

.3 Coat hook: combination hook and rubber door bumper, stainless steel.

.4 Door pull: Standard, stainless steel and barrier-free type suited for out-swing door.

PART 3 Execution

3.1 INSTALLATION

.1 Ensure supplementary anchorage, if required, is in place.

.2 Do work in accordance with CAN/CSA-B651.

3.2 ERECTION – TOILET PARTITIONS

.1 Install partitions and pilasters secure, plumb and square.

.2 Leave 12 mm space between wall and panel or end pilaster.

.3 Anchor mounting brackets to masonry or concrete surfaces using screws and shields: to hollow walls using bolts and toggle type anchors, to steel supports with bolts in threaded holes.

.4 Attach panel and pilaster to brackets with through type sleeve bolt and nut.

.5 Equip each door with coat hook mounted on door.

.6 Attach pilasters to floor with pilaster supports and level, plumb, and tighten installation with levelling device. Secure pilaster shoes in position.

.7 Secure headrail to pilaster face with not less than two fasteners per face.

.8 Set tops of doors parallel with overhead brace when doors are in closed position.

.9 Install hardware. Adjust and align hardware for proper function.

3.3 SCHEDULE

.1 Provide toilet partitions in rooms:

.1 Womens 119

.2 Mens 122

.3 And as noted on drawings.

END OF SECTION

Part 1 General

1.1 RELATED SECTIONS

.1 Section 07 92 00 - Joint Sealants.

1.2 SECTION INCLUDES

.1 Fiberglass reinforced protection panels and associated edge trims.

.2 Stainless steel corner guards.

1.3 REFERENCES

.1 American Society for Testing and Materials International (ASTM)

.1 ASTM E84, 10b Standard Test Method for Surface Burning Characteristics of Building Materials

.2 ASTM D 256, 10 Standard Test Methods for Determining the Izod Pendulum Impact Resistance of Plastics

1.4 SUBMITTALS

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

.2 Product Data: Submit manufacturer's printed product literature and specifications.

.3 Manufacturer's Instructions: Submit manufacturer's installation instructions.

.4 Samples: For each finish product specified, including trim pieces, provide two samples, minimum size 300 by 300 mm, representing actual product, colour, and patterns.

1.5 DELIVERY, STORAGE, AND HANDLING

.1 Deliver materials in original factory wrappings and containers, clearly labeled with manufacturer

1.6 PROJECT CONDITIONS

.1 Maintain environmental conditions (temperature, humidity, and ventilation) within limits recommended by manufacturer for optimum results. Do not install products under environmental conditions outside manufacturer's absolute limits.

1.7 WARRANTY

.1 Product Warranty: Standard manufacturer’s product warranty against manufacturing defects.

Part 2 Products

2.1 WALL PROTECTION

.1 Comply with specified requirements ASTM E 84 for flame spread and smoke developed characteristics.

2.2 FIBERGLASS REINFORCED PANELS

.1 Fiberglass reinforced thermosetting polyester resin panel sheets complying with ASTM D 5319.

.2 Finish: smooth; Colour: white.

.3 Accessories

.1 Color Matched PVC Accessory Moldings

.2 Adhesive and Primer: As recommended by manufacturer.

2.3 CORNER GUARDS:

.1 Stainless Steel, type 304, 90 x 90 x 1220 mm high, 1.2mm thick (18 gauge). Finish: #4 satin. Corners shall be rounded with no sharp edges. Field applied adhesive mounting.

Part 3 Execution

3.1 EXAMINATION

.1 Verify substrates are properly prepared.

.2 Wall surfaces to receive impact-resistant wall covering materials shall be dry and free from dirt, grease, loose paint, and scale.

3.2 INSTALLATION

.1 Avoid materials with chips, cracks, voids, stains, or other defects that might be visible in the finished work.

3.3 FIBERGLASS REINFORCED PANELS

.1 Apply panels to board substrate, above base, vertically oriented with seams plumb and pattern aligned with adjoining panels.

.2 Install panels with manufacturer's recommended gap for panel field and corner joints.

.3 Adhesive trowel and application method to conform to adhesive manufacturer’s recommendations.

.4 Install panels minimum 150mm beyond lip of mop sink and minimum of 1000mm above finished floor. Cut panels to fit around lip of mop sink.

.5 Seal panels to edge of mop sink. Refer to Section 07 92 00 - Joint Sealants.

.6 Apply panel moldings to all panel edges using silicone sealant providing for required clearances.

3.4 CORNER GUARDS

.1 Install aluminum retainers, mounting brackets, and other accessories in strict accordance with the manufacturer's instructions.

.2 Install corner guards with construction adhesive as recommend by manufacturer.

.3 Install corner guards as indicated in schedule.

3.5 CLEANING

.1 Remove excess adhesive in manner recommended by manufacturer.

.2 Clean plastic covers and accessories using a standard non-ammonia based household cleaning agent.

3.6 SCHEDULE

.1 Wall Protection

.1 Room: Jan 118

.2 Corner Guards

.1 As indicated on drawings.

END OF SECTION

Part 1 General

1.1 REFERENCES

.1 American Society for Testing and Materials (ASTM)

.1 ASTM A167-99(2009), Standard Specification for Stainless and Heat-Resisting Chromium-Nickel Steel Plate, Sheet, and Strip.

.2 ASTM A653/A653M-11, Standard 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-1.81-M90, Air Drying and Baking Alkyd Primer for Vehicles and Equipment.

.2 CAN/CGSB-1.88-92, Gloss Alkyd Enamel, Air Drying and Baking.

.3 CGSB 31-GP-107Ma-90, Non-inhibited Phosphoric Acid Base Metal Conditioner and Rust Remover.

.3 Canadian Standards Association (CSA)

.1 CAN/CSA-B651-07(2012), Barrier-Free Design.

.2 CAN/CSA-G164-M92(R2003), Hot Dip Galvanizing of Irregularly Shaped Articles.

1.2 SHOP DRAWINGS

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

.2 Indicate size and description of components, base material, surface finish inside and out, hardware and locks, attachment devices, description of rough-in-frame, building-in details of anchors for grab bars.

1.3 SAMPLES

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

.2 Samples to be returned for inclusion into work.

1.4 CLOSEOUT SUBMITTALS

.1 Provide maintenance data for toilet and bath accessories for incorporation into manual specified in Section 01 78 00 - Closeout Submittals.

1.5 EXTRA MATERIALS

.1 Provide special tools required for accessing, assembly/disassembly or removal for toilet and bath accessories in accordance with requirements specified in Section 01 78 00 - Closeout Submittals.

.2 Deliver special tools to Departmental Representative.

Part 2 Products

2.1 MATERIALS

.1 Sheet steel: to ASTM A653/A653M with ZF001 designation zinc coating.

.2 Stainless steel sheet metal: to ASTM A167, Type 302, with satin finish.

.3 Stainless steel tubing: Type 302, commercial grade, seamless welded, 1.2 mm wall thickness.

.4 Fasteners: concealed screws and bolts hot dip galvanized, exposed fasteners to match face of unit. Expansion shields fibre, lead or rubber as recommended by accessory manufacturer for component and its intended use.

2.2 COMPONENTS

.1 All washroom components shall be supplied by the same manufacturer, from the same design series wherever possible.

.2 Toilet tissue dispenser: double roll type, surface mounted, chrome plated steel frame, capacity of 500 double ply roll, roll under spring tension for controlled delivery.

.1 Bobrick Contura Series – B-4288

.3 Soap dispenser: liquid push-in valve spout, self-contained, 340 mL translucent polyethylene, tamper proof filler lock, surface mounted.

.4 Feminine napkin disposal bin: stainless steel, surface unit, continuous hinged door, embossed with universally accepted symbol, removable plastic receptacles fitted with spring clip for deodorizer block.

.1 Acceptable manufacturer:

.1 Bobrick Contura Series B-270.

.2 Approved alternate.

.5 Feminine napkin dispenser: stainless steel, satin finish, recessed unit, min capacity 20 napkins and 30 tampons, key locked, continuous hinge front panel. Adjustable for cost $0.50 to $0.00 operation.

.1 Acceptable manufacturer:

.1 Bobrick B-4288, “Contura” Series

.2 Approved alternate.

.6 Paper Towel Dispenser: for singlefold paper towels, stainless steel cabinet, hinged front panel, lock and key, surface mounted, minimum capacity 400 singlefold paper towels.

.1 Acceptable material: Bobrick B-263

.2 Approved alternate.

.7 Waste receptacle: 320mm x 320 mm x 560 mm high, stainless steel, open top, no cover.

.1 Acceptable material: Bobrick B-2260 or approved alternate.

.8 Electric Hand Dryer: surface mounted.

.1 Cover- one piece aluminum with chrome finish. Vandal-resistant grille. Cover is secured with concealed fasteners.

.2 Motor/Fan: thermally protected, minimum 75 watt, 1/10 hp on resilient mounts with shielded ball-bearings.

.3 Maximum sound pressure level of 72dB(A) measured at 1 meter from hand dryer.

.4 Automatic start when hands are detected in infrared sensing zone.

.5 The dryer will either automatically turn off immediately after hands are removed, or after 1-1/2 minutes of continuous usage.

.1 Acceptable product: Bobrick High Speed Hand dryer B-778

.2 Approved alternate.

.9 Mirror: Frame: heavy-gauge, one piece, roll-formed stainless steel with bright polished stainless steel finish. Channel shall be a minimum 13mm x13mm x 9.5mm with 90 degree mitred corners. Continuous integral stiffeners on all sides. Back of unit to be galvanized steel.

.1 Mirror: 6 mm tempered glass set on neoprene tubing in frame.

.2 Attachment clips: Vandal resistant stainless steel clips with concealed fasteners. Mirror support brackets sized to suit mirror size.

.3 Size: 450mm x 900mm, or equivalent, in configurations shown on drawings.

.4 Acceptable material: Bobrick B-165 Series or equivalent.

.10 Grab bars: 32 mm dia x 1.6 mm wall tubing of stainless steel, 76 mm diameter wall flanges, concealed screw attachment, flanges welded to tubular bar, provided with steel back plates and all accessories. Peened surface at area of hand grips. Grab bar material and anchorage to withstand downward pull of 2.2 kN.

.11 Clothes Hook

.1 Type 304, 2.8mm stainless steel, all welded construction with no sharp corners. Satin finish.

.2 Acceptable material: Bobrick B-6827 or equivalent.

.12 Mop/Broom Holder:

.1 Stainless steel, spring-loaded rubber cams with anti-slip coating, plated steel retainers. Length 610mm with three holders.

.2 Acceptable material: Bobrick B-223 or approved alternate.

.13 Waste Chute

.1 Circular stainless steel, rolled lip. Inside diameter 135mm.

2.3 FABRICATION

.1 Weld and grind joints of fabricated components flush and smooth. Use mechanical fasteners only where approved.

.2 Wherever possible form exposed surfaces from one sheet of stock, free of joints.

.3 Brake form sheet metal work with 1.5 mm radius bends.

.4 Form surfaces flat without distortion. Maintain flat surfaces without scratches or dents.

.5 Back paint components where contact is made with building finishes to prevent electrolysis.

.6 Hot dip galvanize concealed ferrous metal anchors and fastening devices to CSA G164.

.7 Shop assemble components and package complete with anchors and fittings.

.8 Deliver inserts and rough-in frames to job site at appropriate time for building-in. Provide templates, details and instructions for building in anchors and inserts.

.9 Provide steel anchor plates and components for installation on studding and building framing.

2.4 FINISHES

.1 Chrome and nickel plating: to ASTM B456, satin finish.

.2 Manufacturer's or brand names on face of units not acceptable.

Part 3 Execution

3.1 INSTALLATION

.1 Install and secure accessories rigidly in place as follows:

- .1 Stud walls: install steel back-plate to stud prior to plaster or drywall finish. Provide plate with threaded studs or plugs.
- .2 Hollow masonry units or existing plaster/drywall: use toggle bolts drilled into cell/wall cavity.
- .3 Solid masonry, marble, stone or concrete: use bolt with lead expansion sleeve set into drilled hole.
- .4 Toilet/shower compartments: use male/female through bolts.

.2 Install grab bars on built-in anchors provided by bar manufacturer.

.3 Use tamper proof screws/bolts for fasteners.

.4 Fill units with necessary supplies shortly before final acceptance of building.

.5 Install mirrors in accordance with Section 08 80 50 - Glazing.

3.2 SCHEDULE

.1 Locate accessories where indicated. Exact locations determined by Departmental Representative.

.2 Room 103

.1 1 mirror at sink
.2 1 toilet tissue dispenser
.3 1 soap dispenser
.4 1 electric hand dryer
.5 1 waste disposal
.6 1 feminine napkin disposal bin
.7 1 coat hook
.8 1 grab bar 610 long
.9 1 grab bar 915 long

.3 Room 104

.1 1 paper towel dispenser

.4 Room 109

.1 1 mirror at sink
.2 1 toilet tissue dispenser
.3 1 soap dispenser
.4 1 electric hand dryer
.5 1 waste disposal
.6 1 feminine napkin disposal bin
.7 1 coat hook
.8 1 grab bar 610 long
.9 1 grab bar 915 long

.5 Rooms 118

.1 1 Mop/Broom Holder

.6 Room 119

.1 1 mirror at sink
.2 1 toilet tissue dispenser in each stall
.3 1 soap dispenser
.4 1 electric hand dryer
.5 1 waste disposal
.6 1 feminine napkin dispenser
.7 1 feminine napkin disposal bin

.7 Room 121

.1 2 clothes hooks

.8 Room 122

.1 1 mirror at sink
.2 1 toilet tissue dispenser in each stall
.3 1 soap dispenser
.4 1 electric hand dryer
.5 1 waste disposal
.6 1 feminine napkin dispenser
.7 1 feminine napkin disposal bin

.9 Room 124

.1 2 clothes hooks

.10 Room 152

.1 1 mirror at sink
.2 1 toilet tissue dispenser
.3 1 soap dispenser
.4 1 paper Towel Dispenser
.5 1 waste disposal

.11 Room 155

.1 1 Mop/Broom Holder

END OF SECTION

1 General

1.1 REFERENCES

.1 Canada Green Building Council (CaGBC)
  .1 LEED Canada-NC Version 1.0-2004, LEED (Leadership in Energy and Environmental Design): Green Building Rating System Reference Package For New Construction and Major Renovations.

.2 Health Canada/Workplace Hazardous Materials Information System (WHMIS)
  .1 Material Safety Data Sheets (MSDS).

.3 National Fire Protection Association (NFPA)
  .1 NFPA 10-2006, Standard for Portable Fire Extinguishers.

1.2 SUBMITTALS

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

.2 Product Data:
  .1 Submit manufacturer's printed product literature and datasheet and include product characteristics, performance criteria, physical size, finish and limitations.
  .2 Submit two copies WHMIS MSDS - Material Safety Data Sheets in accordance with Section 02 81 01 - Hazardous Materials.

.3 Provide shop drawings.

.5 Quality control 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, cleaning procedures.

.6 Closeout Submittals:
  .1 Provide operation and maintenance data for incorporation into manual specified in Section 01 78 00 - Closeout Submittals.

2 Products

2.1 MULTI-PURPOSE DRY CHEMICAL EXTINGUISHERS

.1 Cartridge operated type with hose and shut-off nozzle, ULC labelled for A, B and C class protection.
  .1 Sizes: Refer to equipment schedule.

2.2 CARBON DIOXIDE

.1 Extinguishers Insulated handle, hose and horn discharge assembly, self-closing lever or squeeze-grip operation, fully charged, ULC labelled for B and C class protection.
  .1 Sizes: Refer to equipment schedule.

2.3 EXTINGUISHER BRACKETS

.1 Type recommended by extinguisher manufacturer.

2.4 CABINETS

.1 Semi-recessed, as indicated, constructed of 1.6 mm thick steel, 180 degrees opening door of 2.5 mm thick steel with latching device.

.2 Cabinet to maintain fire resistive rating of construction in which they occur.

.3 Cabinet door: with 5 mm full glass panel.

.4 Finish:
- .1 Tub: prime coated.
- .2 Door and frame: No.4 satin finish stainless steel.

2.5 IDENTIFICATION

.1 Identify extinguishers in accordance with recommendations of ANSI/NFPA 10.

.2 Attach bilingual label to extinguishers, indicating month and year of installation. Provide space for service dates.

2.6 FIRE SAFETY BLANKETS

.1 1800 x 1800 mm of silicone coated fibre glass in metal container.

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 or mount extinguishers in cabinets or on brackets as indicated on drawings and / or required by authority having jurisdiction.

.2 Install fire safety blankets as indicated.

Part 1 General

1.1 SECTION INCLUDES

.1 Section includes clothing lockers, change room bench and rifle storage lockers.

1.2 REFERENCES

.1 CAN/CGSB-44.40-2001, Steel Clothing Locker.

1.3 SHOP DRAWINGS

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

.2 Indicate type and class of locker, thicknesses of metal, fabricating and assembly methods, assembled banks of lockers, tops, hooks, shelves, bases, trim, numbering, filler panels, end/back panels, doors, handles, locking method, ventilation method, and finishes.

1.4 SAMPLES

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

.2 Submit duplicate 50 x 50 mm samples of colour and finish on actual base metal.

Part 2 Products

2.1 CLOTHING LOCKERS

.1 Lockers: to CAN/CGSB-44.40.

.2 Steel: cold rolled to ASTM #A1008.

.3 Basis of Design: Shanahan's – "Police and Crew Series, Double Door"

.4 Single tier locker.

- .1 Size: 610 mm wide x 610 mm deep x 1829 mm high, minimum 1.5 mm steel thickness.
- .2 Side and back panels: .56 mm (24 Ga) cold rolled steel.
- .3 Vent holes: vent openings in top and bottom of doors plus additional vent holes in body top of locker. Vent holes in body top to be equal in area to vent holes in top of doors.
- .4 Assembly: factory assembled welded construction.
- .5 Doors:
  - .1 Double doors.
  - .2 Double pan construction. Outer panel shall be no less than .90mm (20 Ga) cold rolled steel to ASTM A366. Inner panel .56 mm (24 Ga) cold rolled steel. Sandwich panel construction welded and complete with honeycomb core. Vent slots in top and bottom of door.

.3 Full length astragal welded to active door (right hand).

.4 Rubber bumpers.

.6 Door hinges: Frame to be equipped with 3 – 64mm long, 5 knuckle hinges, 2 mm (14 Ga).

.7 Door handle: recessed handle stainless steel box and pull.

.8 Shelves and centre divider

.1 Notched into frame, thickness .90mm (20 Ga).

.1 Top shelf, full width of locker; bottom shelf, half width of locker; vertical divider to underside of top shelf; and pull out drawer (full extension), half width of locker complete with keyed cylinder cam lock.

.9 Accessories

.1 Coat rod – 19 mm diameter.

.2 Coat hooks – 6 mm diameter zinc plated steel, 5 per locker.

.10 Locking system: padlocks provided by Owner.

.11 Options: to CAN/CGSB-44.40,

.1 Base: 100 high steel base, colour to match locker frames.

.2 Finished end panels: minimum 0.9 mm steel thickness, colour to match locker frames.

.3 Steel trim including corner angles and jamb trim: minimum 0.9 mm steel thickness, colour to match locker frames.

.4 Filler Panels: minimum 0.9 mm steel thickness, colour to match locker frames.

.5 Number plates: to manufacturer's recommendations.

.12 Finish

.1 Metal finish: Steel surfaces shall be thoroughly cleaned and undercoated with an iron phosphate treatment utilizing a wash and etching process. The paint finish shall be 2 coats of high quality alkyd baking enamel to 40% - 45% gloss, electro-statically applied to a minimum thickness of 1mm.

.2 Color to be selected from manufacturers standard color selector.

2.2 BENCH

.1 Pedestal:

.1 Free standing, A-Frame leg design from cold-rolled steel. Frame is 280 mm at base of legs sloping inward to seat. PVC cap fitted to bottom of legs.

.2 Height: 380 mm to 405 mm high.

.3 Tubing: 25 mm x 25 mm 16 gauge, type 304-4 stainless steel.

.2 Seat

.1 End grain hard Maple, 32 mm thick by 254 wide, edges rounded, all surfaces sanded.

.2 Length:

.1 2 benches 1524 mm long

.2 1 bench 1219mm long

.3 Finish: one coat sealer and one top coat clear lacquer.

2.3 RIFLE LOCKERS

.1 Basis of design: Dasco Storage Solutions, “Weapon Storage Components”

.2 Lockers: to CAN/CGSB-44.40, freestanding.

.1 Steel thickness: No. 16 ga

.2 Assembly: welded construction.

.3 Top: flat

.4 Doors: bi-fold. One-piece double-wall envelope construction, steel thickness 16 ga MSG, door swings as indicated in drawings.

.5 Size: as indicated on drawings.

.6 Hinges: hinges concealed behind door when door is closed.

.7 Door handle: recessed handle steel with nickel-plated finish.

.3 Accessories

.1 Adjustable rifle stock saddles with rubber matting on shelf, barrel saddle.

.2 Extruded rubber edging on all saddles to prevent direct contact between weapon and metal.

.3 Adjustable shelving: steel construction, 16 ga. Adjustable in minimum 50mm increments.

.1 Refer to drawings for number and location.

.4 Mounting: provide holes in back of cabinet for mechanical fastening of cabinet to wall.

.4 Locking

.1 Locking system: cylinder lock keyed to building keying system.

Part 3 Execution

3.1 INSTALLATION

.1 Lockers

.1 Assemble and install lockers in accordance with manufacturer's written instructions.

.2 Securely fasten lockers to floor assembly and blocking in walls.

.3 Install locker bases and level as required.

.4 Install filler panels (false fronts) where indicated and where obstructions occur.

.5 Install finished end panels to exposed ends of locker banks.

.6 Install sloped false tops and gable ends.

.7 Install locker numbers.

.2 Benches

.1 Assemble benches in accordance with manufacturer's written instructions.

.3 Metal Rifle Racks

.1 Assemble and install lockers in accordance with manufacturer's written instructions.

.2 Securely fasten lockers to floor assembly and blocking in walls.

.3 Level as required.

3.2 SCHEDULE

.1 Quantities, sizes and configuration as indicated on drawings.

END OF SECTION

Part 1 General

1.1 SECTION INCLUDES

.1 Section includes metal shelving, steel storage cabinets and mechanically assisted movable shelf storage racks.

1.2 RELATED REQUIREMENTS

.1 Section 03 30 00 - Cast-in-Place Concrete.

1.3 REFERENCES

.1 CAN/CGSB-44.40-2001, Steel Clothing Locker.

.2 American Society for Testing and Materials (ASTM): ASTM A1008 - Steel, Sheet, Cold-Rolled, Carbon, Structural, High Strength Low-Alloy and High-Strength Low-Alloy with Improved Formability.

.3 ASTM A1011 - Steel Sheet and Strip, Hot-Rolled, Carbon, Structural, High Strength Low-Alloy and High-Strength Low-Alloy with Improved Formability.

.4 ASTM B221 - Aluminum-Alloy Extruded Bar, Rod, Wire, Shape, and Tube.

1.4 DESIGN REQUIREMENTS

.1 Layout: Refer to Drawings for configuration and quantities.

.2 Mobile Storage system shall be designed to adequately support live loads as calculated by manufacturer from Owner's stated storage requirements and specific Project conditions.

.1 Stored material design live load: 1016 kg per linear meter (700 pounds per linear foot).

.3 Mobile storage system shall be designed to manually move fully loaded carriage with appropriate gear selections to create an aisle with minimum number of hand cranks. Gear ratios shall move 1,360 to 4,082 kg force with 454 grams.

1.5 SHOP DRAWINGS

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

.2 Schedule of shelving units to be installed on carriages indicating types, materials, quantities, sizes, and finishes.

.3 Design data to determining loads, gear ratio, and anti-tip restraints.

.4 Shop drawings showing layout plans, elevations, dimensions, required tolerances, clearances, spacing of tracks, and details for fabrication, installation, connections, anchors, accessories, and interface with other elements and systems.

.5 Shelving details indicating configuration.

1.6 SAMPLES

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

.2 Minimum 75 mm square sample of each colour and texture to be exposed after installation.

.3 Finish color samples for selection by Departmental Representative.

1.7 QUALITY ASSURANCE

.1 Installer qualifications: Experienced in installation of mobile storage systems and employee of manufacturer or certified by manufacturer for installation of specified system.

1.8 WARRANTY

.1 Provide under provisions of Section 01780 - Closeout Submittals the following warranties:

.1 5 years warranty to cover mobile storage system parts and materials against defects.

.2 2 years warranty to cover workmanship.

Part 2 Products

2.1 MATERIALS

.1 Steel sheet:

.1 Cold rolled steel sheet complying with ASTM A1008.

.2 Hot rolled, pickled steel sheet complying with ASTM A1011.

.2 Steel rail: SAE 1045.

.3 Cast steel wheels: SAE 1144.

.4 Extruded aluminum: ASTM B221, alloy 6063 Temper T-5.

2.2 MOBILE STORAGE SYSTEM

.1 Type: Manually operated, mechanically assisted, high density, mobile storage system consisting of track assembly and wheeled carriages which provide maneuverable platforms for storage units.

.2 Track: Straight section consisting of aluminum housing and steel rail. Number and spacing as determined by manufacturer to accommodate loads and performance requirements.

.3 Housing: Extruded aluminum section with recess for rail, 95 mm minimum base for load distribution, and holes for attachment.

.1 Equip housing with leveling screws capable of adjustment.

.2 Where required to meet design requirements provide aluminum anti-tip track housing to engage anti-tip bracket and roller guide attached to carriage bottom.

.3 Housing shall protect steel rail from rust and corrosion and allow rail to be removed and replaced without removing complete track assembly.

.4 Rail: 16 mm square cold rolled steel bar. Rail material shall match carriage wheel steel to minimize friction and ensure smooth movement.

.5 Joints: Tongue and groove connection such that rail joints do not coincide with housing joints thus ensuring horizontal and vertical continuity.

.6 Stops: Where required by layout, provide stops to prevent carriages from running off track.

.7 Mobile carriages: wheeled, rigid, steel frame supporting storage units.

.1 Framework: Fabricate from 2.75 mm, cold rolled steel side and cross channels with all welded joints.

.8 Joints: Fabricate carriages in single or maximum possible lengths. When required, carriage splices shall be bolted type designed to maintain alignment and rigidity.

.9 Wheels: precision ground solid steel wheel. Steel material shall match rail steel to minimize friction and ensure smooth movement.

.1 Guide wheels: Provide 4 minimum dual flange wheels per carriage.

.2 Drive wheels: Fit wheels on drive shaft with two permanently sealed bearings housed in self-aligning flanged pillow blocks.

.10 Drive shaft: solid steel rod connected to all drive wheels with positive keyway coupling that will not loosen.

.11 Bumpers: Equip carriages with resilient bumpers to provide safety gap between end panels in closed position.

.12 Fixed carriages: Where indicated on Drawings or required by storage layout, provide fixed carriages of same height and construction as movable carriages. Permanently anchor carriages to floor such that storage unit heights are uniform.

.13 Drive system: Manually operated, mechanically assisted, geared reduction, internal drive assembly with handwheel.

.1 Operation: Movement accomplished by chain and sprocket drive system. There shall be no play in drive handle and carriage shall stop without drifting when handle operation ceases.

.2 Housing: Drive mechanism including all chains and sprockets shall be concealed with steel sheet housing mounted on carriage end. Housing shall be designed to allow access to drive mechanism for maintenance. All chain tension adjustment plates to be concealed and tamper proof.

.14 End panels: Provide carriages with end panels which conceal all chains and sprockets of drive mechanism. End panels shall be designed to allow access to drive mechanism for maintenance.

.1 Size: Full height and depth of storage unit.

.2 Construction: 1.00 mm steel sheet with paint finish.

.15 Handwheel: 3 spoke, ergonomic design with rotating knobs allowing direct pull up or down from any possible starting position to initiate carriage movement.

.16 Hand wheel safety lock: Provide push/pull knob, two pin lock mechanism for handwheel to prevent movement of carriage. Fluorescent orange visual indicator shall alert user to locked status.

.17 Hand wheel mounting: Handle to be installed to a steel chain guard housing independently from the end panel.

.18 Accessories:

.1 Provide fasteners, anchors, other attachment hardware, lateral braces, and other accessories as indicated on approved shop drawings and as required for complete, rigid, functional installation.

.2 Provide 1 vertical file divider for each 1 meter of linear shelf space.

.19 Finish:

.1 Thoroughly clean steel parts in multi-stage washer followed by application of phosphate coating.

.2 Electrostatically apply commercial enamel.

.3 Color: As selected by Departmental representative from manufacturer's standard range.

2.3 GENERAL STORAGE CABINETS

.1 All steel construction.

.1 Steel: cold rolled to ASTM #A1008.

.2 Galvanneal conforming to ASTM #653 zf 120 (A40).

.2 Frame:

.1 Horizontal components 1.27 mm (18 ga.)

.2 Vertical components 1.59 mm (16 ga.)

.3 Body:

.1 Side and back panels 0.63 mm (24 ga.)

.2 Top, shelf and bottom 1.59 mm (16 ga.)

.3 Shelves are adjustable with standards riveted to locker sides.

.4 Door:

.1 Outer and inner panels 0.95 mm (20 ga.), 30 mm thick honeycomb core.

.2 Hinge 64mm long, 5 knuckle, 14 gauge.

.3 Stainless steel handle box and pull

.4 Locking plate welded to one door.

.5 Pull and locking:

.1 Stainless steel handle, box and pull.

.2 Locking system: cylinder lock keyed to building keying system.

.6 Finish:

.1 Side, back panels, top, bottom and shelves; pre-painted galvanized, white in colour.

2.4 METAL SHELVING

.1 Shelf:

.1 Cold-rolled furniture-grade steel,1.27 mm (18 ga.) . Double formed on all four sides. Corners are closed with double thickness steel forming a no-slip notch for the shelf clip.

.2 Clip: 12-gauge compression type; cadmium plated.

.3 Reinforcement: 25 mm x 12 GA. bent angle of steel, installed in the front and rear flange of the shelf to provide additional shelf capacity.

.4 Number of shelves per unit as indicated in drawings.

.2 T-Posts

.1 38 mm x 50 mm x 3.17 mm double-formed steel in a "T" style with a smooth, unperforated face.

.3 Closed End Panel Assembly

.1 Two "T" posts welded to a cold-rolled steel side panel to form a single unit providing greater strength and easier handling.

.2 Provide closed end panel between adjacent shelving units.

.4 Back Panel

.1 Cold-rolled steel panel attached to uprights with cadmium-plated back clips.

.5 Base Plates

.1 Formed top and bottom to provide support for the bottom shelf in addition to closing the space under the shelf.

.6 Finish

.1 Prepared components for painting by being cleaned, iron phosphatized and rinsed. Electrostatically apply high-grade alkyd enamel. Bake to provide a hard, long lasting, furniture-grade finish.

.7 Minimum Shelf Capacity

.1 Shelf dimensions: 36 inch wide by maximum 15 inches deep: minimum load capacity 630 pounds.

.2 Shelf dimensions: 48 inch wide by maximum 15 inches deep: minimum load capacity 315 pounds.

Part 3 Execution

3.1 PREPARATION

.1 Verify dimensions and Project conditions prior to fabrication.

.2 Coordinate provision of mobile storage system with casting of concrete floor slab specified in Section 03300 - Cast-in-Place Concrete to ensure accurate location of recesses for track installation.

.1 Layout of floor panel grid is compatible with position of mobile storage floor track.

.2 Adequate support is provided by pedestals for storage system and for anchoring of tracks. Ensure that track pedestals are height which allows installation of tubular steel support.

.3 Verify floor substrate is level and ready to receive mobile storage system.

3.2 INSTALLATION MOBILE STORAGE SYSTEM

.1 Install mobile storage system in accordance with manufacturer's installation instructions and approved shop drawings.

.2 Accurately layout storage system and location of tracks. Use manufacturer provided spacers to ensure tracks are correctly positioned and parallel. Ensure that manufacturer recommended wall clearances are maintained.

.3 Embedded track installation:

.1 Anchor track in concrete recess with expansion anchors of type, size, and spacing recommended by manufacturer. Use leveling screws to adjust tracks such that top is flush with final floor finish. Leave grout space below track housing.

.2 Tightly pack grout under track housing. Allow to cure.

.3 Coordinate installation by others of concrete specified in Section 03300 - Cast-in-Place Concrete in remainder of recess. Ensure track alignment and spacing is not disturbed.

3.3 INSTALLATION GENERAL STORAGE CABINETS

.1 Assemble and install cabinets in accordance with manufacturer's written instructions.

.2 Install storage cabinets in numbers and configurations shown in drawings.

.3 Securely fasten cabinets to blocking in walls.

3.4 INSTALLATION METAL SHELVING

.1 Assemble and install cabinets in accordance with manufacturer's written instructions.

.2 Install storage cabinets in numbers and configurations shown in drawings.

.3 Ensure shelving units are installed square and plumb.

.4 Align shelving units adjacent to each other when they are installed end to end.

.5 Install shelving units parallel and perpendicular to walls according to the layout.

3.5 CLEANING

.1 Remove protective wrappings.

.2 Clean metal surfaces using clean water and mild detergent. Do not use abrasive agent, steel wool, or harsh chemicals. Rinse with clean water.

3.6 DEMONSTRATION

.1 Demonstrate to Owner's designated representatives, complete operation and required maintenance for mobile storage system.

END OF SECTION

PART 1 General

1.1 RELATED SECTIONS

.1 Section 03 30 00 – Cast-in-Place Concrete.

1.2 REFERENCES

.1 ASTM B221 - Aluminum-Alloy Extruded Bar, Rod, Wire, Shape, and Tube.

.2 ASTM B241 - Aluminum and Aluminum-Alloy Seamless Pipe and Seamless Extruded Tube.

.3 CAN/CSA-B72-M87 (R2013) - Installation Code for Lightning Protection Systems.

1.3 SUBMITTALS

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

.2 Shop Drawings:

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

.2 Shop drawings shall clearly indicate detailed dimensions, base, attachment details, anchor requirements, and imposed loads.

.3 Product Data: Provide data on pole, accessories, and configurations.

.4 Maintenance Data: Provide lubrication and periodic maintenance requirements.

1.4 DELIVERY, STORAGE, AND HANDLING

.1 Spiral wrap flagpole with protective covering and pack in protective shipping tubes or containers.

.2 Protect flagpole and accessories from damage or moisture.

PART 2 Products

2.1 POLE MATERIALS

.1 Aluminum: Tapered shaft, 7.5 meters in length. Colour: clear anodized.

2.2 COMPONENTS AND ACCESSORIES

.1 Finial Ball: Aluminum, 150mm diameter

.2 Fixed steel base attached to concrete pile.

.3 Truck Assembly: Cast aluminum; revolving, stainless steel ball bearings, non-fouling.

.4 Cleats: 230mm size, aluminum with stainless steel fastenings, two per halyard.

.5 Cleat Box: Aluminum, with built-in hinge and hasp assembly, attached to pole with tamper proof screws inside box.

.6 Pulleys: nylon or brass.

.7 Halyard: internal, stainless steel cable.

.8 Lightning control: ground spike conforming to CAN/CSA B72.

PART 3 Execution

3.1 INSTALLATION

.1 Install flagpoles and fittings in accordance with manufacturer's instructions.

3.2 ERECTION TOLERANCES

.1 Maximum Variation From Plumb: 25mm.

3.3 ADJUSTING

.1 Adjust operating devices so that halyard functions smoothly.

END OF SECTION

Part 1 General

1.1 REFERENCES

.1 CAN/CSA C300-08: Energy Performance and Capacity of Household Refrigerators, Refrigerator-Freezers, Freezers, and Wine Chillers.

.2 CAN/CSA-C22.2 NO. 150-M89 (R2014): Microwave ovens.

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

1.3 CLOSEOUT SUBMITTALS

.1 Submit in accordance with Section 01 78 00 - Closeout Submittals.

.2 Operation and Maintenance Data: submit operation and maintenance data for incorporation into manual.

1.4 DELIVERY, STORAGE AND HANDLING

.1 Deliver, store and handle materials in accordance with Section 01 61 00 - Common Product Requirements with manufacturer's written instructions.

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

.3 Storage and Handling Requirements:

.1 Store materials indoors and in accordance with manufacturer's recommendations in clean, dry and well-ventilated area.

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

.3 Replace defective or damaged materials with new.

1.5 WARRANTY

.1 Provide 1 year parts and labour warranty.

Part 2 Products

2.1 REFRIGERATORS

.1 Refrigerators are to be from same manufacturer.

.2 Type FR-FRZ – bottom freezer

.1 Width: maximum 30 inches.

.2 Capacity:

.1 Refrigerator: minimum 14 cubic feet.

.2 Freezer: minimum 6 cubic feet.

.3 Temperature controls: electronic.

.4 Shelving: adjustable in refrigerator with storage in refrigerator door.

.1 Refrigerator: minimum 3.

.5 Door: reversible.

.6 Light: refrigerator and freezer compartments.

.7 Defrost system: frost free.

.8 Energy Star qualified.

.9 Wheels: two adjustable and 2 non-adjustable.

.10 Finish: stainless steel.

.11 Acceptable Manufacturers

.1 Kenmore, KitchenAid, Whirlpool, Frigidaire, LG or approved alternate.

.3 Type REFR – no freezer

.1 Capacity:

.1 Minimum 16.5 cubic feet.

.2 Temperature controls: electronic.

.3 Power on indicator light.

.4 Shelving: adjustable

.5 Door: reversible.

.6 Interior light

.7 Defrost system: frost free.

.8 Energy Star qualified.

.9 Wheels: two adjustable and 2 non-adjustable.

.10 Cabinet material: painted steel.

.11 Finish: stainless steel.

.12 Acceptable Manufacturers

.1 Kenmore, KitchenAid, Whirlpool, Frigidaire, LG or approved alternate.

2.2 MICROWAVES

.1 Microwaves are to be from same manufacturer.

.2 Type MIC

.1 Width: maximum 22 inches.

.2 Height: maximum 13 inches.

.3 Depth: maximum 16 inches.

.4 Capacity: minimum 1.6 cubic feet.

.5 Power: minimum 1100 watts.

.6 Options:

.1 Turntable, auto defrost, auto reheat, auto cook, timer, minimum 10 programmable power levels.

.7 Oven liner: painted steel.

.8 Finish: stainless steel.

.9 Acceptable Manufacturers

.1 Kenmore, Panasonic, Bosch, Samsung, Whirlpool LG, GE or approved alternate.

Part 3 Execution

3.1 INSTALLATION

.1 Install according to manufacturer's written instructions.

.2 Install in locations as indicated on drawings.

.3 Set digital clocks to display correct time.

3.2 CLEANING

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

.2 Remove masking or protection after installation.

.3 Clean finished surfaces as recommended by panel manufacturer.

END OF SECTION

Part 1 General

1.1 RELATED SECTIONS

.1 Section 03 35 43 – Polished Concrete

1.2 REFERENCES

.1 American Society for Testing and Materials (ASTM)

.1 ASTM B221M – Aluminum and Aluminium-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes.

.2 The Aluminum Association

1.3 SUBMITTALS

.1 Submit product data in accordance with Section 01 33 00 – Submittals.

.2 Product Data

.1 Product data for each type of floor mat, grid and frame specified, including manufacturer's specifications and installation instructions.

.3 Samples

.1 Samples for verification purposes: Submit an assembled section of floor mat, grid and frame members with selected tread insert showing each type of color for exposed floor grid, frame and accessories required.

.4 Shop Drawings

.1 Shop drawings in sufficient detail showing layout of grid and frame specified including details indicating construction relative to materials, direction of traffic, spline locations, profiles, anchors and accessories.

.5 Closeout Submittals

.1 Provide maintenance date for recessed floor mat for incorporation into manual specified in Section 01 78 00 – Closeout Submittals.

1.4 QUALITY ASSURANCE

.1 Flammability in accordance with ASTM E648, Class 1, Critical Radiant Flux, minimum 0.45 watts/m².

.2 Slip resistance in accordance with ASTM D-2047-96, Coefficient of Friction, minimum 0.60 for accessible routes.

.3 Standard rolling load performance is 300 lb./wheel with larger loading requirements as specified (load applied to a solid 5” x 2” wide polyurethane wheel, 1000 passes without damage).

1.5 DELIVERY STORAGE AND HANDLING

.1 Deliver materials to the project site ready for use and fabricated in as large sections and assemblies as practical, in unopened original factory packaging clearly labeled to identify manufacturer.

1.6 PROJECT CONDITIONS

.1 Field measurements: Confirm floor recess openings before fabrication. Record actual measurements on final shop drawings.

.2 Defer mat installation until building enclosure is complete and related interior finish work is in progress.

Part 2 Products

2.1 RECESSED WELL MATTING

.1 Load: minimum 300 pounds per square foot static and 400 pounds per square foot rolling loads.

.2 Thickness: 45mm deep, extruded aluminum rail. Frame rail supported on EPDM cushions to prevent contact between rails and concrete.

.3 Frame: level base frame with continuous anchor.

.4 Mat insert – heavy duty exterior carpet. Colour selected from manufacturer’s standard range.

Part 3 Execution

3.1 EXAMINATION

.1 Verification of conditions: Examine areas and conditions under which work is to be performed and identify conditions detrimental to proper or timely completion

3.2 INSTALLATION

.1 Install the work of this section in strict accordance with the manufacturer's recommendations.

.2 Cast frame rail into concrete floor. Level frame with top of finished floor. Install frame continuous around recess perimeter.

.3 Install matting on concrete substrate in floor recess.

.4 Cut matting to maintain equal widths of matting in each recess.

.5 Apply a coat of zinc chromate primer to all surfaces in contact with masonry.

.6 Coordinate top of mat surfaces with bottom of doors that swing across to provide minimum required clearance between door and mat.

3.3 PROTECTION

.1 After completing required frame installation and concrete work, provide temporary filler of plywood or fiberboard in recess, and cover frames with plywood protective flooring. Maintain protection until construction traffic has ended and project is near time of substantial completion.

.2 Defer installation of floor mats until time of substantial completion of project.

3.4 SCHEDULE

.1 Sizes shown are nominal. Confirm final sizes to conform to flooring pattern and layout. Adjust final size plus or minus 20 mm to suit manufacturer's manufacturing modules.

.2 Recessed Floor Mats

.1 Vestibule 101 - 2100 mm wide by 1330 mm long

.2 Vestibule 107 – 1300 mm wide by 1360 mm long

.3 Vestibule 131 - 1400 mm wide by 2360 mm long

END OF SECTION

Part 1 General

1.1 RELATED SECTIONS

.1 Section 08 54 13 - Fiberglass Windows

1.2 DESIGN REQUIREMENTS

.1 Design roller shades to following requirements:

- .1 Be designed in a manner that allows wear susceptible parts to be replaceable by either the user or the manufacturer.
- .2 A guarantee of at least five years of available replacement parts following discontinue of the products manufacture.
- .3 Be accompanied by instructions for replacing or repairing worn parts, including inventory numbers for parts and procedures for ordering replacement parts.
- .4 A program that allows for the refurbishing or return of used roller shades.
- .5 Be designed in a manner that permits effective disassembly of components in order to permit recycling of materials for which recycling markets exist.

1.3 SHOP DRAWINGS

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

.2 Indicate dimensions in relation to window jambs, operator details, head and sill anchorage details, hardware and accessories details.

1.4 SAMPLES

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

.2 Submit duplicate samples of manufacturer's standard colours for selection by Consultant.

.3 After approval samples will be returned for incorporation into the Work.

Part 2 Products

2.1 ACCEPTABLE MANUFACTURERS / PRODUCTS

.1 Solarfective “T-1 Teleshade” with black anodized aluminum fascia. Metal chain. Shade colour is to be selected from standard range by Consultant. Shade openness is to be 5%.

.2 Alternate Manufacturers: MechoShade, RollEase (Phifer SW4000 fabric).

2.2 MATERIALS AND FABRICATION

.1 To manufacturer’s standard.

Part 3 Execution

3.1 INSTALLATION

.1 Include centre brackets where necessary to prevent deflection of headrail.

.2 Adjust to provide for operation without binding.

.3 Use non-corrosive metal fasteners for installation, concealed in final assembly.

.4 Install blinds mounted to inside of jambs.

.5 Provide decorative valance with matching insert typical at all locations.

3.2 SCHEDULE

.1

Room Number	Number Of Shades	Window Type
104	3	F
105	2	A
113	13	A,B,E
115	2	A
128	3	C

END OF SECTION

Part 1 General

1.1 REFERENCES

.1 American Society for Testing and Materials International, (ASTM)

ASTM A53/A53M-12, Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated Welded and Steamless.

.2 Canadian Standards Association (CSA International)

CSA-G40.20/G40.21-13, General Requirements for Rolled or Welded Structural Quality Steel.

CAN/CSA-G164-M92(R2003), Hot Dip Galvanizing of Irregularly Shaped Articles.

CSA W48-06(R2011), Filler Metals and Allied Materials for Metal Arc Welding (Developed in co-operation with the Canadian Welding Bureau).

CSA W59-13, Welded Steel Construction (Metal Arc Welding).

1.2 ACTION AND INFORMATIONAL SUBMITTALS

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

.2 Product Data: Submit manufacturer's instructions, printed product literature and data sheets for furniture and include product characteristics, performance criteria, physical size, finish and limitations.

1.3 CLOSEOUT SUBMITTALS

.1 Submit in accordance with Section 01 78 00 - Closeout Submittals.

.2 Operation and Maintenance Data: submit operation and maintenance data for incorporation into manual.

1.4 DELIVERY, STORAGE AND HANDLING

.1 Deliver, store and handle materials in accordance with Section 01 61 00 - Common Product Requirements with manufacturer's written instructions.

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

.3 Storage and Handling Requirements: Store materials indoors and in accordance with manufacturer's recommendations in clean, dry and well-ventilated area.

.4 Store and protect furniture from nicks, scratches, and blemishes.

.5 Replace defective or damaged materials with new.

1.5 WARRANTY

.1 Provide 1 year parts and labour warranty.

Part 2 Products

2.1 MATERIALS

.1 Steel sections and plates: to CSA G40.20/G40.21.

.2 Steel pipe: to ASTM A53/A53M standard weight.

.3 Welding materials: to CSA W59.

.4 Welding electrodes: to CSA W48 Series.

.5 Bolts and anchor bolts: to ASTM A307.

.6 Stainless steel tubing: to ASTM A269, commercial grade seamless welded with AISI No. 4 finish.

2.2 DRYING TABLE (DTAB)

.1 Work surface: stainless steel, 18 gauge top with 56 mm backsplash complete with minimum 2 heavy gauge channel supports.

.2 Hemmed safety edges.

.3 Legs: tubular 42 mm stainless steel with 25 mm adjustable levelling feet.

2.3 INTERVIEW TABLE (ITAB)

.1 Stainless steel top wrapped over steel plate.

.2 Stainless steel: No 7 finish.

.3 Steel finish: Chemically degreased & 1 coat universal rust inhibitive primer, paint.

.4 Table top size 1220 mm long x 760 mm wide x 750 mm high.

.5 Fasteners: roundhead security screws.

2.4 FLOOR STOOL

.1 Seat Top: 14 gauge type 304 stainless steel top 305” diameter x 38 mm deep with a spun #4 finish.

.2 Reinforcement: 200 mm x 200 mmx7 gauge steel reinforcement plate, stitch welded to under side of seat & weld to pedestal.

.3 Pedestal: 50 mm schedule 40 (60 mm od) steel pipe pedestal, with overall height 457 mm from floor to top of seat.

.4 Base plate: 200 mm x 200 mm x 6 mm steel base plate, w/ 4- 12.7 mm diameter holes for bolting to floor. Weld to bottom of pedestal. All joints welded & ground smooth

.5 Finish: Chemically degreased & 1 coat universal rust inhibitive primer

.6 Standard of Acceptance: Kach Model No. 517, SecurityCosmos.com: Model 10-125-85-001 or approved equivalent.

Part 3 Execution

3.1 INSTALLATION

.1 Install according to manufacturer’s written instructions.

3.2 DRYING TABLE (DTAB)

.1 Install table where indicated.

3.3 INTERVIEW TABLE (ITAB)

.1 Form 2 mm thickness stainless steel wrapped over 6 mm thickness steel plate top, welded to 2mm x 102 mm single steel round or square leg.

.2 Weld table leg to stainless steel base plate 400 mm square x 6 mm thickness with four 12.7 mm holes for fastening to floor.

.3 Fabricate table, leg and base with no exposed sharp edges.

.4 All joints welded & ground smooth.

.5 Mechanically fasten table to floor.

.6 Paint steel leg. Refer to Section 09 91 23 Interior Painting.

.7 Install table where indicated.

3.4 FLOOR STOOL

.1 Secure stool pipe support to floor as recommended by manufacturer.

.2 Install stools where indicated.

.3 Install stools in accordance with manufacturer's instructions, reviewed shop drawings and as directed by the Departmental Representative.

3.5 SEALANT

.1 Apply clear silicone sealant to exposed plate edges on floor plate and underside of floor base plate edges and around floor anchor bolts. Strike smooth to a 45° level.

3.6 CLEANING

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

.2 Remove masking or protection after installation.

.3 Clean finished surfaces as recommended by panel manufacturer.

END OF SECTION

Part 1 - General

1.1 RELATED WORK

.1	Access Doors	Division 08
.2	Fire Extinguishers	Division 10
.3	Fire Suppression	Division 21
.4	Plumbing	Division 22
.5	Heating, Ventilating and Air Conditioning	Division 23
.6	Integrated Automation	Division 25

1.2 INTENT

.1 Provide a complete and fully operational mechanical system with facilities and services to meet requirements described herein and in complete accord with applicable codes and ordinances.

.2 Contract documents for mechanical scope are diagrammatic and approximately to scale unless detailed otherwise. They establish scope, material and installation quality and are not detailed installation instructions.

.3 Should any discrepancies occur on drawings or in specifications which leaves doubt as to the intent and meaning of the drawings and specifications, obtain a ruling from the designer before submitting tender. If this is not done, it will be assumed that the most expensive alternate has been allowed for.

.4 Follow manufacturer's recommended installation details and procedures for equipment supplemented by details given herein and on plans subject to approval of the Departmental Representative.

.5 Install equipment generally in locations and routes shown, close to building structure with minimum interference with other services or free space. Remove and replace improperly installed equipment to satisfaction of the Departmental Representative at no extra cost.

.6 Provide labour and materials required to install, test and place into operation complete mechanical system. Provide additional material for modifications required to correct minor job conflictions.

.7 Connect to equipment furnished in other Sections and by Departmental Representative, including uncrating equipment, moving in place and installing complete, start-up and test.

1.3 DELIVERY, STORAGE AND HANDLING

.1 Packing, shipping, handling and unloading:
- .1 Deliver, store and handle in accordance with Section 01 61 00 - Common Product Requirements.
- .2 Deliver, store and handle materials in accordance with manufacturer’s written instructions.
- .3 Store and manage hazardous materials in accordance with cepa, tdga AND Regional and Municipal Regulations.

.2 Waste Management and Disposal:
- .1 Due to location, recycling is not required. Remove from site and dispose of packaging materials at appropriate disposal facilities.

.3 Unused sealant materials must not be disposed of into sewer system, into streams, lakes, onto ground or in other location where it will pose health or environmental hazard.

.4 Handle and dispose of hazardous materials in accordance with CEPA, TDGA, Regional and Municipal regulations.

.5 Provide manifests describing and listing waste created. Transport containers by approved means to licenced landfill for burial**.**

1.4 MATERIALS

.1 Replace materials or workmanship below specified quality and relocate work wrongly placed to satisfaction of the Departmental Representative.

.2 Materials and equipment installed shall be new, full weight and of the best quality specified. Use same brand or manufacturer for each specific application. Statically and dynamically balance rotating equipment for minimum vibration and low operating noise level.

.3 Each major component of equipment shall have manufacturer's name, address, catalog and serial number in a conspicuous place.

.4 Install materials and equipment in a neat and workmanlike manner by competent specialists.

1.5 CUTTING AND PATCHING

.1 Locate and provide holes and sleeves, cutting and fitting required for mechanical work. Relocate improperly located holes and sleeves at no extra cost.

.2 Drill for expansion bolts, hanger rods, brackets, and supports.

.3 Do no cutting or burning of structural members of building frame without obtaining prior written approval from the Departmental Representative.

.4 Provide openings and holes required in precast members for mechanical work. Cast holes larger than 100 mm (4") in diameter. Field-cut smaller than 100 mm (4").

.5 All patching of finished construction of building shall be performed under the sections of specifications covering these materials.

1.6 SEMI-FINAL AND FINAL INSPECTIONS

.1 Perform the following items prior to semi-final inspection.

.1 Heating and air conditioning systems capable of operation with alarm controls functional and automatic controls in operation generally, but not necessarily finally calibrated.

.2 Necessary tests on equipment made including those required by authorities and certificates of approval obtained.

.3 Rough balance of air and water systems completed.

.4 Valve tagging completed and equipment identified. Equipment and piping painted and escutcheons installed.

.5 Equipment lubricated as per manufacturer's data.

.6 Warranty forms have been mailed to manufacturer. Provide copy of original warranty for equipment which has warranty period longer than one year.

.7 Systems chemically cleaned, flushed and water treatment initiated. Provide report from manufacturer's representative to confirm status of treatment.
.8 Submit sample of Operating/Maintenance Manuals. Arrange Operating and Maintenance Instructions and submit schedule for approval.
.9 Review and ensure access doors are suitably located and equipment easily accessible including plumbing cleanouts.
.10 Have noise and vibration control devices and flexible connections inspected by manufacturer's representative and submit written report.
.11 Equipment alignment carried out by qualified millwright and certified report submitted.
.12 Check operations of plumbing systems and fixtures and ensure fixtures are solidly supported.
.13 Fan plenums cleaned, temporary filters removed and permanent filters installed.

.2 Provide declaration in writing that semi-final deficiencies and the following items have been completed prior to the final inspection:
.1 Equipment cleaned inside, outside and lubricated. Plumbing fixtures and brass cleaned.
.2 Final balancing completed and rough data of balance reports submitted.
.3 Final calibration of controls completed.

1.7 SHOP DRAWINGS

.1 Submittal procedures in accordance with Division 1.

.2 Submit materials and equipment by manufacturer, trade name and model number. Include copies of applicable brochure or catalog material. Do not assume applicable catalogues are available in the Departmental Representative's office. Maintenance and operating manuals are not suitable submittal material.

.3 Clearly mark each sheet of printed submittal material (using arrows, underlining or circling) to show particular sizes, types, model numbers, ratings, capacities and options actually being proposed. Cross out non-applicable material. Specifically note on the submittal specified features such as special tank linings, pump seals, materials or painting.

.4 Include dimensional data for roughing in and installation, technical data sufficient to check that equipment meets requirements of drawings and specifications, wiring, piping, and service connection data, motor sizes complete with voltage ratings and schedules as applicable.

.5 Shop drawings to show all information identified under individual product specifications and in general shall show the following:
.1 Mounting arrangements.
.2 Operating and maintenance clearances.
.3 Detailed drawings of bases, supports, and anchor bolts.
.4 Acoustical sound power data, where applicable.
.5 Points of operation on performance curves.
.6 Manufacturer to certify current model production.
.7 Certification of compliance to applicable codes.

.6 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.

1.8 OPERATING AND MAINTENANCE MANUALS

.1 Provide services of qualified and experienced personnel to prepare proper documentation and to instruct the Operating Staff in the operation and preventative maintenance of each piece of equipment and system supplied and installed. Complete and turn over documentation prior to final inspection.

.2 Provide 215 mm x 280 mm (8-1/2" x 11") capacity extension type catalogue binders bound with heavy fabric, hot stamped in gold lettering front and spine. Refer to Division 1 for colour and quantity.

.3 Each binder shall be indexed according to the following indexing system:

.4 Tab-1.0 Mechanical Systems: Title page with clear plastic protection cover.

.5 Tab-1.1 List of Mechanical Drawings.

.6 Tab-1.2 Description of Systems: Provide complete description of each system. Include detailed system description and components comprising that system, explanation of how each component interfaces with others to complete the system, location of each thermostat, controller or operating setpoints. Refer to 21 05 01, 1.1.5 for additional required information.

.7 Tab-1.3 Operation Division: Provide complete and detailed operation of each major component. Include how to energize and exact location of switches and controls, how the component interfaces with other components, operation of controls, including the operational sequence, operational characteristic changes for summer or winter operation, and how to accomplish the changeover, complete troubleshooting sequence, setpoints cannot be maintained, and safeguards to check if equipment goes off line. Refer to 21 05 01, 1.1.5 for additional required information.

.8 Tab-1.4 Maintenance and Lubrication Division: Provide detailed preventative maintenance and lubrication schedule for each of the major components to include daily, weekly, monthly, semi-annual and yearly checks and tasks. Explain how to proceed with each task required for each piece of typical equipment such as bearings, drives, motors and filters. Compile this information for each typical piece of equipment separate from the shop drawings section. Refer to 21 0-5 01, 1.1.5 for additional required information.

.9 Tab-1.5 List of Equipment Suppliers and Contractors: Provide complete list of equipment suppliers and contractors, including address and telephone number. Outline procedures for purchasing parts and equipment. Include steps to take in order to purchase new parts.

.10 Tab-Certification (2.0, 2.1, etc.): Include copy of test data degreasing and flushing of heating system analysis of system water taken at time system was put into operation, hydrostatic or air tests performed on piping systems, equipment alignment certificates, copy of balancing data for air and water systems, copy of valve tag identification and pipe colour code, inspection approval certificates for plumbing system, hot air heating and ventilation systems and fire damper schedule.

.11 Tab-Shop Drawings and Maintenance Bulletins (3.0, 3.1, etc.): Provide materials as received in compliance with clause "Shop Drawings".

.12 The divider tabs shall be laminated mylar plastic, and coloured according to section. The colouring is as follows: Mechanical Systems - 1.0 - 1.5 - Orange, Certification - 2.0 - 2.4 - Green, Shop Drawings and Maintenance - 3.0 - 3.17 - Yellow. Plastic tabs with typed insertions will not be accepted.

.13 Submit documents to the Departmental Representative for approval prior to being turned over to the Departmental Representative. At completion of project, hold a Seminar to instruct the Operating Staff in operation and preventative maintenance of each piece of equipment and system supplied and installed.

.14 Provide one digital copy on compact disk of the final operation and maintenance manual in each of the manuals (six in total).

1.9 RECORD DRAWINGS

.1 Refer to Division 1.

.2 Keep on site, an extra set of white prints and specifications recording changes and deviations daily. Allow for the work required to transfer site changes to Departmental Representative's original tracings and for providing the Departmental Representative with set of sepias marked "Record Drawings". Co-ordinate through Departmental Representative's office. Addenda corrections and Departmental Representative initiated construction changes to original tracings will be the responsibility of the Departmental Representative.

.3 Contractor shall utilize a different colour water proof ink for each service.

.4 Contractor shall ensure that white prints are available on site for reference purposes and inspection.

.5 Record drawings shall identify location of fire dampers, major control lines, access doors, tagged valves and actual room names or numbers.

.6 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).

.7 Submit to Departmental Representative for approval and make corrections as directed.

1.10 IDENTIFICATION

.1 Refer to Section 23 05 54, Mechanical Identification.

1.11 TEMPORARY FACILITIES

.1 Refer to General Requirements - Division 01.

1.12 SUPERVISION

.1 Refer to General Requirements - Division 01.

1.13 TEMPORARY HEAT AND/OR VENTILATION

.1 Refer to General Requirements - Division 01.

.2 Do not use the permanent system for temporary heating or ventilation purposes, without written permission from the Departmental Representative.

.3 Thoroughly clean and overhaul permanent equipment used during the construction period, replacing worn or damaged parts. Exchange equipment or components operating improperly at final inspection with new equipment or components.

.4 Use of permanent systems for temporary heat shall not modify the terms of warranty.

.5 Operate heating systems under conditions which ensure no temporary or permanent damage. Operate fans at proper resistance with filters installed. Change filters at regular intervals. Operate with proper safety devices and controls installed and fully operational. Operate water systems with proper water treatment.

.6 Where air systems are used during temporary heating, provide filter media on return and exhaust air outlets. Clean duct systems which have become dirty.

.7 When permanent systems are used for temporary heat, provide alarm indicating system failure. Connect alarm to independent alarm company system.

.8 Replace mechanical seals in pumps used for temporary heating purposes with new mechanical seals, regardless of condition.

.9 Provide one year warranty from date of Substantial Completion.

1.14 EQUIPMENT PROTECTION AND CLEAN-UP

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

.2 Protect equipment with polyethylene covers and crates.

.3 Operate, drain and flush out bearings and refill with new change of oil, before final acceptance.

.4 Thoroughly clean piping, ducts and equipment of dirt, cuttings and other foreign substances.

.5 Protect bearings and shafts during installation. Grease shafts and sheaves to prevent corrosion. Supply and install necessary extended nipples for lubrication purposes.

1.15 TEMPORARY OR TRIAL USAGE

.1 Temporary or trial usage by the Departmental Representative of mechanical equipment supplied under contract and claimed complete before final acceptance shall not represent acceptance.

.2 Repair or replace permanent equipment used temporarily.

.3 Take responsibility for damage caused by defective materials or workmanship during temporary or trial usage.

1.16 ELECTRICAL MOTORS

.1 Supply mechanical equipment complete with electrical motors.

.2 Provide NEMA premium efficiency motors to CEMA and CSA standards for hard, continuous service, designed to limit temperature rise to 40 deg.C (100 deg.F) for open housing and 50 deg.C (125 deg.F) for drip proof housing, and operate at 1800 RPM unless otherwise specified.

.3 Motors shall have ball or roller type bearings with grease lubrication fittings.

.4 Motors used in conjunction with variable frequency drives shall be suitable for inverter duty, as specified by NEMA MGI-1993, Part 31. Refer to electrical specifications for inverters.

.5 Refer to electrical specification for voltage, phase and cycle.

1.17 ACCESS DOORS

.1 Supply access doors for furred ceilings, ducts or spaces for servicing equipment and accessories or for inspection of safety, operating and fire devices for installation under section erecting the walls or ceilings.

.2 Provide access doors in ductwork in accordance with Section 23 33 00 - Air Duct Accessories

.3 Provide service access door in accordance with Section 08 31 00.01 - Access Doors - Mechanical.

1.18 WASTE MANAGEMENT AND DISPOSAL

.1 Packing, shipping, handling and unloading:
- .1 Deliver, store and handle all mechanical components in accordance with Section 01 61 00 - Common Product Requirements.
- .2 Deliver, store and handle all materials in accordance with manufacturer’s written instructions.
- .3 Store and manage hazardous materials in accordance with cepa, tdga AND Regional and Municipal Regulations.

.2 Waste Management and Disposal:.1 Remove from site and dispose of packaging materials at appropriate recycling facilities.
- .2 Collect and separate for disposal paper, plastic, polystyrene, corrugated cardboard packaging material in appropriate on-site bins for recycling in accordance with Waste Management Plan.
- .3 Divert unused metal materials from landfill to metal recycling facility as approved by Departmental Representative.
- .4 Unused sealant materials must not be disposed of into sewer system, into streams, lakes, onto ground or in other location where it will pose health or environmental hazard.
- .5 Fold up metal and plastic banding, flatten and place in designated area for recycling.
- .6 Handle and dispose of hazardous materials in accordance with CEPA, TDGA, Regional and Municipal regulations.
- .7 Disposal of asbestos waste generated by removal activities must comply with Federal, Provincial, Territorial and Municipal regulations. Dispose of asbestos waste in sealed double thickness 6 ml bags or leak proof drums. Label containers with appropriate warning labels.
- .8 Provide manifests describing and listing waste created. Transport containers by approved means to licenced landfill for burial.

1.19 COMMISSIONING

.1 Mechanical Contractor is responsible to ensure all mechanical systems are fully commissioned and detailed commissioning forms are completed and reviewed with Departmental Representative. Refer to Sections 01 91 13 General Commissioning (Cx) Requirements, 01 91 33 Commissioning Forms, 01 91 41 Commissioning Training for details on Mechanical Contractors responsibilities in addition to all commissioning activities identified under Division 21, 22, 23 and 25. As part of the commissioning process, the contractor is required to complete the Site Standard Equipment Labelling and Tracking sheets for the equipment they supplied, the sheets will be provided by the owner.

1.20 INSTRUCTION OF OPERATING STAFF

.1 Provide trained personnel to instruct operating staff on maintenance, adjustment and operation of mechanical equipment. Instruct staff on changes or modification in equipment made under terms of guarantee.

.2 Supply tools, equipment and personnel to demonstrate and instruct operating and maintenance personnel in operating, controlling, adjusting, trouble-shooting and servicing of all systems and equipment during regular work hours, prior to acceptance.

.3 Where specified elsewhere in Mechanical manufacturers to provide demonstrations and instructions.

.4 Use operation and maintenance data manual for instruction purposes. On completion of instruction, turn one manual over to chief operating personnel, the balance to Departmental Representative.

.5 Record every instruction and training session on digital video.

.6 Time allocated for Instruction:

Chemical	One (1) hour instruction plus Monthly visits
Fire Protection	One (1) hour instruction
Pumps	One-half (1/2) hour instruction per pump type.
Tanks	One-half (1/2) hour instruction
VAV Boxes	One (1) hour instruction
Fans	One (1) hours instruction
Domestic Water Heater	Two (2) hours instruction
Split AC Units	One (1) hour instruction
In-floor Manifolds	One (1) hour instruction
Boilers	Two (2) hours instruction
Controls	Total training to be 40 hours comprised of instruction time and troubleshooting. Each and every formal training session shall be recorded on film. Training to be broken out as follows:

.1 Two (2) sessions lasting four (4) hours each (8 hours in total) before substantial completion. Each session to cover same material to different sets of trainees.

.2 Two (2) sessions lasting four (4) hours each (8 hours in total) after Project Completion. Each session to cover same material to different sets of trainees. These sessions to cover any remaining material, review as-built conditions, any modifications made since initial training and to address field questions from first session.

.3 One four (4) hour follow up session to all trainees after two months of operation. Follow up session to cover all questions/concerns raised by operating staff.

.4 All remaining time (20 hours) to be allocated to trouble shooting issues and addressing questions from operators that arise during first year of operation.

1.21 SUBSTANTIAL COMPLETION

.1 The mechanical portion of the project shall be deemed substantially complete when ALL mechanical systems are operational as designed. In addition, the air and/or water balance must be completed with the report submitted and approved by the Departmental Representative and the temperature control system must be complete, as designed, operational, with all control components calibrated and the maintenance manuals in final form must be submitted. The date will be established by the Departmental Representative and will set the date for the start of the one (1) year warranty on all mechanical systems.

1.22 EXCESSIVE ADMINISTRATION

.1 Following the "Substantial Completion" Inspection a "Final" Inspection will be conducted and a follow up inspection will be conducted to "check off" all outstanding mechanical deficiencies.

.2 If the mechanical portion of the project is not 100 percent complete at the time of the deficiency “checkoff” inspection, the cost of the failed deficiency “check-off” inspection and any and all additional inspections will be back charged directly to the Mechanical Contractor.

.3 The cost of each excessive inspection will be $750.00 plus travel, and will be deducted directly from the total Mechanical Contract amount.

.4 If the contractor fails the deficiency “checkoff” inspection, no additional money will be released and a subsequent inspection will be scheduled when the Contractor re-verifies that they are 100% complete.

.5 This process will repeat until the contractor can demonstrate that the project is 100% complete with all deficiencies rectified.

1.23 ALTERNATE AND SEPARATE PRICES

.1 Referenced specification sections and drawings contain pertinent requirements for materials and methods to achieve work described herein.

.2 Coordinate pertinent related work and modify surrounding work as required to complete project under each alternate designated.

.3 Alternate products may vary in operation or construction, but shall meet or exceed the requirements of the specifications, drawings and the specified equipment for performance capacities, controllability and equipment options.

.4 Revisions required to adapt equipment other than that specified shall be made without extra charge to the Departmental Representative.

1.24 ALTERNATE MATERIALS & EQUIPMENT

.1 The design is based on the materials and equipment as specified. Any alternate materials or equipment that meet or exceed the performance, quality and design intent of that specified will be accepted unless specifically noted otherwise under this article.

.2 If alternate material or equipment will alter the design intent, make proposals to supply said materials or equipment in writing to the Departmental Representative at least ten working days prior to closing date of tender for Mechanical Trade. Any material or equipment that alters the design intent must be formally approved to be accepted.

.3 All proposed equipment is subject to the requirements of the drawings and specifications. Revisions required to adapt equipment other than that specified shall be made without extra charge to the contract. All suppliers, except those specified, shall guarantee in writing that their individual proposed products meet or exceed the performance and quality of specified products. If the departmental representative determines at any time that the equipment or material being supplied does not meet or exceed the performance, quality or design intent of that being specified, the contractor shall replace the article in question with a suitable product at the contractors expense.

.4 The following products shall be supplied as specified, there is no other products/ manufacturers that will be accepted:
- .1 Cell Comby, as listed in Section 22 42 03
- .2 Security Floor Drains and mounting, as listed in Section 22 42 01
- .3 Security Sprinkler heads, as listed in Section 21 13 13.
- .4 Security HVAC grilles, as listed in Section 23 37 13.
- .5 Any other products specifically noted to be supplied as specified.

Part 2 - Materials

2.1 NOT USED

.1 Not Used

Part 3 - Execution

3.1 NOT USED

.1 Not Used.

END OF SECTION

1 General

1.1 REFERENCES

.1 Federal Sprinkler Standard, FCC#403 - Sprinkler Systems.

.2 American National Standards Institute/National Fire Prevention Association (ANSI/NFPA)
- .1 ANSI/NFPA 13- 2007, Installation of Sprinkler Systems.

.3 Underwriters Laboratories of Canada (ULC)
- .1 ULC S543- 1984, Internal Lug Quick Connect Couplings for Fire Hose.

1.1 SHOP DRAWINGS AND PRODUCT DATA

.1 Submit shop drawings and product data in accordance with Section 01 33 00 - Submittal Procedures and in accordance with ANSI/NFPA 13, working plans and design requirements.

.2 Sprinklers shall be referred to on drawings, submittals and other documentation, by the sprinkler identification or model number as specifically published in the appropriate agency listing or approval. Trade names or other abbreviated designations shall not be allowed.

1.2 ENGINEERING DESIGN CRITERIA

.1 Design system in accordance with required and advisory provisions of ANSI/NFPA 13, using following parameters:
- .1 Hazard:
  - .1 To suit occupancy as indicated.
- .2 Pipe size and layout:
  - .1 Hydraulic design.
  - .2 Sprinkler head layout: to ANSI/NFPA 13.
- .3 Water supply:
  - .1 Conduct flow and pressure test of water supply in vicinity of project to obtain criteria for bases of design in accordance with ANSI/NFPA 13.Base design for bidding in accordance with the following:Water pressure at nearest existing municipal hydrant as measured in September 2014 with town pump operating is:
    Static 65 psi
    Flowing – 489 GPM at 36 PSI
    Flowing - 594 GPM at 34 PSI
  - .2 New 150mm service line as indicate on site plan.
  - .3 New fire pump to increase pressure and reduce pipe sizes.
- .4 Zoning:
  - .1 System zoning as indicated.

.2 Include with each system materials, accessories, and equipment inside and outside building to provide each system complete and ready for use.

.3 Design and provide each system to give full consideration to blind spaces, piping, electrical equipment, ducts, and other construction and equipment in accordance with detailed shop drawings

.4 Locate sprinkler heads in consistent pattern with ceiling grid, lights, and air supply diffusers.

.5 Devices and equipment for fire protection service: ULC approved for use in wet pipe sprinkler systems.

.6 Location of Sprinkler Heads:
- .1 Locate heads in relation to ceiling and spacing of sprinkler heads not to exceed that permitted by NFPA 13 required hazard occupancy.
- .2 Uniformly space sprinklers on branch.
- .3 Sprinklers in secure areas shall be located in accordance with RCMP Security standards, as indicated on drawings.

.7 Water Distribution:
- .1 Make distribution uniform throughout the area in which sprinkler heads will open.
- .2 Discharge from individual heads in hydraulically most remote area to be 100% of specified density.

.8 Density of Application of Water:
- .1 Size pipe to provide specified density when system is discharging total maximum required flow.
- .2 Sprinkler Discharge Area:
  - .1 Area: hydraulically most remote area as defined in NFPA 13.
- .3 Outside Hose Allowances:
  - .1 Include allowance in hydraulic calculations for required outside hose streams.
- .4 Friction Losses:
  - .1 Calculate losses in piping in accordance with Hazen-Williams formula with 'C' value of 120 for steel piping, 150 for copper tubing, and 140 for cement-lined ductile-iron piping.

1.5 CLOSEOUT SUBMITTALS

.1 Provide maintenance data for incorporation into manual specified in Section 01 78 00 - Closeout Submittals.

1.6 EXTRA MATERIALS

.1 Provide maintenance materials in accordance with Section 01 78 00 - Closeout Submittals.

.2 Provide spare sprinklers and tools as required by ANSI/NFPA 13.

2 Products

2.1 PIPE, FITTINGS AND VALVES

.1 Pipe:

.1 Steel Pipe: ASTM A53 or A120, Schedule 40 black, with malleable iron or forged steel welding type fittings, screwed or welded.

.2 Fittings and joints to ANSI/NFPA 13:

.1 Ferrous: screwed, welded, flanged or roll grooved.

.1 Grooved joints shall consist of two ductile iron housing segments, pressure responsive gasket, and zinc-electroplated steel bolts and nuts.

.1 Rigid Type: Housings shall be cast with offsetting angle-pattern bolt pads to provide rigidity. Couplings shall be fully installed at visual pad-to-pad offset contact. (Tongue and recess type couplings, or any coupling that requires exact gapping of bolt pads on each side of the coupling at specified torque ratings, are not allowed.) Victaulic Style 009-EZ, 005, and 07.

.2 Flexible Type: For use in locations where vibration attenuation and stress relief are required, and for seismic applications. Victaulic Style 77.

.2 Copper tube: screwed, soldered, brazed, or roll grooved.

.1 Grooved joints shall be manufactured to copper-tube dimensions, with housings cast with offsetting angle-pattern bolt pads. Victaulic Style 606.

.3 Provide welded, threaded, grooved-end type fittings into which sprinkler heads, sprinkler head riser nipples, or drop nipples are threaded.

.4 Plain-end fittings with mechanical couplings and fittings which use steel gripping devices to bite into pipe when pressure is applied will not be permitted.

.5 Rubber gasketted grooved-end pipe and fittings with mechanical couplings are permitted in pipe sizes 32 mm and larger.

.6 Fittings: ULC approved for use in wet pipe sprinkler systems.

.7 Ensure fittings, mechanical couplings, and rubber gaskets are supplied by same manufacturer.

.8 Side outlet tees using rubber gasketted fittings are not permitted.

.9 Sprinkler pipe and fittings: metal.

.3 Valves:

.1 ULC listed for fire protection service.

.2 Up to NPS 2: bronze, screwed or grooved ends, OS & Y; gate or indicating ball valve. Victaulic Style 728.

.3 NPS 2 1/2 and over: cast ductile iron, flanged or roll grooved ends, indicating butterfly valve. Victaulic Style 705W.

.4 Swing or spring-actuated check valves. Victaulic Series 717.

.5 Ball drip.

.6 Gate valves: open by counterclockwise rotation.

.7 Provide rising stem valve beneath each alarm valve in each riser when more than one alarm valve is supplied from same water supply pipe.

.8 Check valves: flanged clear opening swing-check type with flanged inspection and access cover plate for sizes 10 cm and larger.

.9 Provide gate valve in piping protecting elevator hoistways.

.4 Pipe hangers:
.1 ULC listed for fire protection services in accordance with NFPA.
.2 Refer to 23 05 05 and 23 05 29 for more detail.

2.2 GATE VALVES

.1 50 mm and under: Bronze body, bronze trim, non-rising stem, handwheel, inside screw, double disc, solder or threaded ends. To ASTM B61.

.2 Over 50 mm: Iron body, bronze trim, rising stem, handwheel, OS&Y, double disc or wedge, flanged or grooved ends. Victaulic series 771.

.3 Valves: Bear UL label or marking, manufacturer's name and pressure rating on valve body.

2.3 GLOBE VALVES

.1 Valves Up to 50 mm: Bronze body, bronze trim, rising stem and handwheel, inside screw, renewable composition disc, solder or screwed ends, with back seating capacity. To ASTM B61.

.2 Valves Over 50 mm: Iron body, bronze trim, rising stem, handwheel, OS&Y, plug-type disc, flanged ends, renewable seat and disc.

.3 Valves: Bear UL label or marking, manufacturer's name and pressure rating on valve body.

2.4 BALL VALVES

.1 Valves 50 mm (2") nominal and under: bronze to ASTM B584, chrome-plated brass ball, stainless steel stem, with weatherproof actuator, handwheel, supervisory switches, and grooved or threaded. UL/FM approved. Victaulic Series 728.

2.5 BUTTERFLY VALVES

.1 Valves: UL/FM approved, Iron Body, Bronze disc, resilient replaceable liner seat, wafer or lug ends, extended neck, handwheel and gear drive.

.2 Weatherproof actuator with handwheel, supervisory switches.

.3 Victaulic Series 705W.

2.6 SWING CHECK VALVES

.1 Valves Up to 50 mm: Bronze swing disc, renewable disc and seat, flanged ends to ASTM B61. Design for either horizontal or vertical mounting.

.2 Valves over 50mm: UL/ULC/FM pattern, iron body, bronze mounted, regrind-renew bronze or elastomer coated ductile iron disc and seat ring, bolted cap or one-piece body, flanged or grooved ends. Design for either horizontal or vertical mounting with stainless steel spring and shaft. Victaulic Series 717

2.7 SPRINKLER VALVE

.1 Provide approved Automatic Sprinkler Valve with one or two pole (as required) flow detectors with alarm circuits, pressure switch, pressure retard chamber, outside water motor gong, outside electric gong, inside electric gong, and circuit breaker.

2.8 ABOVE GROUND PIPING SYSTEMS

.1 Provide fittings for changes in direction of piping and for connections.
- .1 Make changes in piping sizes through tapered reducing pipe fittings, bushings will not be permitted.
- .2 Perform welding in shop; field welding will not be permitted.
- .3 Conceal piping in areas with suspended ceiling and as indicated on drawings.

2.9 SPRINKLER HEADS

.1 General: to ANSI/NFPA 13 and ULC listed for fire services.

.2 New sprinkler heads to match equivalent types. Confirm on site.

.3 Temperature rating on fusible links shall suit specific hazard area with minimum of safety 10 deg.C.

.4 Sprinklers shall be listed with and bear certification marking of nationally recognized testing agency.

.5 Sprinklers with O-rings are not allowed.

.6 Provide minimum 12 mm (1/2") nominal diameter discharge orifice, except when approved by authorities having jurisdiction.

.7 Provide chrome plated finish for sprinklers in all areas: except mechanical rooms where bronze finish is acceptable.

.8 All pendant type heads to be semi-recessed where possible.

.9 All sprinkler heads located in Mechanical Rooms, Storage Rooms, IT/Equipment and other areas susceptible to damage to be complete with wire guards.

.10 Sprinkler heads shall be located in the centre half or quarter point of ceiling tiles.

.11 Provide quick response heads in all light hazard areas.

.12 Sprinkler body shall be integrally cast with hex-shaped wrench boss to reduce the risk of damage during installations.

.13 Wrenches shall be provided by the sprinkler manufacturer that directly engage the hex-shaped wrench boss integrally cast in the sprinkler body

.14 Provide security sprinkler heads in provost area.

2.10 UPRIGHT SPRINKLER HEAD

.1 Provide glass bulb type in areas indicated on drawings or specified. Bronze in mechanical rooms, chrome elsewhere.

2.11 PENDANT SPRINKLER HEAD

.1 Provide semi-recessed polished chrome glass bulb type in areas indicated on drawings or specified.

2.12 SIDE WALL SPRINKLER HEAD

.1 Provide polished chrome glass bulb type in areas indicated on drawings or specified.

2.13 SECURITY PENDANT SPRINKLER HEAD

.1 Only sprinklers listed as approved by RCMP Security Standards are permitted for installation in Cells. Sprinklers in cells shall be stamped with manufacturer and model number on faceplate of sprinkler.

.2 Escutcheons shall be ordered and supplied with heads.

.3 Approved sprinklers heads are as follows:

.1 Viking Model HQR-2 institutional quick response standard coverage/extended coverage flush pendant sprinkler with sprinkler base part number 10554, sprinkler identification number VK410 and escutcheon package base part number 10627.

2.14 WET SPRINKLER SYSTEM

.1 Provide complete with the following:

.1 Alarm valve.
.2 Indicating control valves.
.3 Inside electric gongs and circuit closer.
.4 Specified water gauges.
.5 Piping and fittings.
.6 Valves.
.7 Hangers.
.8 Floor and ceiling escutcheon plates.
.9 Backflow Preventer
.10 Outside water gongs and circuit closer (this is required by authority)
.11 Outside electric gongs and circuit closer

.2 Provide one alarm valve complete with excess pressure pump or retard chamber and standard accessories, drain valves, check valves, alarm connections and water gauges. Provide indicating type valves for controlling water supply and alarm shut-off.

.1 Alarm valve internal components shall be replaceable without removing the valve from the installed position.
.2 Victaulic Series 759 alarm valve with Series 752.

.3 Connect outside water rotary gong to alarm valve required by Authority Having Jurisdiction.

.4 Provide 100 mm (4") electric gong operated by alarm device.

.5 Provide standard water flow, valve alarm devices and main control valve. Provide trouble transmitter low air circuit closer for complete central station electrical supervision of system, including battery and rectifier and locate adjacent to alarm valve.

.6 Provide excess pressure pump capable of pumping system to 172 kPa (25 psi) within 30 minutes, in excess of normal pressure. Provide pump with supports, safety valve, gauge, starter and connections to wet pipe sprinkler system. Set safety valve 10 kPa (1.5 psi) above operating pressure. Excess pressure pump is not required if alarm valve utilized meets requirements of NFPA 13 without a pressure pump.

2.15 MAKE-UP PRESSURE PUMP (if required)

.1 Provide electrically operated excess pressure pump to maintain higher pressure in sprinkler discharge piping.

.2 Pump shall be capable of producing pressure of 400 kPa in excess of that normally carried.

.3 Provide pump with necessary control valves, check valves, and relief valves with such on supply side of fire pump.

.4 Manually start and stop pump by operation of switch located near sprinkler valve.

.5 Control pump by combined manual/automatic start interconnected with high-low pressure switch installed on sprinkler discharge line.

.6 Rigidly support pump.

2.16 FIRE DEPARTMENT CONNECTION

.1 Siamese fire department connection as indicated to supply fire hose and standpipe system and sprinkler system.

.2 Type: Flush mounted non-freeze wall type with brass finish.

.3 Outlets: Provide connection with two 63 mm (2-1/2") nominal female hose connections fitted with caps and chains of matching material. Threads of 63 mm (2-1/2") nominal connection shall conform to those of local fire department.

.4 At the low-point near each fire department connection, install a 90 degree elbow with drain connection to allow for system drainage to prevent freezing. Elbow shall be Victaulic #10-DR

.5 Include horizontal check valve and automatic drip discharging to nearest floor drain for connection.

.6 Identify pumper connection with sign having raised letters at least 25 mm (1") in size cast on plate or fitting reading "Standpipe - Fire Department Connection".

2.17 SUPERVISORY SWITCHES

.1 General: to ANSI/NFPA 13 and ULC listed for fire service.

.2 Valves: Mechanically attached to valve body, with normally open and normally closed contacts and supervisory capability.

.3 Flow switch type:
.1 With normally open and normally closed contacts and supervisory capability.

.4 Pressure alarm switch:
.1 With normally open and normally closed contacts and supervisory capability.

2.18 SIGNS

.1 Signs for control drain and test valves: to ANSI/NFPA 13.

2.19 SPARE PARTS CABINET

.1 Provide metal cabinet with extra sprinkler heads and sprinkler head wrench adjacent to each alarm valve. Number and types of extra sprinkler heads as specified in NFPA 13.

.2 Construct to sprinkler head manufacturer‘s standard.

2.20 INSPECTOR'S TEST CONNECTION

.1 Locate inspector's test connection at hydraulically most remote part of each system, provide test connections approximately 3 m above floor for each sprinkler system or portion of each sprinkler system equipped with alarm device.

.2 Provide test connection piping to location where discharge will be readily visible and where water may be discharged without property damage.

.3 Provide discharge orifice of same size as corresponding sprinkler orifice.

2.21 ESCUTCHEON PLATES

.1 Provide one piece type metal plates for piping passing through walls, in exposed spaces.

.2 Provide polished stainless steel plates in finished spaces.

.3 Provide paint finish on metal plates in unfinished spaces.

3 Execution

3.1 GENERAL INSTALLATION

.1 Install piping in accordance with NFPA 13 for sprinkler systems and in accordance with manufacturer's recommendations.

.2 Allow for expansion and contraction when installing pipe hangers.

.3 Install signs required by local Fire Protection Department.

.4 Secure outdoor signs with stainless steel bolts.

.5 Locate outside alarms on wall of building adjacent to fire department connection.

.6 Mechanical grooved joints may be used instead of threaded or welded joints.

.7 Grooved joints shall be installed in accordance with the manufacturer's latest published installation instructions. Grooved ends shall be clean and free from indentations, projections, and roll marks in the area from pipe end to groove. Gaskets shall be of an elastomer grade suitable for the intended service, and shall be moulded and produced by the coupling manufacturer.

.8 Die cut screw joints with full cut standard taper pipe threads with read lead and linseed oil or other non-toxic joint compound applied to male threads only.

.9 Provide gate valves or approved butterfly valves, low points of piping and apparatus.

.10 Provide drain valves at main shut-off valves, low points of piping and apparatus.

3.2 SYSTEM TESTS

.1 Hydrostatically test entire system. Test shall be witnessed by Fire Marshall.

3.3 INSPECTION

.1 Do not recess, paint or conceal piping accessories or work prior to inspection and approval by authorities having jurisdiction or authorized representative.

3.4 FIRE DEPARTMENT CONNECTION

.1 Make connections for standpipe system before domestic water connection and meter. Provide two check valves on black steel pipe, or single soft seated check valve on galvanized steel or copper pipe with gate valves on both sides of check valves.

.2 During construction, make one standpipe outlet available on each floor without delay, for department use.

.3 Where the static pressure exceeds 690 kPa at hose station, provide pressure reducing valve to prevent pressure on hose exceeding 620 kPa.

.4 Locate fire department connection with sufficient clearance from walls, obstructions, or adjacent siamese connectors to allow full swing of fire department wrench handle.

3.5 FIELD QUALITY CONTROL

.1 Subject systems and equipment to operational test.

.2 Hydrostatically test water supply connections and fire department connections at 345 mm (13") in excess of normal working pressure but not less than 1400 kPa (203 psi) for 2 hours without loss under supervision.

.3 Upon complete installation of piping and apparatus for sprinkler systems, test joints for tightness and good condition of piping. When testing with water, install pressure gauge at highest point of installation. If impossible to test whole installation in single operation, subdivide into several zones and test each zone in manner described.

.4 The grooved coupling manufacturer's factory trained representative shall provide on-site training for Contractor's field personnel in the use of grooving tools and installation of grooved joint products. The representative shall periodically visit the job site and review Contractor is following best recommended practices in grooved product installation. (A distributor's representative is not considered qualified to conduct the training or job site visits).

.5 During tests, stop any leaks and remove and repair any defective part. Perform test over again until satisfactory results are obtained.

.6 Provide hydraulic pump, temporary connections and labour required for tests.

3.6 SPRINKLER SYSTEM

.1 Install alarm valves and gongs as indicated or as specified.

.2 When water service is for building domestic supply and fire protection system, install testable double check valve and indicating control valve on branch line for fire protection system immediately after branch connection.

.3 Install horizontal valves with stems upright where space allows.

.4 Do not allow sprinklers that have been dropped, damaged, or show a visible loss of fluid. Never install sprinklers with cracked bulbs.

.5 Sprinkler bulb protector shall be removed by hand after installation. Do not use tools or any other devices to remove the protector that could damage the bulb in any way.

.6 Centre sprinkler heads in two directions in ceiling tile and provide piping offsets as required.

.7 Apply strippable tape or paper cover to ensure concealed sprinkler head cover plates do not receive field paint finish.

3.7 PROTECTION OF COMPLETE WORK

.1 Paint exposed steel pipe and fittings, except special finishes, in accordance with Architectural Specifications.

.2 Assume responsibility for protecting sprinkler heads during painting. Replace damaged and painted components.

.3 Provide red wire guards for sprinkler heads in mechanical and electrical rooms and around ventilation equipment, and all other areas required by code or intended usage. Provide wire guards in gymnasiums.

END OF SECTION

1 General

1.1 SECTION INCLUDES

.1 Fire pump package.
.2 Fire pump motor.
.3 Electric jockey pump.
.4 Controllers.

1.2 REFERENCES

.1 CSA C22.2 No. 100-04 - Motors and Generators.
.2 FM - Factory Mutual System - Approval Guide.
.3 NEMA MG1-2006 - Motors and Generators.
.4 NEMA 250-2003 - Enclosures for Electrical Equipment (1000 Volt Maximum).
.5 NFPA 20 - Installation of Stationary Fire Pumps for Fire Protection, 2010 Edition.
.6 NFPA 37 - Installation and Use of Stationary Combustion Engines and Gas Turbines, 2006 Edition.
.7 UL - Fire Protection Equipment Directory.
.8 UL 448 (Amendment 2) - Pumps for Fire Protection Service.
.9 UL 778 (Revision 3) - Motor-Operated Water Pumps.
.10 UL 1478 - Fire Pump Relief Valves, 4th Edition.
.11 ULC - List of Equipment and Materials.

1.3 SYSTEM DESCRIPTION

.1 Fire pump assembly including drivers, controls and pump accessory items, connected to fire standpipe system.

1.4 PERFORMANCE REQUIREMENTS

.1 Conform to NFPA 20.

.2 Fire Pump Assembly: Capable of delivering not less than 150% of rated flow at not less than 65% rated head.

1.5 ADMINISTRATIVE REQUIREMENTS

.1 Section 01 33 00: Project management and coordination procedures.

.2 Pre-installation Meetings: Convene one (1) week before starting work of this section.

1.6 SUBMITTALS FOR REVIEW

.1 Section 01 33 00: Submission procedures.

.2 Product Data: Provide manufacturers literature including general assembly, pump curves showing performance characteristics with pump and system, operating point indicated, NPSH curve, controls, wiring diagrams, and service connections.

.3 Shop Drawings: Indicate layout, general assembly, components, dimensions, weights, clearances, and methods of assembly.

1.7 SUBMITTALS FOR INFORMATION

.1 Section 01 33 00: Submission procedures.

.2 Test Reports: Indicate results of hydrostatic test and field acceptance tests performed to NFPA 20.

.3 Installation Data: Indicate support details, connection requirements, for fire pump system.

1.8 CLOSEOUT SUBMITTALS

.1 Section 01 78 00: Submission procedures.

.2 Maintenance Contracts: Provide service and maintenance of fire pump, driver, and controller for one year from date of Substantial Completion.

.3 Operation and Maintenance Data:
- .1 Include manufacturer's instructions, start-up data, trouble-shooting check lists, for pumps, drivers, and controllers.
- .2 Include manufacturer's literature, cleaning procedures, replacement parts lists, and repair data for pumps, drivers and controllers.

.4 Record Documentation: Record actual locations of components and accessories.

.5 Certificates: Certify that fire pumps meet or exceed specified requirements at specified operating conditions and that the installation complies with regulatory requirements. Submit summary and results of shop tests performed to NFPA 20.

1.9 MAINTENANCE MATERIAL SUBMITTALS

.1 Section 01 78 00: Maintenance and extra material requirements.

.2 Extra Stock Materials: Provide one (1) set of gaskets for each pump type and model supplied.

1.10 QUALITY ASSURANCE

.1 Products of This Section: Manufactured to ISO 9000 certification requirements.

.2 Perform Work to NFPA 20 and NFPA 37. Maintain one copy on site.

.3 Manufacturer Qualifications: Company specializing in manufacturing the Products specified in this section with minimum three (3) years documented experience; capable of assuming complete responsibility for unit assemblies and proper operation of complete unit assembly as indicated by field acceptance test.

.4 Installer Qualifications: Company specializing in performing the work of this section with minimum three (3) years documented experience.

.5 Design fire pump system under direct supervision of a Professional Engineer experienced in design of this Work and licensed at the place where the Project is located.

1.11 REGULATORY REQUIREMENTS

.1 Conform to ULC.

.2 Perform work to NFPA 20 and NFPA 37 for installation and testing of fire pumps, drivers, and controllers.

.3 Provide certificate of compliance from authority have jurisdiction indicating approval of field acceptance tests.

.4 Equipment and Components: Bear ULC label or marking.

.5 Products Requiring Electrical Connection: Listed and classified by ULC as suitable for the purpose specified and indicated.

1.12 DELIVERY, STORAGE, AND PROTECTION

.1 Section 01 61 00: Transport, handle, store, and protect products.

.2 Accept fire pumps and components on site in factory packing. Inspect for damage. Comply with manufacturers rigging and installation written instructions.

.3 Protect fire pumps and components from physical damage including effects of weather, water, and construction debris.

.4 Provide temporary inlet and outlet caps, and maintain in place until installation.

2 Products

2.1 VERTICAL IN-LINE PUMPS

.1 Pump Assembly: ULC listed assembly, including drivers, controls and pump accessory items, labeled and listed for fire service.

.2 Type: UL 448 and UL 778, vertical, single stage, close coupled, radially or horizontally split casing, for in-line mounting, for 1 720 kPa.

.3 Casing:
- .1 Cast or ductile iron, with suction and discharge gauge port, casing wear ring, seal flush connection, drain plug, flanged suction and discharge.
- .2 Suction and discharge flange of identical dimensions and displaced 180° with center lines concentric on the same horizontal plane.

.4 Impeller: Bronze, fully enclosed, keyed directly to motor shaft.

.5 Shaft: Solid alloy steel with bronze sleeve.

.6 Seal: Packing gland with minimum four rings graphite impregnated packing and bronze lantern rings, 110 degrees C maximum continuous operating temperature.
OR
Seal: Carbon rotating against a stationary ceramic seat viton fitted, maximum continuous operating temperature.

.7 Performance: As required to meet sprinkler design. Design is based on pump noted in equipment schedule.

2.2 HORIZONTAL BASE MOUNTED PUMPS

.1 Pump Assembly: ULC listed assembly, including drivers, controls and pump accessory items.

.2 Type: UL 448 and UL 778, horizontal shaft, single stage, double suction, direct connected, horizontally split casing, for 1 720 kPa maximum working pressure.

.3 Casing: Cast iron, with suction and discharge gauge ports, renewable bronze casing wearing rings, seal flush connection, drain plug, flanged suction and discharge.

.4 Impeller: Bronze double suction fully enclosed, balanced and keyed to shaft.

.5 Bearings: Grease lubricated ball bearings, replaceable without opening casing.

.6 Shaft: Alloy steel with replaceable bronze shaft sleeve.

.7 Seal: Packing gland with minimum four rings graphite impregnated packing and bronze lantern rings, 110 degrees C maximum continuous operating temperature.

.8 Drive: Flexible coupling with coupling guard.

.9 Baseplate: Cast iron or fabricated steel with integral drain rim.

.10 Performance: As required to meet sprinkler design. Design is based on pump noted in equipment schedule.

2.4 FIRE PUMP ACCESSORIES

.1 Eccentric suction reducer and OS&Y gate or butterfly valve on suction side of pump.

.2 Concentric increaser and check valve in pump discharge and OS&Y gate or butterfly valve on system side of check valve.

.3 Fire pump bypass fitted with OS&Y gate or butterfly valves and check valve.

.4 Main relief valve, UL 1478, and enclosed type waste cone.

.5 Suction pressure gauge, 110 mm diameter dial with snubber, valve cock and lever handle.

.6 Discharge pressure gauge mounted on board attached to pump, with snubber, valve cock and lever handle.

.7 Casing 20 mm relief valve.

.8 Float operated 20 mm automatic air release valve.

.9 Hose valve manifold with 65 mm hose gate valves with caps and chains.

.10 Drain valve.

.11 Water level gauge device (Vertical Turbine Fire Pumps only).

.12 Flow metering system for closed loop testing.

2.5 CONTROLLER WITH AUTOMATIC POWER TRANSFER SWITCH

.1 The electric fire pump controller and automatic power transfer switch shall meet the latest NFPA 20 and NFPA 70 requirements, be listed with cULus (UL218 and CSA C22.2 No. 14 Industrial Control Equipment) and approved by FM (Factory Mutual).

.2 Controller shall be full service combined manual and automatic type suitable for full voltage across the line starting of the electric fire pump motor.

.3 The automatic power transfer switch shall be housed in its own compartment with its own door and be mechanically attached to the electric fire pump controller and be suitable for connecting to a generator whose capacity exceeds 225 percent of the fire pump motor's full load amperage.

.4 The short circuit withstand rating of the electric fire pump controller only shall be: 50 kA RMS (600V).

.5 Enclosure:
- .1 Enclosure shall be a double door NEMA/UL/CSA type 2.
- .2 The enclosure shall incorporate bottom mounted gland plates for normal and alternate (emergency) power and or motor lead entrance.
- .3 The gland plates shall be field removable and meet the same NEMA rating of the enclosure
- .4 Lifting lugs shall be provided.

.6 The electric fire pump controller and automatic power transfer switch shall be supplied with the following power components:
- .1 Voltage surge arrestor.
- .2 One molded case isolating switch for normal power rated at a minimum of not less than 115% of full load motor current. The normal power isolating switch shall be of the same frame size as the motor circuit breaker.
- .3 One molded case isolating switch for alternate (emergency) power rated at a minimum of not less than 115% of full load motor current. The alternate (emergency) power isolating switch shall be of the same frame size as the motor circuit breaker.
- .4 One molded case motor circuit breaker for normal power rated at a minimum of not less than 115% of full load motor current. The motor circuit breaker shall be of the instantaneous magnetic trip type only and shall be adjusted to a minimum of 13 times the fire pump full load motor current. The motor circuit breaker shall be of the same frame size as the isolating switch.
- .5 One molded case motor circuit breaker alternate (emergency) power rated at a minimum of not less than 115% of full load motor current. The motor circuit breaker shall be of the instantaneous magnetic trip type only and shall be adjusted to a minimum of 13 times the fire pump full load motor current. The motor circuit breaker shall be of the same frame size as the isolating switch.
- .6 Lock rotor protector set to automatically trip within 8 to 20 seconds at 600% of full load current. The locked rotor protector shall be factory calibrated, set and tested. Electric fire pump controllers and automatic power transfer switches allowing for the field adjustment of the locked rotor value shall not be accepted.
- .7 One automatic power transfer switch mechanically held and electrically operated. Manual operation of the transfer switch shall be provided by means of manual operating handle.
- .8 An across the line electric motor starter.

.7 The electric fire pump controller and automatic power transfer switch shall be supplied with the following externally flange mounted components approved to match the NEMA rating of the enclosure.
- .1 One common operating handle for both the normal power isolating switch and the motor circuit breaker mechanically interlocked with the normal power side enclosure door to prohibit access to the interior in the "ON" position. The handle shall have a hidden interlock defeater and be lockable in the "OFF" position.
- .2 One common operating handle for both the alternate (emergency) power isolating switch and the motor circuit breaker mechanically interlocked with the alternate (emergency) power side enclosure door to prohibit access to the interior in the "ON" position. The handle shall have a hidden interlock defeater and be lockable in the "OFF" position.
- .3 "START" pushbutton.
- .4 "STOP" pushbutton.
- .5 "EMERGENCY START" and run handle mechanism latchable in the "ON" position
- .6 "RUN TEST" pushbutton.
- .7 One alarm bell energized when the isolating switch is left in the "OFF" position Transfer switch test pushbutton.

.8 The electric fire pump controller and automatic power transfer switch shall be supplied with two (2) digital annunciator interfaces completely accessible without having to open the controller door. The normal power digital annunciator interface shall be comprised of a 4-line, 20-character and a separate 2-line 20-character continuously back lit digital display screens, keypad type pushbuttons, high luminosity LED's and have the same NEMA rated degree of protection as the enclosure of the electric fire pump controller and automatic power transfer switch. The normal power digital annunciator interface shall numerically display:

.1 Normal power source individual phase to phase incoming voltage and frequency.
.2 Individual phase motor current
.3 True pump elapsed run time
.4 Pump start counts
.5 Time and date
.6 Cut-In and Cut-Out pressure settings
.7 System pressure
.8 Minimum run period timer
.9 Sequential start timer
.10 Weekly test timer

.9 The alternate (emergency) power digital annunciator interface shall be comprised of a 4-line, 20-character continuously back lit digital display screen, keypad type pushbuttons and have the same NEMA rated degree of protection as the enclosure of the electric fire pump controller and automatic power transfer switch. The alternate (emergency) power digital annunciator interface shall numerically display:

.1 Normal power source individual phase to phase incoming voltage and frequency.
.2 Alternate (emergency) power source individual phase to phase incoming voltage and frequency
.3 Transfer switch status text indication.

.10 The voltage and frequency readings of all three phases of both the normal and alternate (emergency) power and amperage readings shall be simultaneously and independently displayed with true RMS technology. Measurement of the voltage, frequency and amperage shall be accomplished with the latest technology to provide the most accurate readings. Electric fire pump controllers and automatic power transfer switches with analog meters and selector switches for the selection of the phase being displayed of either the voltage or current shall not be accepted.

.11 Pump starts and elapsed pump run times shall only be considered if amperage is being drawn by the motor. Simple closure of the run contactor shall not be considered as the pump actually running nor should it count as pump elapsed run time.

.12 The cut-in, cut-out and system pressure indication shall be continuously displayed. The ability to change the unit of measurement from Psi to Bar shall be provided through the adjustment of a dipswitch located inside the controller. Electric fire pump controllers and automatic power transfer switches without the capability of digitally displaying the cut-in, cut-out and system pressure shall not be accepted.

.13 The normal power digital annunciator interface shall digitally indicate:

.1 Phase loss.
.2 Phase unbalance.
.3 Incoming over voltage.
.4 Incoming under voltage.
.5 Motor over current.
.6 Motor under current.
.7 Motor run.
.8 Fail to start.

.14 The alternate (emergency) power digital annunciator interface shall digitally indicate:
- .1 Normal power available.
- .2 Normal position.
- .3 Transfer in progress.
- .4 Generator start signal.
- .5 Alternate power available.
- .6 Alternate position.
- .7 Retransfer in progress.
- .8 Cooling time.

.15 Phase loss shall be indicated if the voltage of any phase drops below 85% of the nominal voltage. A separate phase unbalance indication shall be displayed if the difference of the minimum and maximum voltage is greater than 3% of the average voltage.

.16 Incoming over voltage shall be indicated if any phases are greater than 110% of the nominal voltage of the controller and incoming under voltage shall be indicated if any of the phases are lower than 85% of the nominal voltage of the controller.

.17 Motor over current shall be indicated after 20 seconds if any of the current phases are greater than 130% of the nominal full load amperage of the electric motor and motor under current shall be indicated if any of the phases are lower than 30% of the nominal full load amperage of the electric motor.

.18 A fail to start indication shall appear after 20 seconds of the motor run contactor being closed and the amperage drawn is lower than 5% of the electric motor full load amps.

.19 The normal power digital annunciator interface shall have high luminosity LED's for:
- .1 Power available
- .2 Phase reversal
- .3 Pump on demand
- .4 Weekly test

.20 Electric fire pump controllers and automatic power transfer switches supplied with traditional neon or incandescent bulb pilot lights with coloured lens shall not be accepted.

.21 The normal power digital annunciator interface shall have keypad type pushbuttons for:
- .1 Alarm reset.
- .2 Cut-in pressure setting.
- .3 Cut-out pressure setting.
- .4 Run test.
- .5 Print

.22 The digital annunciator interface shall have a keypad type pushbutton for:
- .1 Transfer switch bypass time delay
- .2 Silence
- .3 Alarm reset

.23 The cut-in and cut-out adjustments shall have independent pushbuttons accessible without having to open the controller door which will raise the setting one unit (Psi or Bar) at a time and also raise the setting by 10 units if held pressed for more than one second. The logic of adjustment shall be so that the cut-out setting must be set before the cut-in setting and that the cut-in setting cannot be raised above the cut-out setting. The adjustment of the cut-out and cut-in shall be tamper proof through the setting of a dipswitch installed inside the controller.

.24 Pressure and Event Recording: The electric fire pump controller shall be equipped with a pressure and event recorder. The recorder will register and keep in memory general system information, pressure fluctuations over time that have occurred over the previous fifteen (15) days and events and alarms that have occurred over the previous fifteen (15) days. General system information, events and alarms include the following:

.1 Time and date of retrieval of data.
.2 Cut-in and Cut-out setting.
.3 Date of the last change of the cut-in and cut-out setting.
.4 Date, time and pressure readings of the minimum and maximum pressure registered over the previous 15 days.
.5 Weekly test information.
.6 Minimum run period timer information.
.7 Pump start time and date.
.8 Pump stop time and date.
.9 Pump on demand time and date.
.10 Pump room alarm time and date.
.11 Motor trouble time and date.
.12 Power On date and time.
.13 Power Off date and time.

.25 Pressure and Event Recording information shall be retrievable through a USB slave communication port accessible without having to open the controller door.

.26 Pressure Sensing Device: The electric fire pump controller shall be supplied with a 304 stainless steel pressure transducer rated for fresh water operation between 0 and 300psi with ±2% accuracy and a minimum burst pressure of 420psi. The pressure transducer shall be used to display the pressure in the sprinkler system and also control the automatic start circuit. The pressure transducer shall be installed inside the controller directly mounted to a bulkhead allowing for an external connection to the sprinkler system sensing line. Controllers supplied with mechanical pressure sensing devises with or without mercury shall not be accepted.

.27 Field Adjustments and Operation:

.1 The manual START and STOP control circuit of the electric fire pump controller shall not be electrically linked to the micro-processor.
.2 The electric fire pump controller shall ship from the factory set for manual stop and shall be field adjustable for automatic stop if required by adjusting a minimum run period timer. The minimum run period timer shall be accessed through the digital annunciator interface which shall display both a text indication and the remaining time of the timer.
.3 A sequential start on delay timer shall be supplied and shall be field adjustable. The sequential start on delay timer shall be accessed through the digital annunciator interface and shall display the remaining time of the timer.
.4 A weekly test timer shall be supplied as standard equipment. The timer shall allow for the setting of the date and start and stop times of the weekly test. This timer shall be field adjustable and accessed through the digital annunciator interface and shall display the remaining time of the timer.
.5 A RUN TEST pushbutton shall be provided to electrically start the electric fire pump motor and hold it running automatically for 10 minutes. The RUN TEST pushbutton will energize the solenoid valve to create an artificial pressure drop which will be sensed by the pressure transducer starting the electric fire pump motor and hold it running for 10 minutes.
.6 Voltage sensing on each phase of the normal power supply factory set at 85% to initiate actuation of the generator set start contact.
.7 Voltage and frequency sensing of the alternate (emergency) power source factory set at 90% to initiate transfer to alternate (emergency) power.
.8 The voltage sensing on all phase of normal power factory set at 90% to initiate retransfer to normal power.

.9 One timing function to override momentary normal outages before activating engine start contact factory set at 3 seconds.
.10 One timing function to delay re-transfer to the normal power supply factory set at 5 minutes. Transfer to normal power shall be instantaneous in case of alternate power failure.
.11 One timing function to allow engine generator cool down after retransfer to normal source factory set at 5 minutes.
.12 Separate remote start and deluge valve start contacts shall be provided.
.13 A field simulation phase reversal system shall be provided in order to verify this alarm condition. The correction of the phase reversal shall be accomplished by the adjustment of a dipswitch mounted inside the controller.
.14 The ability of simultaneously verifying all inputs and outputs on the digital display screen shall be provided

.28 Alarm Contacts: Dry alarm contacts rate at 8A - 250VAC for remote indication shall be provided for the following conditions:
.1 Power or phase failure and/or circuit breaker in open position (DPDT)
.2 Phase reversal (DPDT)
.3 Pump run (1N/0 - 1N/C)
.4 Isolating switch in Off position (DPDT)
.5 Automatic transfer switch in normal power position (1 N/O)
.6 Automatic transfer switch in alternate power position (1 N/O)

2.6 CONTROLLER (Soft Start)

.1 The electric fire pump controller shall meet the latest NFPA 20 and NFPA 70 requirements, be listed with CUL US (UL218 and CSA C22.2 No. 14 Industrial Control Equipment) and approved by FM (Factory Mutual).

.2 Controller shall be full service combined manual and automatic type suitable for reduced voltage electronic soft start starting of the electric fire pump motor.

.3 The short circuit withstand rating of the electric fire pump controller only shall be: 100 kA RMS at 200V-480V or 50 kA RMS at 600V.

.4 Enclosure:
.1 Enclosure shall be a double door NEMA/UL/CSA type 2.
.2 The enclosure shall incorporate bottom entry gland plates for power and or motor lead entrance.
.3 The gland plates shall be field removable and meet the same NEMA rating of the enclosure.
.4 Lifting lugs shall be provided.

.5 The electric fire pump controller shall be supplied with the following power components:
.1 Voltage surge arrestor.
.2 Motor rated combination isolating switch and circuit breaker assembly. Both the isolating switch and circuit breaker shall be rated not less than 115% of the motor full load current..
.3 The circuit breaker overcurrent sensing shall be non-thermal type, magnetic only.
.4 Lock rotor protector set to automatically trip within 8 to 20 seconds at 600% of full load current. The locked rotor protector shall be factory calibrated, set and tested. Electric fire pump controllers allowing for the field adjustment of the locked rotor value shall not be accepted.
.5 An electronic soft start motor starter.

.6 The electric fire pump controller shall be supplied with the following externally flange mounted components approved to match the NEMA rating of the enclosure.
- .1 One common operating handle for both the isolating switch and the circuit breaker assembly mechanically interlocked with the enclosure door to prohibit access to the interior in the "ON" position.

.7 One “Emergency Start" and run handle mechanism latchable in the "ON" position.

.8 Touch Screen Operator Interface:
- .1 The electric fire pump controller shall be supplied with a 4.2" LCD color touch screen (HMI technology) operator interface powered by an embedded microcomputer with software PLC logic. The operator interface's touch screen shall allow navigation through the various operating screens.
- .2 The following keypad type pushbuttons shall be provided:
  - .1 Start
  - .2 Stop
  - .3 Run test
  - .4 Navigation
  - .5 Help
  - .6 Home
  - .7 Alarms
  - .8 Settings/Configuration
  - .9 History/Statistics
- .3 The touch screen operator interface shall graphically display:
  - .1 Voltage and amperage readings of all three phases simultaneously and independently displayed with true RMS technology.
  - .2 Motor starting transition
  - .3 Motor stopped / running
  - .4 Type of starting cause
  - .5 Actuation mode
  - .6 Type of controller
  - .7 Method of shutdown
  - .8 Time and date
  - .9 System pressure in 5 different user selectable units of measure;
    - .1 PSI
    - .2 kPA
    - .3 Bar
    - .4 Feet of head
    - .5 Meter of water
- .4 The touch screen operator interface shall allow for the programming and display of:
  - .1 Cut-In and Cut-Out pressure settings
  - .2 Minimum run period timer
  - .3 Sequential start timer
  - .4 Periodic test timer
  - .5 The user shall be able to select the language of operation on-site.
  - .6 Contextual HELP screens shall be accessible to the user while navigating through the operator interface in the chosen language.

.9 Condition and Alarm Visual Indicators:
- .1 The touch screen operator interface shall visually indicate the following alarms and differentiate the criticalness by color code:
  - .1 Normal power phase reversal
  - .2 Normal power phase loss
  - .3 Normal power loss
  - .4 Locked rotor
  - .5 Fail to start
  - .6 Service required

.7 Undercurrent
.8 Overcurrent
.9 Under voltage
.10 Overvoltage
.11 Phase unbalance
.12 Low water level
.13 Low system (discharge) pressure
.14 Periodic test cut-in not reached
.15 Run test solenoid valve check
.16 Faulty pressure transducer
.17 Pump on demand
.18 Over pressure
.19 Under pressure
.20 Low pump room temperature

.10 Pressure and Event Recording:

.1 The fire pump controller's touch screen operator interface shall be capable of logging pressure data and operational events with time and date stamp. It shall be able to display the last 500 operational events and display the pressure data in text and/or graphic form. Pressure data and operational events shall be stored in memory for the lifetime of the controller. The data shall also be retrievable and downloadable to a flash memory disk via the USB port accessible to the user without having to open the controller door. General system information, events and alarms include the following:

.1 Last service statistics
.1 Powered since
.2 On time
.3 Motor last run
.4 Motor run time
.5 Motor start count
.6 Minimum, maximum, average system pressure
.7 Minimum, maximum, average pump room temperature

.2 All time statistics
.1 First power up
.2 First start up
.3 On time

.3 Power statistics
.1 Voltage between phases with date stamp
.2 Amperage between phases with date stamp

.11 Wetted Parts:

.1 The electric fire pump controller shall be supplied with a pressure transducer and run test solenoid valve assembly. The pressure sensing line connection to the pressure transducer shall be ½" FNPT. Provision for a redundant pressure transducer shall be provided. This assembly shall be rated for 500psi working pressure and be externally mounted with a protective cover.

.12 Service/Flow Testing Capabilities:

.1 The electric fire pump controller's touch screen operator interface shall have the capability of scheduling maintenance reminders. It shall also have the capability of inputting pump flow test data, generate and display the pump curve and store this information in memory for the lifetime of the controller.

.13 Connection for External Devices:

.1 The electric fire pump controller shall provide terminals for the connection for the following external devices:

.1 Manual remote start device
.2 Automatic remote start device

.3 Deluge valve start

.14 Alarm Contacts for Remote Indication:
.1 SPDT dry alarm contacts rated for 8A - 250VAC for remote indication shall be provided for the following conditions;
.1 Power or phase failure and/or circuit breaker in open position
.2 Phase reversal
.3 Pump run (X2)
.4 Common pump room alarm
.5 Common motor trouble
.2 Removable alarm contact terminals shall be provided.

.15 Audible Alarm:
.1 A 4" alarm bell rated for 85dB at 10ft (3m) shall sound during boot up and internal communication error.

.16 Basis of Specification
.1 The specifications are based on an electric fire pump controller Model GPS with ViZi Touch operator interface as manufactured by Tornatech Inc.

2.8 PRESSURE BOOSTER (JOCKEY) PUMP

.1 Electrically operated, horizontal turbine type with standard open drip-proof horizontal motor. Refer to 21 13 13.

.2 Control by automatic jockey pump controller with full voltage starter and minimum run timer to start pump on pressure drop in system and stay in operation for minimum period of time. Fire pump to start automatically on further pressure drop or on jockey pump failure.

.3 Electrical Characteristics: As noted in equipment schedule.

2.9 SOURCE QUALITY CONTROL

.1 Manufacturer's Factory Tests: Prior to shipment, hydrostatically test and run each individual pump at a pressure of not less than one and one-half (1-1/2) times the no flow (shut-off) head of the pump's maximum diameter impeller plus the maximum allowable suction head, but in no case less than 250 psig.

3 Execution

3.1 INSTALLATION

.1 Install to NFPA 20.

.2 Provide access space around pumps for service; no less than minimum as recommended by manufacturer.

.3 Install piping to applicable sections. Decrease from line size with long radius reducing elbows or reducers. Support piping adjacent to pump such that no weight is carried on pump casings. For base mounted pumps, provide supports under elbows on pump suction and discharge.

.4 Provide drains for bases and seals, piped to and discharging into floor drains.

.5 Mount unit on vibration isolators. Refer to Section 23 05 48.

.6 Provide for connection to electrical service. Refer to Section 26 05 80.

.7 Lubricate pumps before start-up.

.8 Check, align, and certify base mounted pumps by qualified millwright prior to start-up.

3.2 FIELD QUALITY CONTROL

.1 Section 01 45 00: Field inspection.

.2 Perform flow test on entire system to NFPA 20.

.3 Flow water through calibrated nozzles, approved flow meters or other accurate device as selected by authority having jurisdiction.

.4 Require test to be witnessed by Fire Marshall,

3.3 CLOSEOUT ACTIVITIES

.1 Demonstration: Demonstrate automatic operation of system including verification of pressure switch set points.

1 General

1.1 RELATED REQUIREMENTS

.1 Materials and installation for domestic water service used in the following:
- .1 Incoming domestic water service, up to NPS 2 1/2.
- .2 Hard domestic hot and cold water services inside building.
- .3 Soft tubing inside building.
- .4 Soft buried tubing outside building, as in between potable water source and meter inside building.

.2 Sustainable requirements for construction, verification and operation.

1.2 REFERENCES

.1 American National Standards Institute (ANSI)/American Society of Mechanical Engineers International (ASME)
- .1 ANSI/ASME B16.15-06, Cast Bronze Threaded Fittings, Classes 125 and 250.
- .2 ANSI/ASME B16.18-01, Cast Copper Alloy Solder Joint Pressure Fittings.
- .3 ANSI/ASME B16.22-01, Wrought Copper and Copper Alloy Solder Joint Pressure Fittings.
- .4 ANSI/ASME B16.24-01, Cast Copper Alloy Pipe Flanges and Flanged Fittings, Class 150, 300, 400, 600, 900, 1500 and 2500.

.2 ASTM International Inc.
- .1 ASTM A307-07b, Standard Specification for Carbon Steel Bolts and Studs, 60,000 PSI Tensile Strength.
- .2 ASTM A536-84(2004)e1, Standard Specification for Ductile Iron Castings.
- .3 ASTM B88M-05, Standard Specification for Seamless Copper Water Tube (Metric).

.3 American National Standards Institute/American Water Works Association (ANSI)/ (AWWA)
- .1 ANSI/AWWA C111/A21.11-07, Rubber-Gasket Joints for Ductile-Iron Pressure Pipe and Fittings.

.4 Canada Green Building Council (CaGBC)
- .1 LEED Canada-NC Version 1.0-2004, LEED (Leadership in Energy and Environmental Design): Green Building Rating System Reference Package For New Construction and Major Renovations.
- .2 Rating System Addenda for New Construction and Major Renovations LEED Canada-NC Version 1.0-Addendum 2007.
- .3 LEED Canada-CI Version 1.0-2007, LEED (Leadership in Energy and Environmental Design): Green Building Rating System Reference Guide For Commercial Interiors.

.5 Canadian Standards Association (CSA International)
- .1 CSA B242-05, Groove and Shoulder Type Mechanical Pipe Couplings.

.6 Department of Justice Canada (Jus)
- .1 Canadian Environmental Protection Act, 1999, c. 33 (CEPA).

.7 Health Canada/Workplace Hazardous Materials Information System (WHMIS)
.1 Material Safety Data Sheets (MSDS).

.8 Manufacturer's Standardization Society of the Valve and Fittings Industry (MSS).
.1 MSS-SP-67-02a, Butterfly Valves.
.2 MSS-SP-70-06, Gray Iron Gate Valves, Flanged and Threaded Ends.
.3 MSS-SP-71-05, Gray Iron Swing Check Valves, Flanged and Threaded Ends.
.4 MSS-SP-80-03, Bronze Gate, Globe, Angle and Check Valves.

.9 National Research Council (NRC)/Institute for Research in Construction
.1 NRCC 38728, National Plumbing Code of Canada (NPC) - 1995.

.10 Transport Canada (TC)
.1 Transportation of Dangerous Goods Act, 1992, c. 34 (TDGA).

1.3 ACTION AND INFORMATIONAL SUBMITTALS

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

.2 Product Data:
.1 Provide manufacturer's printed product literature and datasheets for insulation and adhesives, and include product characteristics, performance criteria, physical size, finish and limitations.

.3 Closeout Submittals:
.1 Provide maintenance data for incorporation into manual specified in Section 01 78 00 - Closeout Submittals.

2 Products

2.1 PIPING

.1 Domestic hot, cold and recirculation systems, within building.
.1 Above ground: copper tube, hard drawn, type K: to ASTM B88M.
.2 Buried or embedded: copper tube, soft annealed, type K: to ASTM B88M, in long lengths and with no buried joints.

2.2 FITTINGS

.1 Bronze pipe flanges and flanged fittings, Class 150: to ANSI/ASME B16.24.

.2 Cast bronze threaded fittings, Class 125: to ANSI/ASME B16.15.

.3 Cast copper, solder type: to ANSI/ASME B16.18.

.4 Wrought copper and copper alloy, solder type: to ANSI/ASME B16.22.

.5 NPS 2 and larger: ANSI/ASME B16.18 or ANSI/ASME B16.22 roll grooved to CSA B242.

.6 NPS 1 1/2 and smaller: wrought copper to ANSI/ASME B16.22; with 301stainless steel internal components and EPDM seals. Suitable for operating pressure to 1380 kPa.

2.3 JOINTS

.1 Rubber gaskets, latex-free mm thick: to AWWA C111.

.2 Bolts, nuts, hex head and washers: to ASTM A307, heavy series.

.3 Solder: 95/5.

.4 Teflon tape: for threaded joints.

.5 Grooved couplings: designed with angle bolt pads to provide rigid joint, complete with EPDM gasket.

.6 Dielectric connections between dissimilar metals: dielectric fitting, 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 23.01 - 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 23.01 - Valves - Bronze.

.3 NPS 2 1/2 and over, in mechanical rooms, flanged:
- .1 Rising stem: to MSS-SP-70, Class 125, 860 kPa, flat flange faces, cast-iron body, OS&Y bronze trim specified Section 23 05 23.02 - Valves - Cast Iron.

.4 NPS 2 1/2 and over, other than mechanical rooms, 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 23.02 - 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 23.01 - Valves - Bronze.
- .2 Lockshield handles: as indicated.

.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 23.01 - Valves - Bronze.
- .2 Lockshield handles: as indicated.

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, regrindable seat as specified Section 23 05 23.01 - Valves - Bronze.

.2 NPS 2 and under, screwed:
.1 To MSS-SP-80, Class 125, 860 kPa, bronze body, bronze swing disc, screw in cap, regrindable seat as specified Section 23 05 23.01 - 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 seat, bronze disc, bolted cap specified Section 23 05 23.02 - 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 ball, PTFE adjustable packing, brass gland and PTFE seat, steel lever handle as specified Section 23 05 23.01 - Valves - Bronze.

.2 NPS 2 and under, soldered:
.1 To ANSI/ASME B16.18, Class 150.
.2 Bronze body, chrome plated brass ball, PTFE adjustable packing, brass gland and PTFE seat, steel lever handle, with NPT to copper adaptors as specified Section 23 05 23.01 - Valves - Bronze.

2.8 BUTTERFLY VALVES

.1 NPS 2-1/2 and over, wafer:
.1 To MSS-SP-67, Class 200.
.2 Cast iron body, ductile iron chrome plated disc, stainless steel stem, EPT liner.
.3 Lever operated, NPS8 and over, gear operated.

.2 NPS 2-1/2 and over, grooved ends:
.1 Class 300 psig CWP, bubble tight shut-off, bronze body EPDM coated ductile iron disc with integrally cast stem.
.2 Operator:
.1 NPS 4 and under: lever handle.
.2 NPS 6 and over: gear operated.

3 Execution

3.1 APPLICATION

.1 Manufacturer's Instructions: comply with manufacturer's written recommendations, including product technical bulletins, handling, storage and installation instructions, and datasheets.

3.2 INSTALLATION

.1 Install in accordance with NPC.

.2 Install pipe work in accordance with Section 23 05 05 - Installation of Pipework, supplemented as specified herein.

.3 Assemble piping using fittings manufactured to ANSI standards.

.4 Install CWS piping below and away from HWS and HWC and other hot piping so as to maintain temperature of cold water as low as possible.

.5 Connect to fixtures and equipment in accordance with manufacturer's written instructions unless otherwise indicated.

3.3 ROUTES AND GRADES

.1 Route piping in orderly manner and maintain proper grades. Install to conserve headroom and interfere as little as possible with use of space. Run exposed piping parallel to walls. Group piping wherever practical at common elevations. Install concealed pipes close to the building structure to keep furrings to a minimum.

.2 Slope water piping 25 mm in 12 m (1" in 40') and arrange to drain at low points.

.3 On closed systems, equip low points with 20 mm (3/4") drain valves and hose nipples. Provide, at high points, collecting chambers and high capacity float operated automatic air vents.

.4 Make reductions in water pipes with eccentric reducing fittings installed to provide drainage and venting.

.5 Grade horizontal drainage and vent piping 22 mm per meter (1/4" per foot) minimum unless otherwise indicated on drawings.

3.4 VALVES

.1 Isolate equipment, fixtures and branches with gate valves.

.2 Balance recirculation system using lockshield globe valves. Mark settings and record on as-built drawings on completion.

.3 Install valves with stems upright or horizontal, not inverted.

.4 Install gate, ball and butterfly valves for isolating service, to isolate equipment, part of systems or vertical risers.

.5 Install globe, ball or angle valves for throttling service and control device or meter bypass.

.6 Use plug cocks in water systems for throttling service. Use non-lubricated plug cocks only when shut-off or isolation valves are also provided.

.7 Provide drain valves at main shut-off valves, low points of piping and apparatus.

3.5 PRESSURE TESTS

.1 Conform to requirements of Section 21 05 01 - Common Work Results for Mechanical.

.2 Test pressure: greater of 1 times maximum system operating pressure or 860 kPa.

3.6 FLUSHING AND CLEANING

.1 Disinfect and rinse entire system to requirements of authority having jurisdiction and RCMP site standards.

.2 Flush entire system for 8 hours. Ensure outlets flushed for 2 hours. Let stand for 24 hours, then draw one sample off longest run. Submit to testing laboratory to verify that system is clean copper. Let system flush for additional 2 hours, then draw off another sample for testing.

.3 Upon completion, provide laboratory test reports on water quality for Departmental Representative approval. Include one copy of approved test reports in Operation and Maintenance Manual.

3.7 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.

3.8 START-UP

.1 Timing: start up after:
- .1 Pressure tests have been completed.
- .2 Disinfection procedures have been completed.
- .3 Certificate of static completion has been issued.
- .4 Water treatment systems operational.

.2 Provide continuous supervision during start-up.

.3 Start-up procedures:
- .1 Establish circulation and ensure that air is eliminated.
- .2 Check pressurization to ensure proper operation and to prevent water hammer, flashing and/or cavitation.
- .3 Monitor piping HWS and HWC piping systems for freedom of movement, pipe expansion as designed.
- .4 Check control, limit, safety devices for normal and safe operation.

.4 Rectify start-up deficiencies.

3.9 PERFORMANCE VERIFICATION

.1 Scheduling:
- .1 Verify system performance after pressure and leakage tests and disinfection are completed, and Certificate of Completion has been issued by authority having jurisdiction.

.2 Procedures:
- .1 Verify that flow rate and pressure meet Design Criteria.
- .2 Verify performance of temperature controls.
- .3 Verify compliance with safety and health requirements.

.4 Check for proper operation of water hammer arrestors. Run one outlet for 10 seconds, then shut of water immediately. If water hammer occurs, replace water hammer arrestor or re-charge air chambers. Repeat for outlets and flush valves.

.5 Confirm water quality consistent with supply standards, and ensure no residuals remain as result of flushing or cleaning.

.3 Reports:

.1 In accordance with Section 01 91 13 - General Commissioning (Cx) Requirements: Reports, using report forms as specified in Section 01 91 13 - General Commissioning (Cx) Requirements: Report Forms and Schematics.

.2 Include certificate of water flow and pressure tests conducted on incoming water service, demonstrating adequacy of flow and pressure.

3.10 OPERATION REQUIREMENTS

.1 Co-ordinate operation and maintenance requirements including, cleaning and maintenance of specified materials and products with Section 23 05 05 - Installation of Pipework.

END OF SECTION

1 General

1.1 SUMMARY

.1 Section Includes:
- .1 The installation of drainage waste and vent piping. Sustainable requirements for construction and verification.

1.2 REFERENCES

.1 American Society for Testing and Materials International, (ASTM).
- .1 ASTM B32-03, Specification for Solder Metal.
- .2 ASTM B306-02, Specification for Copper Drainage Tube (DWV).
- .3 ASTM C564-03a, Specification for Rubber Gaskets for Cast Iron Soil Pipe and Fittings.

.2 Canadian Standards Association (CSA International).
- .1 CSA B67-1972 (R1996), Lead Service Pipe, Waste Pipe, Traps, Bends and Accessories.
- .2 CAN/CSA-B70-02, Cast Iron Soil Pipe, Fittings and Means of Joining.
- .3 CAN/CSA-B125-01, Plumbing Fittings.

1.3 QUALITY ASSURANCE

.1 Health and Safety:
- .1 Do construction occupational health and safety in accordance with Section 01 35 29.06 - Health and Safety Requirements.

2 Products

2.1 COPPER TUBE AND FITTINGS

.1 Above ground sanitary, storm and vent Type DWV to: ASTM B306.
- .1 Fittings.
  - .1 Cast brass: to CAN/CSA-B125.
  - .2 Wrought copper: to CAN/CSA-B125.
- .2 Solder: 95:5, type TA, to ASTM B32.

2.2 CAST IRON PIPING AND FITTINGS

.1 Above ground sanitary, storm and vent: to CAN/CSA-B70.
- .1 Joints.
  - .1 Hub and spigot.
    - .1 Caulking lead: to CSA B67.
  - .2 Mechanical joints.
    - .1 Neoprene or butyl rubber compression gaskets with stainless steel clamps.

3 Execution

3.1 INSTALLATION

.1 In accordance with Section 23 05 05 - Installation of Pipework.

.2 Install in accordance with Provincial Plumbing Code and local authority having jurisdiction.

3.2 TESTING

.1 Pressure test buried systems before backfilling.

.2 Hydraulically test to verify grades and freedom from obstructions.

3.3 PERFORMANCE VERIFICATION

.1 Cleanouts:
- .1 Ensure accessible and that access doors are correctly located.
- .2 Open, cover with linseed oil and re-seal.
- .3 Verify that cleanout rods can probe as far as the next cleanout, at least.

.2 Test to ensure traps are fully and permanently primed.

.3 Storm water drainage:
- .1 Verify domes are secure.
- .2 Ensure weirs are correctly sized and installed correctly.
- .3 Verify provisions for movement of roof system.

.4 Ensure that fixtures are properly anchored, connected to system and effectively vented.

END OF SECTION

1 General

1.1 SUMMARY

.1 Section Includes:
  .1 The installation of drainage waste and venting piping - plastic.
.2 Sustainable requirements for construction and verification.

1.2 REFERENCES

.1 American Society for Testing and Materials International, (ASTM).
  .1 ASTM D2564-02, Specification for Solvent Cements for Poly (Vinyl-Chloride) (PVC) Plastic Piping Systems.

.2 Canadian Standards Association (CSA International).
  .1 CSA-Series B1800-02, Plastic Nonpressure Pipe Compendium.
  .2 CSA-B181.2-02, PVC Drain, Waste and Vent Pipe and Pipe Fittings.
  .3 CSA-B182.1-02, Plastic Drain and Sewer Pipe and Pipe Fittings.

2 Products

2.1 PIPING AND FITTINGS

.1 For buried and or above ground DWV piping to:
  .1 CSA-B181.1.
  .2 CSA-B181.2.
  .3 CSA-B182.1.

2.2 JOINTS

.1 Solvent weld for PVC: to ASTM D2564.

3 Execution

3.1 INSTALLATION

.1 In accordance with Section 23 05 05 - Installation of Pipework.

.2 Install in accordance with Provincial Plumbing Code and local authority having jurisdiction.

.3 Refer to 23 05 05 Installation of Pipework for fire stopping requirements.

3.2 TESTING

.1 Pressure test buried systems before backfilling.

.2 Hydraulically test to verify grades and freedom from obstructions.

3.3 PERFORMANCE VERIFICATION

.1 Cleanouts:
- .1 Ensure accessible and that access doors are correctly located.
- .2 Open, cover with linseed oil and re-seal.
- .3 Verify cleanout rods can probe as far as the next cleanout, at least.

.2 Test to ensure traps are fully and permanently primed.

.3 Storm water drainage:
- .1 Verify domes are secure.
- .2 Ensure weirs are correctly sized and installed correctly.
- .3 Verify provisions for movement of roof system.

.4 Ensure fixtures are properly anchored, connected to system and effectively vented.

END OF SECTION

1 General

1.1 SUMMARY

.1 Section Includes:
- .1 Materials and installation for plumbing specialties and accessories.
- .2 Sustainable requirements for construction and verification.

1.2 REFERENCES

.1 American Society for Testing and Materials International (ASTM).
- .1 ASTM A126-95 (2001), Specification for Gray Iron Castings for Valves, Flanges and Pipe Fittings.
- .2 ASTM B62-02, Specification for Composition Bronze or Ounce Metal Castings.

.2 Canadian Standards Association (CSA International).
- .1 CSA-B64 Series-01, Backflow Preventers and Vacuum Breakers.
- .2 CSA-B79-94 (R2000), Floor, Area and Shower Drains, and Cleanouts for Residential Construction.
- .3 CSA-B356-00, Water Pressure Reducing Valves for Domestic Water Supply Systems.

.3 Health Canada/Workplace Hazardous Materials Information System (WHMIS).
- .1 Material Safety Data Sheets (MSDS).

.4 Plumbing and Drainage Institute (PDI).
- .1 PDI-G101-96, Testing and Rating Procedure for Grease Interceptors with Appendix of Sizing and Installation Data.
- .2 PDI-WH201-92, Water Hammer Arresters Standard.

1.3 SUBMITTALS

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

.2 Product Data:
- .1 Submit manufacturer's printed product literature, specifications and datasheet for fixtures and equipment.
- .2 Indicate dimensions, construction details and materials for specified items.

.3 Shop Drawings:
- .1 Submit shop drawings to indicate materials, finishes, method of anchorage, number of anchors, dimensions, construction and assembly details and accessories.

.4 Certificates: submit certificates signed by manufacturer certifying that materials comply with specified performance characteristics and physical properties.

.5 Instructions: submit manufacturer's installation instructions.

1.4 QUALITY ASSURANCE

.1 Health and Safety:
- .1 Do construction occupational health and safety in accordance with Section 01 35 29.06 - Health and Safety Requirements.

.2 Provide materials, equipment and labour to install plumbing as required by Provincial and Local Codes and as specified herein.

.3 Provide water and drainage connections to equipment furnished in other sections of this specification and by the Departmental Representative.

.4 Fittings of same type shall be product of one manufacturer.

2 Products

2.1 FLOOR DRAINS

.1 Floor Drains: to CSA B79.

.2 Provide trap primer tapping on all floor drains where trap primers are required by Code and authority having jurisdiction.

.3 FD-1 – regular floor drain
- .1 Type 1 (General Duty): Epoxy coated cast iron body with double drainage flange, reversible clamping collar with primary and secondary weep holes, combined two piece body and adjustable nickel-bronze strainer. Shower and washroom floor drains shall have a removable perforated sediment bucket.
- .2 Type 2 (Heavy Duty): Epoxy coated cast iron body with double drainage flange, reversible clamping collar with primary and secondary weep holes, combined two piece body and adjustable heavy duty nickel-bronze strainer.
- .3 Type 3 (Combination Funnel Floor Drain): Epoxy coated cast iron body with double drainage flange, reversible clamping collar with primary and secondary weep holes, combined two piece body and adjustable nickel-bronze strainer with integral 102 mm x 229 mm oval nickel bronze funnel.

.4 FD-2 (Security Drain) Floor drain for security areas shall be 75mm (3”) drain with flush mounted tamper proof grille. Grille openings shall have a maximum dimension of 12mm (note that square openings shall be 12mm or less on diagonal dimension of opening). Grille shall be secured with security screws and each screw shall be mounted using Loctite Liquid Thread Locker, Series 262 Mil-Spec S-46163A Type II Grade 0 (no equivalent product).

2.2 CLEANOUTS

.1 Cleanout: Adjustable floor cleanout with lacquered cast iron body and anchor flange, secondary O ring test seal, 4" diameter cleanout opening and combined scoriated satin finished nickel bronze cover and plug top assembly with stainless steel vandal-proof allan key screws and primary gasket seal. Provide membrane clamp for all membrane floors. Specification based on Mifab Model C1100.

.2 Access Covers:

.1 Wall Access: face or wall type, polished nickel bronze with chrome plated cap, round cover with flush head securing screws, bevelled edge frame complete with anchoring lugs.

.2 Floor Access: round cast iron body and frame with adjustable secured nickel bronze top and:

.1 Plugs: bolted bronze with neoprene gasket.

.2 Cover for Unfinished Concrete Floors: round, nickel bronze, gasket, vandal-proof screws.

.3 Cover for Terrazzo Finish: Polished nickel bronze with recessed cover for filling with terrazzo, vandal-proof locking screws.

.4 Cover for Tile and Linoleum Floors: polished nickle bronze with recessed cover for linoleum or tile infill, complete with vandal-proof locking screws.

.5 Cover for Carpeted Floors; polished nickel bronze with deep flange cover for carpet infill, complete with carpet retainer vandal–proof locking screws.

.3 Provide bolted cover plates on all vertical rainwater leaders.

2.3 WATER HAMMER ARRESTORS

.1 Stainless steel bellow type or copper piston type to PDIWH201.

.2 Air chamber same size as supply line or 19 mm minimum, and minimum 450 mm long.

2.4 INTERIOR HOSE BIBBS AND SEDIMENT FAUCETS

.1 Cast brass anti-contamination faucet; exposed type, mild climate, anti-contamination wall faucet with 19 mm male hose connection and anti-siphon vacuum breaker. Exterior finish to be polished chrome plated, operating handle to be cast iron wheel handle, and inlet connection to be 19 mm F.P.T. unless specifically noted as 12 mm on drawings. Vacuum breaker to be certified to the ASSE Standard 1011 and listed by IAPMO.

.2 Specification based on Mifab Model MHY-90.

2.5 EXTERIOR HOSE BIBBS AND SEDIMENT FAUCETS

.1 A.S.S.E. 1019-B certified encased key operated non-freeze self-draining wall hydrant with A.S.S.E. 1011 approved anti-siphon and vandal resistant integral vacuum breaker and 19 mm diameter male hose connection. Length to suit wall thickness. Hydrant assembly complete with neoprene plunger to control both the flow and drain functions, hardened bronze operating stem, drain port under the hexagon nut, heavy duty brass casing, 360 degree swivel inlet connection, heavy duty chrome plated bronze head casting, polished chrome plated face plate and satin finished nickel bronze box with hinged locking cover. Operating key to be furnished with each hydrant.

.2 Specification based on Mifab Model MHY-20.

2.6 TRAP SEAL PRIMERS (Electronic)

.1 Group Trap Seal Primer:

.1 MIFAB Series MI-100-10 (6-10 outlet ports) enclosed electronic trap seal primer system with timer, ½" F.I.P. plastic ball valve, lead free bronze vacuum breaker, 1/2" solenoid valve and plastic Manifold with distribution ports. Electrical components to include single point power connection at 24VDC, manual override switch, minimum 5 amp breaker, 24 hour timer with relay and adjustable delay. All components to be factory assembled and installed into a 16 gauge satin coated steel box for recessed (standard) or surface mounted installation as indicated on drawings. The entire assembly is tested and certified to the ASSE 1044 Standard. 100 p.s.i. operating pressure.

.2 Specification based on Mifab Model MI 100.

.2 Air Gap Fitting:

.1 Copper air gap fitting complete with a 12 mm male NPT fitting at the inlet supply incorporating a stream directing nozzle, a 12 mm NPT female outlet, and a ANSI/ASME A112.1.2 air gap in plumbing systems standard.

.2 Specification based on Mifab Model MI-GAP.

2.7 VACUUM BREAKERS

.1 Breakers: To CSA-B64 Series.

2.8 STRAINERS

.1 Size 50 mm and under: Screwed brass, Y pattern with 0.7 mm stainless steel perforated screen.

.2 Size 63 mm to 100 mm: Flanged iron body with bolted cap, Y pattern with 1.2 mm stainless steel perforated screen.

.3 Size 127 mm and larger: Flanged iron body, basket pattern with 3 mm stainless steel perforated screen.

.4 Screen free area shall be minimum three times area of inlet pipe. Provide valved drain and hose connection off strainer bottom.

2.9 EYE WASH EW-1

.1 Eyewash: wall mounted recessed swing down eye/face wash with drain pan shall include stainless steel cabinet for recess mounting in finished wall. Unit shall include all welded 16 gauge type 304 stainless steel construction, chrome plated brass eye/face wash supply fittings, ½" IPS brass rotating plug-type valve with Teflon coated O-ring seals. Supplied with in-line strainer to prevent debris from affecting the valve, and 2" IPS drain. Unit shall have (2) polypropylene 'FS Plus' spray heads with integral filters and 3.2 GPM flow control orifices. Activate valve by rotating 90 degree from stored position. Unit shall include ANSI compliant sign. Unit shall be fully factory assembled and hydrostatically tested to meet or exceed ANSI Z358.1 - 2009, and come with a full 2 year warranty.

.2 Tempering System: prepackaged, fully engineered and tested system that mixes hot and cold water to supply tempered water to eyewash fixtures requiring flow up to 5 gpm. System consists of a thermostatic mixing valve, a high temperature limit valve, a bypass valve, and an outlet temperature gauge. Unit is constructed of bronze, brass, copper and stainless steel. Maximum inlet pressure: 125 psi. Maximum inlet temperature: 180 deg.F (82 deg.C). Recommended inlet temperature: 140 deg.F (60 deg.C). Pressure requirements: 50 psi to adequately supply water for eye/face wash. Inlet and Outlet: 1/2" IPS. Dielectric outlet union provided.

.3 Provide check valves on hot and cold supply risers.

.4 Design based on: Eyewash Guardian GBF1735DB, Tempering System Guardian TMV.

2.10 ROOF DRAINS

.1 Roof Drains for standard roof; Lacquered cast iron body with removable cast metal dome strainer, membrane flange and membrane clamp ring with integral gravel stop, adjustable under deck clamp, to suit roof construction.

.2 Roof drains for inverted roofing system; cast iron body with cast iron dome, under-deck clamp and sump receiver to suit roof construction, with integral gravel stop and stainless steel drainage grid

2.11 HOSE REEL HR-1

.1 Spring retractable hose reel, all steel construction with baked-on powder coat finish. Hose reel to have the following features:

- .1 Hose anti latch-out feature ensures hose retracts every time.
- .2 Guide arm is field adjustable for wall or ceiling mounting positions.
- .3 Dual pedestal base and guide arm design are structurally reinforced.
- .4 Five-in-one, heat-treated aluminium casting incorporates main shaft, ratchet, spring arbor and inlet/outlet plumbing in one-piece casting.
- .5 Containerized spring assembly to provide safe and easy handling during maintenance.
- .6 Two sealed ball bearings for smooth rotation of main shaft.

.2 Unit to be complete with 23m (75ft) of 19mm (3/4”) I.D. low pressure PVC hose rated to 65 Deg.C (150 Deg.F) at 17 Bar (250 PSI).

.3 Wall-Mounted Swing Bracket: Provide bracket matched to hose reel that shall pivot approximately 180°. All steel construction with a durable baked on powder coat finish.

.4 Unit to be complete with 19mm (3/4”) flexible inlet hose assembly to connect from hosebibb to reel inlet. Length to match site requirements, assumed to be 0.91m (3’).

.5 Unit to be complete with all required mounting accessories.

.6 Specification is based on ReelCraft Series 8000, Model D83075 OLP reel with hose, 601034-3 inlet hose, 600980 swing bracket.

3 Execution

3.1 MANUFACTURER'S INSTRUCTIONS

.1 Compliance: comply with manufacturer's written recommendations or specifications, including product technical bulletins, handling, storage and installation instructions, and data sheet.

3.2 INSTALLATION

.1 Install in accordance with Provincial Codes, and local authority having jurisdiction.

.2 Install in accordance with manufacturer's instructions and as specified.

3.3 CLEANOUTS

.1 Install cleanouts at base of soil and waste stacks, and rainwater leaders, at locations required by Code, and as indicated.

.2 Bring cleanouts to wall or finished floor unless serviceable from below floor.

.3 Building drain cleanout and stack base cleanouts: line size to maximum NPS4.

.4 Lubricate cleanout plugs with mixture of graphite and linseed oil. Prior to building turnover remove cleanout plugs, relubricate and reinstall using only enough force to ensure permanent leak proof joint.

3.4 WATER HAMMER ARRESTORS

.1 Install on branch supplies to fixtures or group of fixtures as required to eliminate water hammer.

3.5 HOSE BIBBS AND SEDIMENT FAUCETS

.1 Install at bottom of risers, at low points to drain systems, and as indicated.

.2 Install complete with isolation valve upstream of hose bibbs.

3.6 TRAP SEAL PRIMERS

.1 Install for floor drains and elsewhere, as required by Code and/or where indicated on drawings. Trap primers shall be electronic.

.2 Install on cold water supply to nearest frequently used plumbing fixture, in concealed space, to approval of Departmental Representative.

.3 Install plastic PEX tubing to floor drain.

3.7 STRAINERS

.1 Install with sufficient room to remove basket.

3.8 VACUUM BREAKERS

.1 Install vacuum breakers on plumbing lines where contamination of domestic water may occur; generally make-up lines, hose bibbs, and flush valves.

3.9 HOSE REEL

.1 Install hose reel on wall bracket to permit reel to be placed against wall with hose end facing door.

.2 Connect to hose bibb with flexible inlet hose supplied with reel. Ensure hose bibb location is suitable for length of hose purchased.

3.10 START-UP

.1 Timing: Start-up only after:
- .1 Pressure tests have been completed.
- .2 Disinfection procedures have been completed.
- .3 Certificate of static completion has been issued.
- .4 Water treatment systems operational.

.2 Provide continuous supervision during start-up.

3.11 TESTING AND ADJUSTING

.1 Timing:
- .1 After start-up deficiencies rectified.
- .2 After certificate of completion has been issued by authority having jurisdiction.

.2 Application tolerances:
- .1 Pressure at fixtures: within tolerance allowable by manufacturer.
- .2 Flow rate at fixtures: +/- 10%.

.3 Adjustments:
- .1 Verify that flow rate and pressure meet design criteria.
- .2 Make adjustments while flow rate or withdrawal is (1) maximum and (2) 25% of maximum and while pressure is (1) maximum and (2) minimum.

.4 Floor drains:
- .1 Verify operation of trap seal primer.
- .2 Prime, using trap primer. Adjust flow rate and timer to suit site conditions.
- .3 Check operations of flushing features.
- .4 Check security, accessibility, removeability of strainer.
- .5 Clean out baskets.

.5 Vacuum breakers, backflow preventers, backwater valves:
- .1 Test tightness, accessibility for O&M of cover and of valve.
- .2 Simulate reverse flow and back-pressure conditions to test operation of vacuum breakers, backflow preventers.
- .3 Verify visibility of discharge from open ports.

.6 Access doors:
- .1 Verify size and location relative to items to be accessed.

.7 Cleanouts:
- .1 Verify covers are gas-tight, secure, yet readily removable.

.8 Water hammer arrestors:
- .1 Verify proper installation of correct type of water hammer arrester.

.9 Strainers:
- .1 Clean out repeatedly until clear.
- .2 Verify accessibility of cleanout plug and basket.
- .3 Verify that cleanout plug does not leak.

.10 Hose bibbs, sediment faucets:
- .1 Verify operation of vacuum breakers.

.11 Training:
- .1 In accordance with Section 21 05 01 Common Work Results - Mechanical, Training of Operation and Maintenance Personnel, supplemented as specified.
- .2 Demonstrate full compliance with Design Criteria.

END OF SECTION

1 General

1.1 SUMMARY

.1 Section Includes:
- .1 The supply and installation of Plumbing Fixtures and Trim.

.2 Products Installed but not Supplied Under this Section:
- .1 Install rough-in for equipment supplied by others, complete with valves on hot and cold water supplies, waste and vent.
- .2 Equipment installed by others.
  - .1 Connect with unions.

1.2 REFERENCES

.1 Canadian Standards Association (CSA International).
- .1 CAN/CSA-B45 Series-02, Plumbing Fixtures.
- .2 CAN/CSA-B125-01, Plumbing Fittings.
- .3 CAN/CSA-B651-95 (R2001), Barrier-Free Design.

1.3 SUBMITTALS

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

.2 Closeout Submittals:
- .1 Submit maintenance data in accordance with Section 01 78 00 - Closeout Submittals.
- .2 Include:
  - .1 Description of fixtures and trim, giving manufacturer's name, type, model, year, capacity, material, water consumption and details of all items noted under specification..
  - .2 Details of operation, servicing, maintenance.
  - .3 List of recommended spare parts.

1.4 GENERAL REQUIREMENTS

.1 Provide new fixtures, CSA approved, free from flaws and blemishes with finished surfaces clear, smooth and bright.

.2 Provide CSA approved plumbing fittings. Visible parts of fixture brass and accessories shall be heavily chrome plated.

.3 Fixtures shall be product of one manufacturer. Fittings of same type shall be product of one manufacturer.

.4 Protect fixtures against use and damage during construction.

1.5 JOB CONDITIONS

.1 Check millwork shop drawings. Confirm location and size of fixtures and openings before rough-in and installation.

2 Products

2.1 MANUFACTURED UNITS

.1 Fixtures: manufacture in accordance with CAN/CSA-B45 series.

.2 Trim, fittings: manufacture in accordance with CAN/CSA-B125.

.3 Exposed plumbing brass to be chrome plated.

.4 Number, locations: architectural drawings to govern.

.5 Fixtures in any one location to be product of one manufacturer and of same type.

.6 Trim in any one location to be product of one manufacturer and of same type.

2.2 WATER CLOSET WC-1 (Accessible Water Closet)

.1 Handicapped close coupled floor mounted 300 mm rough-in, tank style with 4.8 LPF (1.1 GPF) siphon jet flushing action. Water closet to be capable of flushing 1000 grams of waste under bulk waste removal protocols conducted by a CSA certified laboratory. Water closet to be complete with 5 year limited warranty.

.2 Bowl/Tank: 419 mm (16-1/2") high, white, vitreous china, elongated bowl, oversized flush valve, 54 mm (2-1/4") fully glazed trapway, siphon jet, 2 bolt caps, insulated tank complete with fittings and bolt down lid on tank.

.3 Supplies and Riser Tubes: chrome plated angle supplies with lockshield stem, screwdriver stop, 9.5 mm O.D. x 305 mm long flexible braided stainless steel riser and stainless steel escutcheon plate.

.4 Seat: White, elongated, open front, moulded plastic seat with cover and self-sustaining stainless steel hinges and stainless steel insert post.

.5 Design based on the following: Bowl/Tank - American Standard Cadet 3 FloWise Right Height Elongated, Seat - Bemis 1950SS, Supplies – Delta 47T2312SD

2.3 WATER CLOSET WC-2 (Standard Water Closet)

.1 Handicapped close coupled floor mounted 300 mm rough-in, tank style with 4.8 LPF (1.1 GPF) siphon jet flushing action. Water closet to be capable of flushing 1000 grams of waste under bulk waste removal protocols conducted by a CSA certified laboratory. Water closet to be complete with 5 year limited warranty.

.2 Bowl/Tank: 419 mm (16-1/2") high, white, vitreous china, elongated bowl, oversized flush valve, 54 mm (2-1/4") fully glazed trapway, siphon jet, 2 bolt caps, insulated tank complete with fittings and bolt down lid on tank.

.3 Supplies and Riser Tubes: chrome plated angle supplies with lockshield stem, screwdriver stop, 9.5 mm O.D. x 305 mm long flexible braided stainless steel riser and stainless steel escutcheon plate.

.4 Seat: White, elongated, open front, moulded plastic seat less cover and self-sustaining stainless steel hinges and stainless steel insert post.

.5 Design based on the following: Bowl/Tank - American Standard Cadet 3 FloWise Right Height Elongated, Seat - Bemis 1955SSC, Supplies – Delta 47T2312SD

2.4 WATER CLOSET WC-3 (Lavatory toilet combination for Secure Facility)

.1 Provide and install 450 mm (18") wide Lav/Toilet Suicide Resistant Comby. Contractor to confirm angled left, central or angled right units based on plans. Provide hemispherical cabinet design to reduce the risk of fixture being used as a suicide device. Fixture shall be fabricated from 14 gauge, type 304 stainless steel. Constructions hall be seamless welded exposed surfaces shall have a satin finish. Provide D shaped lavatory bowl.

.2 Fixture shall have air controlled pneumatically operated, push button valves. Valves shall require less than 2.3 kg to activate. Valves to comply with NSF 61, section 9-1997 lead free requirements.

.3 Provide BPH hemispherical penal bubbler and hemispherical penal pushbuttons. Provide toilet bowl housing to prohibit the attachment of objects. Toilet shall be concealed blowout jet type with an elongated bowl, self-draining flushing rim, and an integral contoured seat with a sanitary high polish finish.

.4 Toilet trap shall pass a 66 mm (2-5/8") diameter ball and shall be fully enclosed. Toilet shall conform to ANSI 112.19.2M. Cabinet interior shall be sound deadened with fire resistant material. Fixture shall withstand loading of 1360 kg without permanent damage. Fixture shall be furnished with necessary fasteners for proper installation.

.5 Fixture shall be furnished with necessary fasteners for proper installation. The following options shall be provided with the units: Pinned cleanout plug, rear outlet P-trap, wall sleeve (Contractor to confirm wall depth) and 75 mm (3") waste outlet. Acceptable product: Acorn Penal-Ware 144-2-BPH-4-FV (1.6)-PC-PT-SW-W03 or Willoughby Model ECW-18060R/L-MOD.

.6 Provide a hot water tempering valve on the hot water supply line to the lavatory. Acceptable product: Symmons Model 4-10B. Note: unit shall be stamped with the manufacturer's model number on the face of the unit. Fixture to be installed with epoxy sealant between all flush mounted surfaces and the walls and/or floor.

2.5 LAVATORY L-1 (Accessible Counter Top Manual)

.1 Bowl: self-rimming countertop lavatory, 533 mm x 445 mm, vitreous china, hole drilling to match trim, rear overflow with faucet ledge, white.

.2 Trim: ADA compliant chrome plated single lever manual faucet, 0.5 GPM/1.9 LPM vandal proof spray head, 100mm centerset, cast brass lead free waterway, ceramic drip-free disc valve cartridge, 89 mm lever.

.3 Supplies and Riser Tubes: chrome plated angle supplies with lockshield stem, screwdriver stop, 9.5 mm O.D. x 305 mm long flexible braided stainless steel riser and stainless steel escutcheon plate.

.4 Tailpiece and Trap: offset open grid drain assembly with open grid strainer. Chrome plated cast brass adjustable P-trap complete with cleanout, and escutcheon.

.5 Provide anti-scald temperature mixing controls: pressure independent thermostatic mixing valve complete with integral check valves, service isolation valves, and vandal resistant temperature setting adjustments.

.6 Insulate trap and supplies with Truebro Lavguard or equivalent accessibility approved pipe insulation assembly complete with PVC jackets for supplies tailpiece and trap assembly, white.

.7 Design based on the following: Bowl - American Standard Cadet Oval Countertop, Trim – Delta 22C151, Supplies – Delta 47T2312SD, Tailpiece – Delta 33T290-1, Trap - Delta 33T311.

2.6 LAVATORY L-2 (Accessible Wall hung Lavatory)

.1 Bowl: ADA compliant wall hung lavatory drilled for concealed arm carrier, 527 mm x 464 mm, vitreous china, single hole supply, with overflow, white.

.2 Trim: ADA compliant chrome plated single lever manual faucet, 0.5 GPM/1.9 LPM vandal proof spray head, 100mm centerset, cast brass lead free waterway, ceramic drip-free disc valve cartridge, 89 mm lever.

.3 Supplies and Riser Tubes: chrome plated angle supplies with lockshield stem, screwdriver stop, 9.5 mm O.D. x 305 mm long flexible braided stainless steel riser and stainless steel escutcheon plate.

.4 Tailpiece and Trap: offset grid drain assembly with open grid stainless steel strainer. Chrome plated cast brass adjustable P-trap complete with cleanout, plug with chain and escutcheon.

.5 Insulate trap and supplies with Truebro Lavguard accessibility approved pipe insulation assembly complete with PVC jackets for supplies tailpiece and trap assembly, white.

.6 Carrier: Floor mounted lavatory support system with concealed arms for wall mounted lavatories. Unit to be complete with rectangular steel uprights with welded feet, cast iron adjustable headers, concealed arms, steel sleeves, alignment truss, and mounting fasteners. Metal to be complete with protective coating.

.7 Design is based on the following: Bowl - Kohler Greenwich Model K-2031, Trim – Delta 22C151,, Carrier: Zurn - Z1231, Supplies - Delta 47T2312SD, Tailpiece - Delta 33T290-1, Trap - Delta 33T311.

2.7 URINAL U-1

.1 Wall hung siphon jet flush valve urinal 1.9 LPF (0.5 GPF). Urinal to be complete with 5 year limited warranty.

.2 Bowl: Vitreous china, top spud siphon-jet action with integral fully glazed trapway. Bowl to have anti-microbial surface equivalent to a double coated mirror finish. Nominal Dimensions: 356 mm (14") wide x 356 mm projection x 546 mm (21-1/2") high.

.3 Flush Valve: 1.9 litre exposed chrome plated automatic hard wire operated diaphragm style flush valve with recessed wall mounted infrared sensor, sensor range adjustment, true mechanical override button, dual filtered bypass, high back pressure vacuum breaker, adjustable tailpiece, bak-chek angle stop with vandal resistant cap and cast wall flange with setscrew. Provide 102mm square electrical box for mounting sensor plate and box mount hard wired transformer to convert 120V / 1 phase to 24 VA 50 A.

.4 Carrier, epoxy coated with heavy gauge steel uprights with welded feet supports and with top and bottom universal steel hanger plates with plated hardware, heavy gauge epoxy coated steel offset uprights, plated hardware. Each carrier to support one unit. Carrier to be suitable for installation in 102 mm (4") finished metal stud wall.

.5 Design based on the following: Bowl/Valve - Sloan WEUS-1005.1401-0.5 G2, Carrier – Watts CA-321.

3. Execution

3.1 INSTALLATION

.1 Install each fixture that is to be operational with its own trap, easily removable for servicing and cleaning. At completion thoroughly clean plumbing fixtures and equipment.

.2 Provide chrome plated rigid or stainless steel flexible supplies to fixtures that are to be operational complete with screwdriver stops, reducers and escutcheons.

.3 Install wall mounted lavatories, urinals and water closets with approved wall carriers, model to suit installation.

.4 Mounting heights:
- .1 Standard: to comply with manufacturer's recommendations unless otherwise indicated or specified by architect.
- .2 Physically handicapped: to comply with most stringent of either NBCC or CAN/CSA B651.

.5 Install hose and faucets and hose connections with vacuum breakers.

3.2 PLUMBING FIXTURE ROUGH-IN SCHEDULE

.1 Rough-in fixture piping connections in accordance with the following table of minimum sizes or as required for particular fixtures:

	Hot Water	Cold Water	Waste	Vent
Lavatories	12 mm (½") (½")	12 mm (1-1/2")	38 mm (1-1/4")	32 mm
Water Closet (flush valve)	-----	32 mm (1-1/4")	75 mm (3")	51 mm (2")
Water Closet (tank)	-----	12 mm (1/2")	75 mm (3")	51 mm (2")
Urinals (flush valve)	-----	19 mm (3/4")	51 mm (2")	38 mm (1-1/2")
Hose Bibbs	19 mm (3/4")	19 mm (3/4")	-----	-----

3.3 ADJUSTING

.1 Conform to water conservation requirements specified this section.

.2 Adjustments:
- .1 Adjust water flow rate to design flow rates.
- .2
- .3 Adjust pressure to fixtures to ensure no splashing at maximum pressures.

.3 Checks:
- .1 Aerators or Laminar Flow Control: operation, cleanliness.
- .2 Vacuum breakers, backflow preventers: operation under all conditions.

.4 Thermostatic controls:
- .1 Verify temperature settings, operation of control, limit and safety controls.

1 General

1.1 SUMMARY

.1 Section Includes:
- .1 The supply and installation of Plumbing Fixtures and Trim.

.2 Products Installed but not Supplied Under this Section:
- .1 Install rough-in for equipment supplied by others, complete with valves on hot and cold water supplies, waste and vent.
- .2 Equipment installed by others.
  - .1 Connect with unions.

1.2 REFERENCES

.1 Canadian Standards Association (CSA International).
- .1 CAN/CSA-B45 Series-02, Plumbing Fixtures.
- .2 CAN/CSA-B125-01, Plumbing Fittings.
- .3 CAN/CSA-B651-95(R2001), Barrier-Free Design.

1.3 SUBMITTALS

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

.2 Closeout Submittals:
- .1 Submit maintenance data in accordance with Section 01 78 00 - Closeout Submittals.
- .2 Include:
  - .1 Description of fixtures and trim, giving manufacturer's name, type, model, year, capacity, material, water consumption and details of all items noted under specification..
  - .2 Details of operation, servicing, maintenance.
  - .3 List of recommended spare parts.

1.4 GENERAL REQUIREMENTS

.1 Provide new fixtures, CSA approved, free from flaws and blemishes with finished surfaces clear, smooth and bright.

.2 Provide CSA approved plumbing fittings. Visible parts of fixture brass and accessories shall be heavily chrome plated.

.3 Fixtures shall be product of one manufacturer. Fittings of same type shall be product of one manufacturer.

.4 Protect fixtures against use and damage during construction.

1.5 JOB CONDITIONS

.1 Check millwork shop drawings. Confirm location and size of fixtures and openings before rough-in and installation.

2 Products

2.1 MANUFACTURED UNITS

.1 Fixtures: manufacture in accordance with CAN/CSA-B45 series.

.2 Trim, fittings: manufacture in accordance with CAN/CSA-B125.

.3 Exposed plumbing brass to be chrome plated.

.4 Number, locations: architectural drawings to govern.

.5 Fixtures in any one location to be product of one manufacturer and of same type.

.6 Trim in any one location to be product of one manufacturer and of same type.

2.2 SINK SK-1 (Single Compartment)

.1 Bowl: single compartment, 18-10 stainless steel, 18 gauge, self-rimming sink 520 mm x 510 mm x 250 mm, complete with 89 mm removable drain assembly and 89 mm crumb cup strainer.

.2 Trim: heavy duty cast brass 200mm (8") center two handle sink faucet complete with 150mm (6") radius vandal resistant spout with 5.7 L/minute vandal resistant laminar flow control and limited swing. Handles to be 152mm (6") wrist blade handles.

.3 Trap: cast brass adjustable swivel pattern P-trap with cleanout.

.4 Supplies and Riser Tubes: chrome plated angle supplies with lockshield stem, screwdriver stop, 9.5 mm O.D. x 305 mm long flexible braided stainless steel riser and stainless steel escutcheon plate.

.5 Design based on the following: Bowl - Franke LBS6810P-1, Trim - Delta 26C3925-LS, Supplies – Delta 47T2312SD, Tailpiece - Delta 33T290-1, Trap - Delta 33T311.

2.3 SINK SK-2 (Exhibit Sink)

.1 Bowl: Type 304, 18-10 stainless steel, 16 gauge, 690 mm x 700 mm floor mounted single compartment sink with 225 mm backsplash and 610 mm x 610 mm x 360 mm deep basin with 89 mm (3-1/2") crumb cup waste assembly. Unit to have stainless steel tubular legs with adjustable feet.

.2 Trim: 203 mm two handle wall mount centerset complete with 150 mm radius, 264 mm high vandal resistant gooseneck swivel spout with 5.7 LPM (1.5 GPM) antimicrobial laminar flow control. ADA compliant 102 mm wrist blade handles. Unit to have integral check stops.

.3 Trap: Cast brass adjustable swivel pattern P-trap with cleanout.

.4 Supplies: chrome plated angle supplies with lockshield stem, screwdriver stop, 9.5 mm O.D. x 305 mm long flexible braided stainless steel riser and stainless steel escutcheon plate.

.5 Provide check valves on hot and cold supply risers.

.6 Design based on: Bowl - Kindred Model SL2424-1, Trim - Delta 28T6924, Supplies - Delta Model 47T2512SD.

2.4 SINK SK-3 (Secure Kitchenette)

.1 Bowl: single compartment, 18-10 stainless steel, 18 gauge, self-rimming sink 520 mm x 510 mm x 250 mm, complete with 89 mm removable drain assembly and 89 mm crumb cup strainer.

.2 Trim: heavy duty cast brass 200mm (8") center two handle sink faucet complete with 150mm (6") radius vandal resistant spout with 5.7 L/minute vandal resistant laminar flow control and limited swing. Handles to be 152mm (6") wrist blade handles.

.3 Trap: cast brass adjustable swivel pattern P-trap with cleanout.

.4 Supplies and Riser Tubes: chrome plated angle supplies with lockshield stem, screwdriver stop, 9.5 mm O.D. x 305 mm long flexible braided stainless steel riser and stainless steel escutcheon plate.

.5 Design based on the following: Bowl - Franke LBS6810P-1, Trim - Delta 26C3925-LS, Supplies – Delta 47T2312SD, Tailpiece - Delta 33T290-1, Trap - Delta 33T311.

2.5 SINK SK-4 (Breath Testing)

.1 Bowl: single compartment, 18-10 stainless steel, 18 gauge, self-rimming sink 520 mm x 510 mm x 250 mm, complete with 89 mm removable drain assembly and 89 mm crumb cup strainer.

.2 Trim: Polished chrome-plated cast brass faucet body with integral shanks, quarter turn ceramic disc cartridges and a 6-1/4" [159mm] centerline swing double bend spout. Unit is furnished with a 1.0 GPM [3.8 L] pressure compensating vandal resistant laminar flow control in base of spout (complying with ANSI A112.18.1 Standard for flow), 2-1/2" [64mm] vandal-resistant color coded metal lever handles, mounting hardware and 1/2" NPSM coupling nuts for standard lavatory risers.

.3 Trap: cast brass adjustable swivel pattern P-trap with cleanout.

.4 Supplies and Riser Tubes: chrome plated angle supplies with lockshield stem, screwdriver stop, 9.5 mm O.D. x 305 mm long flexible braided stainless steel riser and stainless steel escutcheon plate.

.5 Design based on the following: Bowl - Franke LBS6810P-1, Trim – Zurn Z812Y1 with G67694-FC-22F spout, Supplies – Delta 47T2312SD, Tailpiece - Delta 33T290-1, Trap - Delta 33T311.

2.6 MOP SINK MS-1 (Floor Mount Mop Sink)

.1 Bowl: 610 mm x 610 mm x 254 mm deep white moulded stone, floor mounted sink with 24 mm wide shoulders, SS strainer, complete with 76 mm brass drain assembly.

.2 Trim: Exposed wall type supply with cross handles, spout adjustable wall brace, vacuum breaker, pail hook and 3/4" hose thread on spout. Unit to be complete with hose and hose bracket, strainers, eccentric adjustable inlets, integral screwdriver stops with covering caps and adjustable threaded wall flanges. Provide 760 mm of 12 mm diameter

plain end reinforced hose, hose clamp and mop hanger. Provide stainless steel bumper guards.

.3 Provide and install check valves on hot and cold supply risers.

.4 Design is based on the following: Bowl - Fiat MSB2424, Spout: Fiat 830-AA, Hose and Bracket - Fiat 832AA, Mop Hangar - Fiat 889-CC, Bumper Guards - Fiat E-88-AA.

3 Execution

3.1 INSTALLATION

.1 Install each fixture that is to be operational with its own trap, easily removable for servicing and cleaning. At completion thoroughly clean plumbing fixtures and equipment.

.2 Provide chrome plated rigid or stainless steel flexible supplies to fixtures that are to be operational complete with screwdriver stops, reducers and escutcheons.

.3 Install wall mounted lavatories, urinals and water closets with approved wall carriers, model to suit installation.

.4 Mount fixtures above finished floor as noted on Architectural drawings.

.5 Install hose and faucets and hose connections with vacuum breakers.

.6 Mounting heights:

.1 Standard: to comply with manufacturer's recommendations unless otherwise indicated or specified by architect.

.2 Physically handicapped: to comply with most stringent of either NBCC or CAN/CSA B651.

3.2 PLUMBING FIXTURE ROUGH-IN SCHEDULE

.1 Rough-in fixture piping connections in accordance with the following table of minimum sizes or as required for particular fixtures:

	Hot Water	Cold Water	Waste	Vent
Sink	12 mm (½")	12 mm (½")	38 mm (1-1/2")	32 mm (1-1/4")
Mop Sink	19 mm (3/4")	19 mm (3/4")	50 mm (2")	38 mm (1-1/2")

3.3 ADJUSTING

.1 Conform to water conservation requirements specified this section.

.2 Adjustments:

.1 Adjust water flow rate to design flow rates.

.2 Adjust pressure to fixtures to ensure no splashing at maximum pressures.

.3 Checks:

.1 Aerators or laminar flow control: operation, cleanliness.

.2 Vacuum breakers, backflow preventers: operation under all conditions.

.4 Thermostatic controls:

.1 Verify temperature settings, operation of control, limit and safety controls.

END OF SECTION

1 General

1.1 SUMMARY

.1 Section Includes:
- .1 The supply and installation of Plumbing Fixtures and Trim.

.2 Products Installed but not Supplied Under this Section:
- .1 Install rough-in for equipment supplied by others, complete with valves on hot and cold water supplies, waste and vent.
- .2 Equipment installed by others.
  - .1 Connect with unions.

1.2 REFERENCES

.1 Canadian Standards Association (CSA International).
- .1 CAN/CSA-B45 Series-02, Plumbing Fixtures.
- .2 CAN/CSA-B125-01, Plumbing Fittings.
- .3 CAN/CSA-B651-95(R2001), Barrier-Free Design.

1.3 SUBMITTALS

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

.2 Closeout Submittals:
- .1 Submit maintenance data in accordance with Section 01 78 00 - Closeout Submittals.
- .2 Include:
  - .1 Description of fixtures and trim, giving manufacturer's name, type, model, year, capacity, material, water consumption and details of all items noted under specification..
  - .2 Details of operation, servicing, maintenance.
  - .3 List of recommended spare parts.

1.4 GENERAL REQUIREMENTS

.1 Provide new fixtures, CSA approved, free from flaws and blemishes with finished surfaces clear, smooth and bright.

.2 Provide CSA approved plumbing fittings. Visible parts of fixture brass and accessories shall be heavily chrome plated.

.3 Fixtures shall be product of one manufacturer. Fittings of same type shall be product of one manufacturer.

.4 Protect fixtures against use and damage during construction.

1.5 JOB CONDITIONS

.1 Check millwork shop drawings. Confirm location and size of fixtures and openings before rough-in and installation.

2 Products

2.1 MANUFACTURED UNITS

.1 Fixtures: manufacture in accordance with CAN/CSA-B45 series.

.2 Trim, fittings: manufacture in accordance with CAN/CSA-B125.

.3 Exposed plumbing brass to be chrome plated.

.4 Number, locations: architectural drawings to govern.

.5 Fixtures in any one location to be product of one manufacturer and of same type.

.6 Trim in any one location to be product of one manufacturer and of same type.

2.2 SHOWER SH-1 (Standard Shower)

.1 Cabinet: Acrylic finish reinforced fibreglass shower, one piece seamless unit with smooth rounded corners, 3-1/4' low profile, standard grab bar with integrated shelves. Complete with centre drain and textured floor. Shower shall not exceed 914 mm x 914 mm and a height of 2006mm. Colour - White.

.2 Trim: Concealed in-wall single lever pressure balancing mixing valve control, polished chrome plated metal trim, integral stops and checks, and vandal resistant metal lever handle; combination integral diverter and volume control and adjustable stop screw to limit handle turn. Wall-mounted shower head with arm and flange, and polished chrome plated finish. Wall/hand shower with flexible metal hose, in-line vacuum breaker, wall connection and flange, 30" slide bar for hand shower mounting. Volume control - 7.6 LPM flow control. Unit to be vandal resistant. Trim to have 5-year warranty in commercial installation.

.3 Design based on: Cabinet – MAAX Allia SH-3636, Trim - Symmons - Temptrol 96-500-B30-L-V-2.0-X-CHKS-VP

2.3 SHOWER SH-2 (Security Shower)

.1 Cabinet: Refer to Architectural.

.2 Shower Trim:

.1 Shower system shall be complete with shower head, push button actuator and remote valve installed in service space above shower room.

.2 Shower panels shall be fabricated from 14 gauge, type 304 stainless steel and shall have a satin finish. Trim shall be stainless steel or chrome-plated brass. Shower valve shall be Air-Control, metering, nonhold open type. Fixture shall be furnished with necessary fasteners for proper installation.

.3 Shower is arranged to be installed on finished wall. Back of shower is provided with anchor tappings. Fixture is fabricated from 14 gauge, type 304 stainless steel with a satin finish.

.4 Shower Head - chrome plated brass and vandal-resistant. The nozzle is threaded into the body and then locked into place by a set screw from the rear. The spray pattern can only be changed by use of an allen wrench inserted through the nozzle. Unit shall have penal locakable up/down ball joint

.5 Valve - pneumatically operated, pushbutton Air-Control valve using atmospheric air. Hemispherical pushbutton is vandal-resistant and requires less than 5 pounds to activate valve. Valve is metering, non-hold open type. Valve timing is adjustable from 5 to 60 seconds. Valve to be single temperature with 1.6 GPM flow control and can be remotely located up to 10 feet from the operating pushbutton. Valve conforms with lead free requirements of NSF61, Section 9, 1997.

.6 Provide and install the remote electronic modular valve controller system using low voltage, 24 VAC power. Unit to be complete with transformer for 120 VAC to 24 VDC. Provide a solenoid valve made with non-corrosive wet parts. Stainless steel fixture pushbutton shall be vandal resistant and shall pneumatically actuate the Modular Valve Controller, with no electrical impulse at the pushbutton. Valve timing/lockout cycle shall have 10 preset intervals ranging from 1 second to 9 minutes, easily adjustable with a knob. Modular Valve Controller shall have colored lights to indicate system is functioning and permit easy trouble shooting.

.3 Design based on: Shower Panel – Acorn Penal-Ware 1743-MVC2-F1.6-MT-SW-PZZ-PBH

3. Execution

3.1 INSTALLATION

.1 Install each fixture that is to be operational with its own trap, easily removable for servicing and cleaning. At completion thoroughly clean plumbing fixtures and equipment.

.2 Provide chrome plated rigid or stainless steel flexible supplies to fixtures that are to be operational complete with screwdriver stops, reducers and escutcheons.

.3 Mounting heights:
- .1 Standard: to comply with manufacturer's recommendations unless otherwise indicated or specified by architect.
- .2 Physically handicapped: to comply with most stringent of either NBCC or CAN/CSA B651.

3.2 PLUMBING FIXTURE ROUGH-IN SCHEDULE

.1 Rough-in fixture piping connections in accordance with the following table of minimum sizes or as required for particular fixtures:

	Hot Water	Cold Water	Waste	Vent
Shower	12 mm (½")	12 mm (½") (2")	50 mm (1-1/4")	38 mm

3.3 ADJUSTING

.1 Conform to water conservation requirements specified this section.

.2 Adjustments:
- .1 Adjust water flow rate to design flow rates.
- .2 Adjust pressure to fixtures to ensure no splashing at maximum pressures.

.3 Checks:
- .1 Aerators or Laminar Flow Control: operation, cleanliness.
- .2 Vacuum breakers, backflow preventers: operation under all conditions.

.4 Thermostatic controls:
- .1 Verify temperature settings, operation of control, limit and safety controls.

END OF SECTION

1 General

1.1 SECTION INCLUDES

.1 Domestic Booster Variable Speed Pumping Package
.2 Pump Control Panel
.3 Variable Frequency Drive
.4 Sensor Transmitters
.5 Sequence of Operation

1.2 REFERENCES

.1 ASHRAE 90A - Energy Conservation in New Building Design.
.2 AWWA - American Water Works Association
.3 ANSI - American National Standards Institute
.4 ASTM - American Standards for Testing Materials
.5 HI - Hydraulic Institute
.6 ASME - American Society of Mechanical Engineers
.7 UL - Underwriters Laboratories
.8 ISO - International Standards Organization
.9 NEMA - National Electrical Manufacturers Association
.10 ETL - Electrical Testing Laboratories
.11 CSA - Canadian Standards Association
.12 NEC - National Electrical Code
.13 IEC - International Electrotechnical Commission
.14 NSF - NSF International

1.3 SUBMITTALS FOR REVIEW

.1 Section 01 33 00: Submission procedures.

.2 Product Data:
- .1 System profile analysis including variable speed pump curves and system curve. The analysis shall also include pump, motor, job specific load profile, staging points and VFD efficiencies horsepower and kilowatt/hour consumption.
- .2 Provide certified pump curves showing pump performance characteristics with pump and system operating point plotted. Include NPSH curve when applicable.
- .3 Provide electrical characteristics and connection requirements.

.3 Shop Drawings:
- .1 Indicating dimensions, required clearances and location and size of each field connection.
- .2 Power and control wiring diagrams.

1.4 SUBMITTALS FOR INFORMATION

.1 Section 01 33 00: Submission procedures.

1.5 CLOSEOUT SUBMITTALS

.1 Section 01 78 00: Submission procedures.

.2 Record Documentation: Record actual locations of components.

.3 Operation and Maintenance Data: Include operation, maintenance, and inspection data, replacement part numbers and availability, and service depot location and telephone number.

.4 Warranty Documentation: Submit manufacturer warranty and ensure forms have been completed in Owner's name and registered with manufacturer.

1.6 QUALITY ASSURANCE

.1 Products of This Section: Manufactured to ISO 9000 certification requirements.

.2 Manufacturer Qualifications: Company specializing in manufacturing the Products specified in this section with minimum 10 years documented experience.

.3 The pumping package shall be assembled by the pump manufacturer. An assembler of pumping systems not actively engaged in the design and construction of centrifugal pumps shall not be considered a pump manufacturer. The manufacturer shall assume "Unit Responsibility" for the complete pumping package. Unit responsibility shall be defined as responsibility for interface and successful operation of all system components supplied by the pumping system manufacturer.

.4 All functions of the variable speed pump control system shall be tested at the factory prior to shipment

.5 Ensure pumps operate at specified system fluid temperatures without vapour binding and cavitation, are non-overloading in parallel or individual operation, operate within 25 percent of midpoint of published maximum efficiency curve.

.6 The pumping package shall be certified by an approved independent testing and certification organization as being compliant with the requirements of NSF/ANSI 61 for potable drinking water and NSF-61 Annex G for low lead content.

.7 Manufacturer shall be listed by UL as a manufacturer of packaged pumping systems under UL/cUL category QCZJ.

.8 Manufacturer shall be listed by UL as a manufacturer of control panels under UL 508A.

.9 The manufacturer's production facility shall be certified by an approved independent testing and certification organization as being compliant with the requirements of NSF/ANSI 61 and NSF-61 Annex G. The manufacturing facility shall be subjected to periodic inspections and audits.

1.6 DELIVERY, STORAGE, AND PROTECTION

.1 Section 01 61 00: Transport, handle, store, and protect products in strict accordance with manufacturer's requirements.

.2 Provide temporary inlet and outlet caps. Maintain caps in place until installation.

1.7 WARRANTY

.1 Section 01 78 00: Warranties.

2 Products

2.1 MANUFACTURED UNITS

.1 Furnish and install as shown on the plans a Variable Speed System, refer to Equipment Schedule for performance. Suction and discharge headers shall be 6.0 in and constructed of 304 series stainless steel.

.2 Manufacturer shall be listed by Underwriters Laboratories as a manufacturer of packaged pumping systems.

.3 The entire pumping package shall be NSF/ANSI/NSF-61 certified for potable drinking water and NSF-61 Annex G for a wetted area, weighted average lead content =0.25%.

.4 The control system shall include, as a minimum, the programmable logic station controller, variable frequency drives, a manifold mounted 4-20mA pressure transducer and any additional equipment as specified or as required to properly execute the sequence of operation.

.5 System shall require only suction, discharge and drain connections and single point power connections with service entrance disconnect functionality.

.6 All components shall be mounted and shipped as a single unit.

.7 The discharge of each pump shall be fitted with a control valve appropriate for station operation. Each pump and discharge valve assembly shall also be equipped with isolation valves so that the pump can be serviced while system is still filled.

.8 Pressure gauges shall be installed on the suction and discharge headers.

.9 Piping shall be sized so that water velocity shall not exceed 10.0 ft/sec in either the branches or manifolds.

.10 Pumps shall be protected from thermal accumulation via individual thermal relief mechanisms.

2.2 VARIABLE SPEED PUMP LOGIC CONTROLLER

.1 Design is based on The Technologic 1500 pump logic controller

.2 Controller shall be listed by and bear the label of Underwriter's Laboratory, Inc. (UL/cUL). The controller shall be specifically designed for packaged pressure booster applications.

.3 The pump logic controller shall be microcomputer based and hold its software in non-volatile memory. On-line field modified data entries, such as stage point, alternation, serial communication, and sensor setup, as a minimum, shall be stored in flash memory with capability to prevent accidental loss of data due to voltage surge or spike. In the event of a complete power outage, all factory preset or last saved data values remain stored and available for recall by the operator.

.4 The variable speed pump controller shall function to a proven program that safeguards the pumps/system against damaging hydraulic conditions including:

- .1 Motor Overload
- .2 Pump Flow Surges
- .3 Hunting
- .4 Integral Curve Limiting Feature: The pump logic controller shall automatically protect the system from overload through frequency/current optimization.
- .5 End of Curve Protection: The pump logic controller through a factory pre-programmed algorithm shall be capable of protecting the pumps from hydraulic damage due to operation beyond their published end-of-curve. This feature requires an optional flow meter for activation.

.5 The pump logic controller shall be capable of accepting individual analog inputs from zone sensor/transmitters as indicated on the plans. Analog input resolution shall be 12-bit minimum, and the controller shall scan each analog input a minimum of once every 100 milliseconds. Use of a multiplexer for multiple sensor inputs is not acceptable. All sensor/transmitter inputs shall be individually wired to the pump logic controller for

continuous scan and comparison function. All analog inputs shall be provided with current limit circuitry to provide short circuit protection and safeguard against incorrect wiring of sensors.

.6 Hydraulic stabilization program shall utilize a proportional-integral-derivative control function. The proportional, integral and derivative values shall be user-adjustable over an infinite range. The scan and compare rate that selects the command set point and process variable signal shall be continuous and automatically set for optimum performance. Each sensor shall be scanned at least once every 100 milliseconds.

.7 The pump logic controller shall be self-prompting. All messages shall be displayed in plain English. The following features shall be provided: Multi-fault memory and recall On-screen help functions LED pilot lights and switches Soft-touch membrane keypad switches.

.8 The variable speed pumping controller shall be provided with a user friendly operator interface complete with membrane switches and numeric keypad. Display shall be no less than four lines with each line capable of displaying up to twenty characters. The human interface panel shall display the following values:

.1 Pump On/Off Status
.2 Pump % Speed
.3 Individual Alarm Conditions
.4 Troubleshooting Diagnostics
.5 User-adjustable parameters such as alternation, PID, set points, etc.

.9 The system shall utilize the QuickStart feature to simplify programming and startup of the pump control system. The feature shall be specific to pump systems and use suitable pump terminology.

.10 A data-logging feature shall be provided as a function of the pump logic controller. The Alarm log shall include the last 40 alarms with date/time stamp. The Pump data log shall display individual pump run timers and pump cycle counters. A Signal log shall be provided to display the maximum and minimum values with date/time stamps for each process variable.

.11 The Logic controller shall incorporate a Flash Memory for saving and reloading customized settings. These field determined values shall be permanently retained in Flash memory for automatic reloading of the site specific setup values in the event of data corruption due to external disturbances. The Controller shall also employ a sensor setup copy feature.

.12 The pump controller shall be capable of communicating with the Energy Management Control System (EMCS) by both hard-wired and serial communications. The following communication features shall be provided to the BAS in hardwired form via 4-20ma analog output signals and digital input/outputs:

.1 Remote system start/stop (dry contact supplied by EMCS).
.2 General Alarm (qty. 1, relay output from pump controller).
.3 Process variable or VFD speed (qty. 1 4-20ma analog output supplied by pump controller).
.4 System on/off status (qty. 1 relay output supplied by pump controller)

.13 The following communication features shall be provided to the EMCS via an onboard RS-485 port utilizing a protocol compatible with the winning EMCS contractor (either LonWorks or Ethernet):

.1 All sensor process variables
.2 Individual zone setpoints
.3 Individual pump failure
.4 Individual pump on/off status
.5 Individual VFD on/off status

.6 VFD speed
.7 Individual VFD Failure
.8 Individual sensor failure

.14 Enclosure shall be NEMA 1 with NEMA 4 operator interface.

2.3 VARIABLE FREQUENCY DRIVE

.1 The Drive shall be rated to operate from 3-phase power as indicated in Equipment Schedule, +10%/-15%, 48Hz to 63Hz. The drive shall employ a full wave rectifier to prevent input line notching and operate at a fundamental (displacement) input power factor of 0.98 at all speeds and nominal load. The drive efficiency shall be 98% or better at full speed and load. An internally mounted AC line reactor or DC choke shall be provided to reduce input current harmonic content, provide protection from power line transients such as utility power factor correction capacitor switching transients and reduce RFI emissions. When a DC choke is utilized it shall be of swinging choke design to mitigate harmonics substantially more than conventional choke designs and shall provide equivalent to 5% impedance. Refer to Section 23 05 14 Variable Frequency Drives.

.2 The VFD, including all factory-installed options, shall have UL and cUL approval.

.3 Enclosure shall be NEMA 1 ventilated for installation as a wall mounted or freestanding unit, depending on the amp rating. Drive shall be equipped with an integrated fusible disconnect switch, pad lockable in the open position for safety during maintenance, and fuses to protect against ground faults.

.4 VFD shall utilize a full wave rectifier to convert three phase AC to a fixed DC voltage. Power factor shall remain above 0.98 regardless of speed or load. VFD's employing power factor correction capacitors shall not be acceptable.

.5 An internal line reactor (5% impedance) shall be provided to lower harmonic distortion of the power line and to increase the fundamental power factor.

.6 The VFD shall be suitable for elevations to 3300. ft above sea level without derating. Maximum operating ambient temperature rating shall not be less than 104 deg F. VFD shall be suitable for operation in environments up to 95% non-condensing humidity.

.7 The VFD shall be capable of displaying the following information in plain English via an alphanumeric display:
.1 Output Frequency
.2 Output Voltage
.3 Motor Current
.4 Kilowatts per hour
.5 Fault identification with text
.6 Percent torque
.7 Percent power
.8 RPM

.8 The VFD shall have the ability to automatically restart after an over-current, overvoltage, under- voltage, or loss of input signal protective trip. The number of restart attempts, trial time, and time between reset attempts shall be programmable.

.9 Three (3) programmable critical frequency lockout ranges to prevent the VFD from operating the load continuously at an unstable speed.

.10 Operator Control Panel (Keypad)

.1 Each VFD shall be equipped with a front mounted operator control panel (keypad) consisting of a backlit, alphanumeric, graphic display and a keypad with keys for Start/Stop, Local/Remote, Up/Down and Help. Two (2) Softkeys will be provided which change functionality depending upon the position within the parameter hierarchy or state of panel.

.2 All parameter names, fault messages, warnings and other information shall be displayed in complete English words or Standard English abbreviations to allow the user to understand what is being displayed without the use of a manual or cross-reference table.

.3 The Display shall have contrast adjustment provisions to optimize viewing at any angle.

.4 The control panel shall provide a real time clock for time stamping events and fault conditions.

.5 The control panel shall include a feature for uploading parameter settings to control panel memory and downloading from the control panel to the same Drive or to another Drive.

.6 All Drives throughout the entire power range shall have the same customer interface, including digital display, and keypad, regardless of horsepower rating.

.7 The keypad shall be able to be installed or removed from the drive while it is powered, capable of remote mounting, and shall have its own non-volatile memory.

.11 Protective Functions

.1 For each programmed warning and fault protection function, the Drive shall display a message in complete English words or Standard English abbreviations. The three (3) most recent fault messages along with time, current, speed, voltage, frequency and DI Status shall be stored in the Drive's fault history. The last ten (10) fault names shall be stored in Drive memory.

.2 The Drive shall include internal MOV's for phase to phase and phase to ground line voltage transient protection.

.3 Output short circuit withstand rating and ground fault protection rated for 100,000 AIC shall be provided per UL508C without relying on line fuses. Motor phase loss protection shall be provided.

.4 The Drive shall provide electronic motor overload protection qualified per UL508C.

.5 Protection shall be provided for AC line or DC bus overvoltage at 130% of maximum rated or under voltage at 65% of min. rated and input phase loss.

.6 A power loss ride through feature will allow the Drive to remain fully operational after losing power as long as kinetic energy can be recovered from the rotating mass of the motor and load.

.7 Output short circuit withstand rating and ground fault protection rated for 100,000 AIC shall be provided per UL508C without relying on line fuses. Motor phase loss protection shall be provided.

.8 The Drive shall provide electronic motor overload protection qualified per UL508C.

.9 Protection shall be provided for AC line or DC bus overvoltage at 130% of maximum rated or under-voltage at 65% of min. rated and input phase loss.

.10 A power loss ride through feature will allow the Drive to remain fully operational after losing power as long as kinetic energy can be recovered from the rotating mass of the motor and load.

.12 Electrical

.1 Pump Logic Controller Enclosure. Main station disconnect shall have a through door operator and shall be sized as shown in the technical data sheet. Individual integrated fusible drive disconnects shall have exterior operators, and shall be sized as shown in the technical data sheet. Station disconnect panel shall be housed in a NEMA 1 enclosure with integral latches. The control enclosure shall be constructed of 14-gauge steel and the back plate assembly

shall be constructed of 14-gauge steel.

.2 Controls and Enclosure. The control panel with controls shall be built in accordance with NEC, and shall comply with UL standards. Pump station manufacturer shall be authorized under UL508A to manufacture its own control panels. All equipment and wiring shall be mounted within the enclosure and each device shall be labeled with proper identification. All adjustments and maintenance shall be accessible from the front of the control enclosure. A complete wiring circuit diagram and legend with terminals, components, and wiring completely identified shall be provided. Main disconnect shall be interlocked with door.

.13 Sensor / Transmitters

.1 Pressure transducer shall be utilized for providing all pressure signals for the pump control logic. Pressure transducer shall be a solid-state bonded strain gage type with an accuracy of < ±0.5% BFSL and constructed of 316 stainless steel. Transducer shall be rated for a pressure of 300 psi and shall provide gauge pressure output, rather than an absolute. Pressure transducer constructed of plastic is not acceptable. Pressure transducer shall be 4-20mA analog type with 10-28 VDC supply range and utilize a packard type connector to prevent moisture intrusion.

.14 Variable Speed System Sequence of Operation

.1 The system shall consist of a pump logic controller with multi-pump parallel operation control, duty-standby pump selection, automatic alternation and automatic transfer to the standby pump upon pump/VFD failure.

.2 The pumping system shall start upon the closure of customer's contact when the pump logic controller Mode of Operation is in REMOTE.

.3 When the pump logic controller mode in LOCAL, the pumping system shall operate automatically.

.4 Each sensor/transmitter shall send a 4-20mA signal to the pump logic controller, indicative of process variable condition.

.5 When the set point is satisfied by the process variable, the pump speed shall remain constant at the optimum energy consumption level.

.6 The pump controller shall automatically start the lag pumps as necessary to satisfy system demand.

.7 As demand is satisfied, the controller shall automatically stop lag pumps as necessary to conserve energy.

.8 In the event of a pump failure or a VFD fault, the pump logic controller automatically initiates a timed sequence of operation to start the redundant pump/VFD set in the variable speed mode.

.9 In the event of the failure of a zone sensor/transmitter, its process variable signal shall be removed from the scan/compare program. The redundant zone sensor/transmitters, if available, shall remain in the scan/compare program for control.

.10 PUMP or VFD fault shall be continuously scrolled through the display on the operator interface of the pump logic controller until the fault has been corrected and the controller has been manually reset.

.11 When the system is satisfied, the pump controller shall shut down the single running lead pump and enter energy saving / no flow shutdown mode.

2.4 STATION FRAME

.1 The pump station frame shall be designed and fabricated to provide structural support for all attached equipment, and provide anchor bolt support. The base shall supply sufficient rigidity to withstand the stresses of reasonable and competent transportation to site, off loading, installation, and operation.

2.5 PIPING

.1 All piping shall be constructed from 304 stainless steel, schedule 10 or heavier pipe as required to maintain a 3 to 1 pressure safety factor (including 0.062 in corrosion allowance).

2.6 ISOLATION VALVES

.1 Ball Valves
- .1 Isolation ball valves shall be certified to NSF-61 for use with potable drinking water.
- .2 Isolation ball valves shall be certified as low lead having wetted surface area with a weighted average lead content<0.25%.
- .3 Valves shall be rated for 600.0 psi g WOG / 150.0 psi g WSP for valves 0.25 in to 2.0 in and 400.0 psi g WOG / 125.0 psi g WSP for valves 2.5 in to 4.0 in.
- .4 Seats and stem packing shall be virgin PTFE. Stem shall be bottom loaded blowout proof design with fluorocarbon elastomer O-ring to prevent stem leaks.
- .5 Valves shall be 2-piece full port design.

.2 Grooved Butterfly Valves
- .1 Valves shall be certified to NSF-61 for use with potable drinking water.
- .2 Valve bodies shall be investment cast C8FM to ASTM A743 with integral neck and ISO mounting top.
- .3 Valve handle shall be a 304 stainless steel.
- .4 The disc shall be a dual-seal type, encapsulated either with Gr. E EPDM for cold and hot water services.
- .5 Valves shall be rated for 300.0 psi g CWP

.3 Lug Style Butterfly Valve
- .1 Valve shall be certified to NSF-61 for use with potable drinking water.
- .2 Valve body shall be made of ASTM 536 ductile iron and will be coated with an FDA approved epoxy. Valve face to face dimensions shall comply with API 609 and MSS-SP-67.
- .3 Disc shall be made of ASTM A-351 stainless steel. Shaft shall be made of 316SS.
- .4 Bushing shall be made of a Teflon®-Darcon inner liner bonded to fiberglass-epoxy resin outer shell.
- .5 Seat shall be EPDM.
- .6 Valve shall be rated to 200.0 psi g WOG.

2.7 CHECK VALVES

.1 Threaded Check Valves
- .1 All valve metallic components shall be 316SS.
- .2 Seat shall be Viton.
- .3 Valve shall be rated for 400.0 psi g WOG.

.2 Wafer Check Valves
- .1 The valve body shall be constructed of ASTM A126 Class B cast iron for Class 125/150 and Class 250/300 valves.
- .2 The seat and disc shall be ASTM B584 Alloy C83600 cast bronze or ASTM B148 Alloy C95200 aluminum bronze.
- .3 The compression spring shall be ASTM A313 Type 316 Stainless Steel with ground ends.
- .4 Valve interiors and exteriors shall be coated with an NSF/ANSI-61 certified fusion bonded epoxy in accordance with AWWA C550.
- .5 The exterior of the valve shall be coated with a universal alkyd primer.

.6 The valve design shall incorporate a center guided, spring loaded disc, guided at opposite ends and having a short linear stroke that generates a flow area equal to the nominal valve size.

.7 The operation of the valve shall not be affected by the position of installation. The valve shall be capable of operating in the horizontal or vertical positions with the flow up or down.

.8 All component parts shall be field replaceable without the need of special tools. A replaceable guide bushing shall be provided and held in position by the spring. The spring shall be designed to withstand 100,000 cycles without failure and provide a cracking pressure of 0.5 psi g.

.9 The valve disc shall be concave to the flow direction providing for disc stabilization, maximum strength, and a minimum flow velocity to open the valve.

.10 The valve disc and seat shall have a seating surface finish of 16 micro-inch or better to ensure positive seating at all pressures. The leakage rate shall not exceed the allowable rate for metal seated valves allowed by AWWA Standard C508 or 1 oz (30 ml) per hour per inch (mm) of valve diameter.

.11 The valve flow way shall be contoured and unrestricted to provide full flow areas at all locations within the valve. Cv flow coefficients shall be equal to or greater than specified below and verified by an independent testing laboratory.

Valve Size	Wafer Style Cv
50 (2")	43
65 (2.5")	88
75 (3")	130
100 (4")	228
150 (6")	350

.12 The valves shall be hydrostatically tested at 1.5 times their rated cold working pressure and seat tested at the valve CWP.

2.8 PRESSURE GAUGES

.1 Gauges shall be provided for the suction and discharge manifold.

.2 Accuracy shall be ±1.5%

.3 Bourdon tube and connection shall be constructed of 316SS.

.4 Case, bezel and internals shall be constructed of 316SS.

.5 Gauge shall be filled with glycerin in order to dampen pulsation and vibration and to provide lubrication to the internal parts.

.6 Gauge range shall be selected to cover the largest operating range for the specific conditions and pump selected.

2.9 FLANGE BOLTS

.1 Bolts shall be zinc plated and shall meet ASTM Grade A193 B7.

2.10 FINISH

.1 The finish coat shall be acrylic enamel to a thickness of no less than 3 mils.

3 Execution

3.1 INSTALLATION

.1 Install equipment in accordance with manufacturer's instructions.

.2 The Contractor shall align the pump and motor shafts to within the manufacturer's recommended tolerances prior to system start-up.

.3 Power wiring, as required, shall be the responsibility of the electrical contractor. All wiring shall be performed per manufacturer's instructions and applicable state, federal and local codes.

.4 Control wiring for remote mounted switches and sensor / transmitters shall be the responsibility of the controls contractor. All wiring shall be performed per manufacturer's instructions and applicable state, federal and local codes.

.5 Pumps:

.1 Provide air cock and drain connection on horizontal pump casings.

.2 Support piping adjacent to pump such that no weight is carried on pump casings.

.3 Ensure pumps operate at specified system fluid temperatures without vapour binding and cavitation, are non-overloading in parallel or individual operation, and operate within 25 percent of midpoint of published maximum efficiency curve.

3.2 DEMONSTRATION

.1 The system manufacturer or factory trained representative shall provide start-up of the packaged pumping system. This start-up shall include verification of proper installation, system initiation, adjustment and fine tuning. Start-up shall not be considered complete until the sequence of operation, including all alarms, has been sufficiently demonstrated to the owner or owner's designated representative. This job site visit shall occur only after all hook-ups, tie-ins, and terminations have been completed and signed-off on the manufacturer's start-up request form.

.2 The system manufacturer or factory trained representative shall provide on-site training for owner's personnel. This training shall fully cover maintenance and operation of all system components.

.3 The system manufacturer must have a complete pressure booster training program available for owner's personnel. The training sessions shall take place at the manufacturer's facility and cover all aspects of pressure booster system design, service and operation.

3.2 START-UP SERVICE

.1 When discharge piping, electrical connections, and electrical inspection have been completed, the pump station representative shall be contacted for start up. A minimum two-week notice shall be given to manufacturer representative prior to scheduled start up date. During start up, the complete pumping system shall be given a running test of normal start and stop, and fully loaded operating conditions. During this test, each pump shall demonstrate its ability to operate without undue vibration, or overheating, and shall demonstrate its general fitness for service. All defects shall be corrected and adjustments shall be made to the pumping station for satisfactory operation. System problems or concerns will be corrected by the general contractor or site station staff, in conjunction with the appropriate factory representative. Testing shall be repeated until satisfactory results are obtained, as determined by the engineer. Start up assistance will be provided by the factory representative as required to complete start-up and commissioning.

1 General

1.1 SUMMARY

.1 Section Includes:
- .1 Use of mechanical systems during construction.

1.2 USE OF SYSTEMS

.1 Use of new permanent heating and ventilating systems for supplying temporary heat or ventilation is permitted only under following conditions and with the express written permission of Departmental Representative:
- .1 Entire system is complete, pressure tested, cleaned, flushed out.
- .2 Specified water treatment system has been commissioned, water treatment is being continuously monitored.
- .3 Building has been closed in, areas to be heated/ventilated are clean and will not thereafter be subjected to dust-producing processes.
- .4 There is no possibility of damage.
- .5 Supply ventilation systems are protected by 80% filters, inspected daily, changed every week or more frequently as required.
- .6 Return systems have approved filters over openings, inlets, outlets.
- .7 Systems will be:
  - .1 Operated as per manufacturer's recommendations and instructions.
  - .2 Operated by Contractor.
  - .3 Monitored continuously by Contractor.
- .8 Warranties and guarantees are not relaxed.
- .9 Regular preventive and other manufacturers recommended maintenance routines are performed by Contractor at own expense and under supervision of Departmental Representative.
- .10 Refurbish entire system before static completion; clean internally and externally, restore to "as- new" condition, replace filters in air systems.

.2 Filters specified in this Section are over and above those specified in other Sections of this project.

.3 Exhaust systems are not included in approvals for temporary heating ventilation.

.4 Contractor shall not assume at time of bidding that permission will be given to use permanent heating and/or ventilation systems.

2 Products

2.1 NOT USED

.1 Not Used.

3 Execution

3.1 NOT USED

.1 Not Used.

END OF SECTION

1 General

1.1 REFERENCES

.1 Canadian General Standards Board (CGSB)
  .1 CAN/CGSB-1.181-99, Ready-Mixed Organic Zinc-Rich Coating.

1.2 REGULATORY REQUIREMENTS

.1 Conform to ASME B31.9 - Building Services Piping.

.2 Contractor to supply shop drawings for all grooved end components. Do piping system work including hangers in accordance with ANSI B31.1. Install all grooved end components as per manufacturer's latest recommendations. All grooved joint couplings, fittings, valves and specialties shall be the products of a single manufacturer. Grooving tools shall be of the same manufacturer as the grooved components.

.3 All castings used for coupling housings, fittings, valve bodies, etc., shall be date stamped for quality assurance and traceability.

1.3 WELDING

.1 Welding materials and labour must conform to ASME Code and the Provincial Board of Labour Regulations.

.2 Use welders fully qualified and licensed by Provincial Authorities.

1.4 SUBMITTALS

.1 Submit shop drawings to requirements of Section 01 33 00.

.2 Submit shop drawings and product data for manufactured products and assemblies required for this project. Include data on pipe material, pipe fittings, valves and accessories.

.3 Shop drawings shall clearly indicate product description, make, model, dimensions, component sizes, rough-in requirements, location, type, size, service clearances, finishes, and pressure rating.

.4 Submit copies of valve "ordering schedule" for approval before ordering valves.

1.5 QUALITY ASSURANCE

.1 Gas piping shall meet the requirements of CSA Standard B149.1, Installation Code for Natural Gas Burning Appliances and Equipment.

.2 Domestic water, drainage and vent piping shall meet the requirements of the National Building Code and the Provincial and Municipal Codes.

.3 Automatic sprinkler system piping shall conform to the requirements of NFPA No. 13.

.4 Contractor to supply shop drawings for all grooved end components. Do piping system work including hangers in accordance with ANSI B31.1-1983. Install all grooved end components as per manufacturer's latest recommendations. All grooved joint couplings, fittings, valves and specialties shall be the products of a single manufacturer. Grooving tools shall be of the same manufacturer as the grooved components.

.5 All castings used for coupling housings, fittings, valve bodies, etc., shall be date stamped for quality assurance and traceability.

2 Products

2.1 PIPE

.1 Heating Water (to 110 Deg.C)

- .1 Steel Pipe: ASTM A53 or A120, Schedule 40 Black, with malleable iron (1034 KpA) or forged steel welding type fittings (2065 KpA), screwed, grooved mechanical, or welded. For pipe sizes 300mm (12") and larger, wall thickness to be 9.5mm (3/8")
- .2 Copper Pipe: Type L hard copper, with cast brass or wrought copper fittings, 95/5 solder
- .3 Cross Linked Polyethylene (PEX) pipe: ASTM F876 and ASTM F877, 690 kPa (100 psig) operating pressure at 82 degrees C (180 degrees F). Fittings: Brass and copper. Joints: Mechanical compression fittings. PEX piping shall be acceptable for use on mains and branch lines up to and including 50mm (2") in size.

.2 Refrigerant Piping

- .1 Copper Tubing: ASTM B280, Type ACR hard drawn or annealed. Fittings: ASME B16.22 wrought copper. Joints: Braze, AWS A5.8 BCuP silver/phosphorus/copper alloy with melting range 640 to 805 degrees (1190 to 1480 degrees F).

.3 Equipment Drains/Overflow

- .1 Steel Pipe: ASTM A53 or A120, Schedule 40 galvanized, with galvanized cast iron or malleable iron fittings, screwed joints or grooved mechanical couplings.
- .2 Plastic Pipe buried or crawlspace may be PVC Pipe: Schedule 40 or SDR 21 or 26, with PVC fittings, solvent weld or grooved mechanical joints.
- .3 Plastic Pipe in ceiling space shall be fire rated PVC Pipe: Schedule 40 or SDR 21 or 26, with fire rated PVC fittings, solvent weld or grooved mechanical joints. Rating to meet 25/50 flame and smoke spread.
- .4 Copper Pipe: Type L hard copper, with cast brass or wrought copper fittings, 95/5 solder.

.4 Sanitary Drainage and Vent (unburied)

- .1 Cast iron pipe and fittings; hub-and spigot, neoprene gaskets; or hubless with neoprene gaskets and stainless steel clamp-and-shield assemblies.
- .2 Type "M" or "DWV" copper with cast brass, or bronze or wrought copper fittings; 95/5 solder joints or grooved mechanical.
- .3 Plastic PVC-XFR-15/50 or CPVC pipe and fittings; solvent weld joints or grooved mechanical.

.5 Water Piping (buried)
- .1 Copper tubing type K annealed; wrought copper fittings 95/5 solder or silver braze joints.
- .2 Plastic "BLUE BRUTE" pipe and fittings; solvent weld joints.
- .3 All piping and fitting shall be rated to a minimum of 1034 kPa (150 PSI)

.6 Water Piping (unburied)
- .1 Type L hard copper; with cast brass or wrought copper fittings; 95/5 solder joints.
- .2 Stainless steel pipe, Schedule 40; Vic Press Pipe.
- .3 Cross Linked Polyethylene (PEX) pipe.

.7 Storm Water Piping (unburied)
- .1 Plastic PVC-XFR-15/50 or CPVC pipe and fittings; solvent weld joints or grooved mechanical.

.8 Natural Gas Piping
- .1 Steel pipe, Schedule 40 black. Fittings: Malleable iron 1034 kPa (150 PSI) threaded for pipe sizes under 50mm (2"). Fittings: forged steel welding fittings and welded joints for pipe sizes 50mm (2") and above.

.9 Use factory fabricated butt welded fittings for welded steel pipes.

.10 Use long radius elbows for steel and cast iron water piping.

3 Execution

3.1 CONNECTIONS TO EQUIPMENT

.1 In accordance with manufacturer's instructions unless otherwise indicated.

.2 Use valves and unions or flanges (as indicated) for isolation and ease of maintenance and assembly.

.3 Use double swing joints when equipment mounted on vibration isolation and when piping subject to movement.

3.2 CLEARANCES

.1 Provide clearance around systems, equipment and components for observation of operation, inspection, servicing, maintenance and as recommended by manufacturer.

.2 Provide space for disassembly, removal of equipment and components as recommended by manufacturer or as indicated (whichever is greater) without interrupting operation of other system, equipment, components.

3.3 DRAINS

.1 Install piping with grade in direction of flow except as indicated.

.2 Install drain valve complete with isolation at low points in piping systems, at equipment and at section isolating valves.

.3 Pipe each drain valve discharge separately to nearest floor drain where indicated. Discharge to be visible.

.4 Drain valves: NPS 3/4 gate or globe valves unless indicated otherwise, with hose end male thread, cap and chain.

3.4 AIR VENTS

.1 Install manual air vents at high points in piping systems complete with isolation valve and u-bend copper tubing to allow discharge to bucket.

.2 Install automatic air valve at each air separator and where indicated.

.3 Install isolating valve at each automatic air valve.

.4 Install drain piping to approved location and terminate where discharge is visible.

3.5 DIELECTRIC COUPLINGS

.1 General: Compatible with system, to suit pressure rating of system.

.2 Locations: Where dissimilar metals are joined.

.3 NPS 2 and under: isolating unions or bronze valves.

.4 Over NPS 2: Isolating flanges.

3.6 ROUTE AND GRADES

.1 Route piping in orderly manner and maintain proper grades. Install to conserve headroom and interfere as little as possible with use of space. Run exposed piping parallel to walls. Group piping wherever practical at common elevations. Install concealed pipes close to the building structure to keep furrings to a minimum.

.2 Slope water piping 25 mm in 12 m and arrange to drain at low points.

.3 On closed systems, equip low points with 20 mm drain valves and hose nipples. Provide, at high points, collecting chambers and high capacity float operated automatic air vents.

.4 Make reductions in water pipes with eccentric reducing fittings installed to provide drainage and venting.

.5 Grade horizontal drainage and vent piping 20 mm per meter minimum.

3.7 PIPEWORK INSTALLATION

.1 Screwed fittings jointed with Teflon tape.

.2 Protect openings against entry of foreign material.

.3 Install to isolate equipment and allow removal without interrupting operation of other equipment or systems.

.4 Assemble piping using fittings manufactured to ANSI standards.

.5 Saddle type branch fittings may be used on mains if branch line is no larger than half the size of main.

.1 Hole saw (or drill) and ream main to maintain full inside diameter of branch line prior to welding saddle.

.2 Do not project brach pipe inside the main pipe.

.6 Install exposed piping, equipment, rectangular cleanouts and similar items parallel or perpendicular to building lines.

.7 Install concealed pipework to minimize furring space, maximize headroom, conserve space.

.8 Slope piping, except where indicated, in direction of flow for positive drainage and venting.

.9 Install, except where indicated, to permit separate thermal insulation of each pipe.

.10 Provide clearance for proper installation of insulation and for access to valves, air vents, drains and unions. Valves to be complete with valve handle extensions where insulation is thicker than 25mm, extension to suit insulation thickness.

.11 Group piping wherever possible.

.12 Ream pipes, remove scale, welding slag and other foreign material, inside and outside before assembly.

.13 Use eccentric reducers at pipe size changes to ensure positive drainage and venting.

.14 Install piping to allow for expansion and contraction without unduly stressing pipe or equipment connected.

.15 Screw joint steel piping up to and including 38 mm . Weld piping 63 mm and larger, including branch connections. Screw or weld 50 mm piping.

.16 Make screwed joints with full cut standard taper pipe threads with red lead and linseed oil or other approved non-toxic joint compound applied to male threads only.

.17 Clamp cast iron water pipe at fittings with 20 mm rods and properly anchor and support.

.18 Use grooved mechanical couplings and mechanical fasteners in accessible locations, risers, pipe chases, and in other locations as approved by Departmental Representative. Use flexible couplings at pumps, coils and all vibration isolated equipment in lieu of flexible connectors, all other couplings to be rigid.

.1 Grooved joints shall be installed in accordance with the manufacturer's latest published installation instructions.

.2 The grooved coupling manufacturer's factory trained representative shall provide on-site training for Contractor's field personnel in the use of grooving tools and installation of grooved joint products. The representative shall periodically visit the job site and review Contractor is following best recommended practices in grooved product installation. (A distributor's representative is not considered qualified to conduct the training or job site visits.)

.19 Make connections to equipment and branch mains with unions or flanges, as indicated:

.1 Unions are not required in installations using grooved mechanical joint couplings (The couplings shall serve as disconnect points.)

.20 Provide non-conducting type connections wherever jointing dissimilar metals in systems. Brass adaptors and valves are acceptable. Refer to dielectric couplings.

.21 Pressfit piping and fittings are not permitted.

.22 Install piping to allow for expansion and contraction without unduly stressing pipe or equipment connected.

.1 For mechanical pipe jointing systems, use adequate numbers of Victaulic Style 77 flexible couplings in header piping to accommodate thermal growth and contraction, and for the elimination of expansion loops. (In accordance with Victaulic instructions and as approved by the Departmental Representative.) Where expansion loops are required, use Victualic Style 77 couplings on the loops.

.23 Install piping material specified as inside the building to 2.4 meters outside of building.

.24 Use of PVC or other plastic pipe allowed where approved by the authority having jurisdiction. Plastic pipe run in plenum spaces shall have flame and smoke rating for that purpose. Plastic pipe to be complete with ULC labelled intumescent fire stopping wherever penetrating fire separations.

.25 Valves:

.1 Shall be flanged for steam and condensate 38 mm and larger.

.2 Install in accessible locations.

.3 Remove interior parts before soldering.

.4 Install with stems upright or horizontal, not inverted.

.5 Valves accessible for maintenance without removing adjacent piping.

.6 Install globe valves in bypass around control valves.

.7 Use ball valves up to 50 mm or butterfly valves 63 mm and larger at branch take-offs for isolating purposes except where otherwise specified.

.8 Install butterfly valves on chilled water and related condenser water systems only.

.9 Install butterfly valves between weld neck flanges to ensure full compression of liner.

.10 Install ball valves for glycol service and domestic water.

.11 Install gate valves on steam and condensate.

.12 Use chain operators on valves NPS 2-1/2 and larger where installed more than 2400 mm above floor in Mechanical Rooms.

.13 Install gate, ball and butterfly valves for isolating service, to isolate equipment, part of systems or vertical risers.
.14 Install globe, ball or angle valves for throttling service.
.15 Use plug cocks in water systems for throttling service. Use non-lubricated plug cocks only when shut-off or isolation valves are also provided.
.16 Grooved end triple service valves shall be 2068 kPa bubble tight dead end shutoff and non-slamming backflow prevention. Victualic Tri-Service valve assembly.
.17 Use butterfly valves in fire protection systems where approved.
.18 Provide drain valves at main shut-off valves, low points of piping and apparatus.
.19 Valve operators to be complete with extensions on systems with insulation thicker than 25mm, extension to suit insulation thickness.

.26 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 Provide spring loaded check valves on discharge of condensate pumps and condenser water.

.27 Provide thermometers, thermometer wells, and DDC sensor wells where thermometers are indicated on drawings and schematics.

.28 Provide plug cocks at all pressure tapping locations.

3.8 SLEEVES

.1 General: Install where pipes pass through masonry, concrete structures, fire rated assemblies, and elsewhere as indicated.

.2 Material: Schedule 40 black steel pipe.

.3 Construction: Foundation walls and where sleeves extend above finished floors to have annular fins continuously welded on at mid-point.

.4 Sizes: 6 mm minimum clearance between sleeve and uninsulated pipe or between sleeve and insulation.

.5 Installation:
.1 Concrete, masonry walls, concrete floors on grade: Terminate flush with finished surface.
.2 Other floors: Terminate 25 mm above finished floor.
.3 Before installation, paint exposed exterior surfaces with heavy application of zinc-rich paint to CAN/CGSB-1.181.

.6 Sealing:
.1 Foundation walls and below grade floors: Fire retardant, waterproof non-hardening mastic.
.2 Elsewhere: Provide space for firestopping. Maintain fire rating integrity.

.3 Sleeves installed for future use: Fill with lime plaster or other easily removable filler.

.4 Ensure no contact between copper pipe or tube and sleeve.

3.9 ESCUTCHEONS

.1 Install on pipes passing through walls, partitions, floors, and ceilings in finished areas.

.2 Construction: One piece type with set screws. Chrome or nickel plated brass or type 302 stainless steel.

.3 Sizes: Outside diameter to cover opening or sleeve. Inside diameter to fit around pipe or outside of insulation if so provided.

3.10 PREPARATION FOR FIRESTOPPING

.1 Material and installation within annular space between pipes, ducts, insulation and adjacent fire separation to Section 07 84 00 - Firestopping.

.2 Uninsulated unheated pipes not subject to movement: No special preparation.

.3 Uninsulated heated pipes subject to movement: Wrap with non-combustible smooth material to permit pipe movement without damaging firestopping material or installation.

.4 Insulated pipes and ducts: Ensure integrity of insulation and vapour barriers.

3.11 FLUSHING OUT OF PIPING SYSTEMS

.1 In accordance with Section 23 08 02 - Cleaning and Start-up of Mechanical Piping Systems. Before start-up, clean interior of piping systems in accordance with requirements of Section 01 74 11-Cleaning supplemented as specified in relevant sections of Mechanical.

.3 Preparatory to acceptance, clean and refurbish equipment and leave in operating condition, including replacement of filters in piping systems.

3.12 PRESSURE TESTING OF EQUIPMENT AND PIPEWORK

.1 Advise Departmental Representative 48 hours minimum prior to performance of pressure tests.

.2 Pipework: Test as specified in relevant sections of Mechanical or to 1.5 times maximum operating pressure. All installed piping to be tested unless noted otherwise.

.3 Maintain specified test pressure without loss for 4 hours minimum unless specified for longer period of time in relevant sections of Mechanical.

.4 Prior to tests, isolate equipment and other parts which are not designed to withstand test pressure or media.

.5 Conduct tests in presence of Departmental Representative.

.6 Pay costs for repairs or replacement, retesting, and making good. Departmental Representative to determine whether repair or replacement is appropriate.

.7 Insulate or conceal work only after approval and certification of tests by Departmental Representative.

END OF SECTION

1 General

1.1 SUMMARY

.1 Section Includes:
- .1 Electrical motors, drives and guards for mechanical equipment and systems.
- .2 Supplier and installer responsibility indicated in Motor, Control and Equipment Schedule 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 26 except for conduit, wiring and connections below 50 V which are related to control systems specified in Division 22, 23 and 25. Refer to Division 26 for quality of materials and workmanship. Sustainable requirements for construction and verification.

1.2 REFERENCES

.1 American Society of Heating, Refrigeration and Air-Conditioning Engineers (ASHRAE)
- .1 ASHRAE 90.1, Energy Standard for Buildings Except Low-Rise Residential Buildings (IESNA cosponsored; ANSI approved; Continuous Maintenance Standard).

.2 Electrical Equipment Manufacturers' Association Council (EEMAC)

.3 Health Canada/Workplace Hazardous Materials Information System (WHMIS)
- .1 Material Safety Data Sheets (MSDS).

1.3 SUBMITTALS

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

.2 Product Data:
- .1 Submit manufacturer's printed product literature, specifications and datasheet in accordance with Section 01 33 00 - Submittal Procedures. Include product characteristics, performance criteria, and limitations.
- .2 Shop Drawings: submit drawings stamped and signed by professional engineer registered or licensed in Province of Saskatchewan.

.3 Closeout Submittals
- .1 Provide maintenance data for motors, drives and guards for incorporation into manual specified in Section 01 78 00 - Closeout Submittals.

1.4 QUALITY ASSURANCE

.1 Regulatory Requirements: work to be performed in compliance with CEPA, CEAA, TDGA, and applicable Provincial /Territorial regulations.

.2 Health and Safety Requirements: do construction occupational health and safety in accordance with Section 01 35 29.06 - Health and Safety Requirements.

2 Products

2.1 GENERAL

.1 Motors: premium efficiency, in accordance with local Hydro company standards and to ASHRAE 90.1.

.2 Must be inverter duty for all variable frequency drive applications.

.3 Must be CSA approved.

2.2 MOTORS

.1 Provide motors for mechanical equipment as specified.

.2 Motors 373 W (1/2 HP) and under: speed as indicated, continuous duty, built-in overload protection, resilient mount, single phase, 120 V, unless otherwise specified or indicated.

.3 Motors 373 W (3/4 HP) and larger: EEMAC Class B, squirrel cage induction, speed as indicated, continuous duty, drip proof, ball bearing, maximum temperature rise 40 degrees C, 3 phase, 208V, unless otherwise indicated.

2.3 TEMPORARY MOTORS

.1 If delivery of specified motor will delay completion or commissioning work, install motor approved by Departmental Representative for temporary use. Work will only be accepted when specified motor is installed.

2.4 BELT DRIVES

.1 Fit reinforced belts in sheave matched to drive. Multiple belts to be matched sets.

.2 Use cast iron or steel sheaves secured to shafts with removable keys unless otherwise indicated.

.3 For motors under 7.5 kW (10 HP) : standard adjustable pitch drive sheaves, having plus or minus 10% range. Use mid-position of range for specified r/min.

.4 For motors 7.5 kW (10 HP) and over: sheave with split tapered bushing and keyway having fixed pitch unless specifically required for item concerned. Provide sheave of correct size to suit balancing.

.5 Correct size of sheave determined during commissioning.

.6 Minimum drive rating: 1.5 times nameplate rating on motor. Keep overhung loads within manufacturer's design requirements on prime mover shafts.

.7 Motor slide rail adjustment plates to allow for centre line adjustment.

.8 Supply one set of spare belts for each set installed in accordance with Section 01 78 00 - Closeout Submittals.

2.5 DRIVE GUARDS

.1 Provide guards for unprotected drives.

.2 Guards for belt drives;
- .1 Expanded metal screen welded to steel frame.
- .2 Minimum 1.2 mm thick sheet metal tops and bottoms.
- .3 38 mm diameter holes on both shaft centres for insertion of tachometer.
- .4 Removable for servicing.

.3 Provide means to permit lubrication and use of test instruments with guards in place.

.4 Install belt guards to allow movement of motors for adjusting belt tension.-

.5 Guard for flexible coupling:
- .1 "U" shaped, minimum 1.6 mm thick galvanized mild steel.
- .2 Securely fasten in place.
- .3 Removable for servicing.

.6 Unprotected fan inlets or outlets:
- .1 Wire or expanded metal screen, galvanized, 19 mm mesh.
- .2 Net free area of guard: not less than 80% of fan openings.
- .3 Securely fasten in place.
- .4 Removable for servicing.

3 Execution

3.1 MANUFACTURER'S INSTRUCTIONS

.1 Compliance: comply with manufacturer's written recommendations or specifications, including product technical bulletins, handling, storage and installation instructions, and datasheet.

3.2 INSTALLATION

.1 Fasten securely in place.

.2 Make removable for servicing, easily returned into, and positively in position.

3.3 CLEANING

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

.2 Upon completion and verification of performance of installation, remove surplus materials, excess materials, rubbish, tools and equipment.

END OF SECTION

1 General

1.1 SECTION INCLUDES

.1 Materials and installation for flexible connections, expansion joints, anchors and guides for building services piping.

.2 Sustainable requirements for construction, verification and operation.

1.2 REFERENCES

.1 American Society for Testing and Materials International, (ASTM).

.1 ASTM A53/A53M-02, Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated Welded and Seamless.

.2 ASTM A105/A105M-03, Standard Specification for Carbon Steel Forgings, for Piping Applications.

1.3 SUBMITTALS

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

.2 Submit product data and indicate for items as applicable:

.1 Manufacturer, model number, line contents, pressure and temperature rating.

.2 Movement handled, axial, lateral, angular and the amounts of each.

.3 Nominal size and dimensions including details of construction and assembly.

.3 Submit maintenance data in accordance with Section 01 78 00 - Closeout Submittals.

.4 Data to include:

.1 Servicing requirements, including special requirements, stuffing box packing, lubrication and recommended procedures.

1.4 HEALTH AND SAFETY

.1 Do construction occupational health and safety in accordance with Section 01 35 29.06 - Health and Safety Requirements.

1.5 GENERAL REQUIREMENTS

.1 Verify, prior to installation, required anchors and expansion joints to adequately protect system.

.2 Base expansion calculations on -10 deg.C installation temperature to 100 deg.C for hot water heating and 60 deg.C for domestic hot water, plus 30% safety factor.

2 Products

2.1 SLIP TYPE EXPANSION JOINTS

.1 Application: for axial pipe movement, copper and steel to be 50 mm and under.

.2 Repacking: under full line pressure.

.3 Body and packing housings: Class 300, 2MPa carbon steel pipe to ASTM A53/A53M, Grade B. Wall thickness to match pipe with raised face flanges to match pipe.

.4 Slip or traverse sleeves: carbon steel pipe to ASTM A53/A53M, Grade B, hard chrome plated.

.5 Anchor base: construction steel, welded to body.

.6 Guides (internal and external): embody into packing housing with concentric alignment of slip or traverse sleeve with packing housing.

.7 Extension limit stop: stainless steel, to prevent over-extension with accessible and removable pins.

.8 Packing rings: 6 minimum, PTFE or graphite impregnated non-asbestos.

.9 Thermal plastic packing: PTFE or graphite impregnated non-asbestos slug supplied loose.

.10 Lubricating fittings: pet cocks with grease nipple.

.11 Plunger body and plunger:
- .1 Plunger body: heavy wall carbon steel welded to body.
- .2 Plunger: carbon steel with hex head for use with socket wrench.

.12 Lubricant: to manufacturer's recommendations.

.13 Lubricant gun: complete with hose assembly.

.14 Drip connection: 20 MPa forged steel to ASTM A105/A105M. Include half coupling with drain plug.

2.2 BELLOWS TYPE EXPANSION JOINTS

.1 For axial, lateral or angular movements, copper and steel pipe 64 and over.

.2 Maximum working pressure: 862 kPa WSP, 1380 kPa WOG.

.3 Maximum operating temperature: 204 degrees C at WSP, 121 deg.C at WOG.

.4 Type A: controlled flexing, factory tested to 1 1/2 times maximum working pressure. Furnish test certificates.

.5 Type B: externally pressurized, designed to eliminate pressure thrust, factory tested to 1-1/2 times maximum working pressure. Furnish test certificates.

.6 Bellows:
- .1 Multiple bellows, hydraulically formed, two ply, austenitic stainless steel for specified fluid, pressure and temperature, water treatment and pipeline cleaning procedures.

.7 Reinforcing or control rings:
- .1 2 piece nickel iron.

.8 Ends:
- .1 Butt weld flanges to match pipe.

.9 Liner:
- .1 Austenitic stainless steel in direction of flow.

.10 Shroud:
.1 Carbon steel, painted.

2.3 GROOVED PIPE EXPANSION JOINTS

.1 Grooved end expansion joints for steel piping:
.1 Packless, gasketed, slip expansion joints: 2400 kPa maximum working pressure, steel pipe fitting consisting of telescoping body and slip-pipe sections, PTFE modified polyphenylene sulfide coated slide section, with grooved ends. Suitable for axial end movement to 80 mm Victaulic Style 150.
.2 Expansion joint consisting of a series of grooved end pipe nipples joined in tandem with Victaulic Style 77 flexible couplings. Total joint movement dependent on the number of couplings and nipples used. Victualic Series 155.

2.4 FLEXIBLE CONNECTION

.1 Application: to suit motion as indicated.

.2 Minimum length in accordance with manufacturer's recommendations to suit offset as indicated.

.3 Inner hose: bronze corrugated for copper pipe, inner hose stainless steel corrugated for steel pipe.

.4 Braided wire mesh bronze outer jacket, for copper pipe.

.5 Braided wire mesh stainless steel after jacket for steel pipe.

.6 Diameter and type of end connection: as indicated under Section 23 05 01.

.7 Operating conditions:
.1 Working pressure: 1034 kPa minimum.
.2 Working temperature: 232 degrees C minimum.
.3 To match system requirements.

2.5 ANCHORS AND GUIDES

.1 Anchors:
.1 Provide as indicated.
.2 Concrete: to Section 03 30 00 - Cast-in-Place.
.3 Reinforcement: to Section 03 20 33 - Concrete Reinforcing.

.2 Alignment guides:
.1 Provide as indicated.
.2 To accommodate specified thickness of insulation.
.3 Vapour barriers, jackets to remain uninterrupted.

3 Execution

3.1 INSTALLATION

.1 Install expansion joints and flexible connections in accordance with manufacturer's instructions.

.2 Install pipe anchors and guides as indicated and required. Anchors to withstand 150% of axial thrust.

.3 Provide flexible pipe connectors on pipes connected to all equipment supported by vibration isolation and where shown on drawings and schematics.

.4 Provide structural work and equipment required to control expansion and contraction of piping, loops, pipe offsets, and swing joints and provide corrugated bellows type expansion joints where indicated or required.

.5 Install flexible connectors at right angles to displacement. Install one end immediately adjacent to isolated equipment and anchor at other end.

.6 Rigidly anchor pipe to building structure at points shown and where required, where necessary provide pipe guides so that movement takes place along axis of pipe.

.7 Three Victualic Style 77 couplings may be used in lieu of a flexible connector for vibration attenuation and stress relief. The couplings shall be placed in close proximity to the source of the vibration.

.8 Rigidly anchor pipe to building structure at points shown, and where necessary provide pipe guides so that movement takes place along axis of pipe only.

3.2 CLEANING AND START-UP

.1 In accordance with Section 23 08 02 - Cleaning and Start-up of Mechanical Piping Systems.

3.3 PERFORMANCE VERIFICATION

.1 In accordance with Section 23 08 01 - Performance Verification: Mechanical Piping Systems.

END OF SECTION

1 General

1.1 REFERENCES

.1 American National Standards Institute/American Society of Mechanical Engineers (ANSI/ASME)
- .1 ANSI/ASME B31.1-1998, Power Piping.
- .2 ANSI/ASME B31.3-2000, Process Piping Addenda A.
- .3 ANSI/ASME B31.3-2001, Process Piping Addenda B.
- .4 ANSI/ASME Boiler and Pressure Vessel Code-1998:
  - .1 Section I: Power Boilers.
  - .2 Section V: Nondestructive Examination.
  - .3 Section IX: Welding and Brazing Qualifications.

.2 American National Standards Institute/American Water Works Association (ANSI/AWWA)
- .1 ANSI/AWWA C206-97, Field Welding of Steel Water Pipe.

.3 American Welding Society (AWS)
- .1 AWS C1.1-2000, Recommended Practices for Resistance Welding.
- .2 AWS Z49.1-1999, Safety Welding, Cutting and Allied Process.
- .3 AWS W1-2000, Welding Inspection Handbook..

.4 Canadian General Standards Board (CGSB)
- .1 CAN/CGSB-48.2-92, Spot Radiography of Welded Butt Joints in Ferrous Materials.

.5 Canadian Standards Association (CSA International)
- .1 CSA W47.2-M1987 (R1998), Certification of Companies for Fusion Welding of Aluminum.
- .2 CSA W48 series-01, Filler Metals and Allied Materials for Metal Arc Welding.
- .3 CSA B51-97, Boiler, Pressure Vessel and Pressure Piping Code.
- .4 CSA-W117.2-01, Safety in Welding, Cutting and Allied Processes.
- .5 CSA W178.1-02, Certification of Welding Inspection Organizations.
- .6 CSA W178.2-01, Certification of Welding Inspectors.

1.2 QUALIFICATIONS

.1 Welders
- .1 Welding qualifications in accordance with CSA B51.
- .2 Use qualified and licensed welders possessing certificate for each procedure performed from authority having jurisdiction.
- .3 Furnish welder's qualifications to Departmental Representative.
- .4 Each welder to possess identification symbol issued by authority having jurisdiction.
- .5 Certification of companies for fusion welding of aluminum in accordance with CSA W47.2.

.2 Inspectors
- .1 Inspectors qualified to CSA W178.2.

1.3 QUALITY ASSURANCE

.1 Registration of welding procedures in accordance with CSA B51.

.2 Copy of welding procedures available for inspection.

.3 Safety in welding, cutting and allied processes in accordance with CSA-W117.2.

2 Products

2.1 ELECTRODES

.1 Electrodes: in accordance with CSA W48 Series.

3 Execution

3.1 WORKMANSHIP

.1 Welding: in accordance with ANSI/ASME B31.1, B31.3, ANSI/ASME Boiler and Pressure Vessel Code, Sections I and IX and ANSI/AWWA C206, using procedures conforming to AWS B3.0, AWS C1.1, and applicable requirements of provincial authority having jurisdiction.

3.2 INSTALLATION REQUIREMENTS

.1 Identify each weld with welder's identification symbol.

.2 Backing rings:
- .1 Where used, fit to minimize gaps between ring and pipe bore.
- .2 Do not install at orifice flanges.

.3 Fittings:
- .1 NPS 2 and smaller: install welding type sockets.
- .2 Branch connections: install welding tees or forged branch outlet fittings.

3.3 INSPECTION AND TESTS - GENERAL REQUIREMENTS

.1 Review weld quality requirements and defect limits of applicable codes and standards with Departmental Representative before work is started.

.2 Formulate "Inspection and Test Plan" in co-operation with Departmental Representative.

.3 Do not conceal welds until they have been inspected, tested and approved by inspector.

.4 Provide for inspector to visually inspect welds during early stages of welding procedures in accordance with Welding Inspection Handbook. Repair or replace defects as required by Codes and as specified.

3.4 SPECIALIST EXAMINATIONS AND TESTS

.1 Hydrostatically test welds to requirements of ANSI/ASME B31.1.

.2 Visual examinations: include entire circumference of weld externally and wherever possible internally.

.3 Failure of visual examinations:
- .1 Upon failure of welds by visual examination, perform additional testing as directed by Departmental Representative of total of up to 10% of welds, selected at random by Departmental Representative by radiographic particle tests.

.4 Full radiographic tests for piping systems.
- .1 Spot radiography to CAN/CGSB-48.2.
  - .1 Conduct spot radiographic tests of up to 10% of welds, selected at random by Departmental Representative from welds which would be most difficult to repair in event of failure after system is operational.
- .2 Radiographic film:
  - .1 Identify each radiographic film with date, location, name of welder, and submit to Departmental Representative. Replace film if rejected because of poor quality.
- .3 Interpretation of radiographic films:
  - .1 By qualified radiographer.
- .4 Failure of radiographic tests:
  - .1 Extend tests to welds by welder responsible when those welds fails tests.

.5 Magnetic particle tests for piping systems.

3.5 DEFECTS CAUSING REJECTION

.1 As described in ANSI/ASME B31.1 and ANSI/ASME Boiler and Pressure Vessels Code.

.2 In addition, chilled water systems:
- .1 Undercutting greater than 0.8 mm adjacent to cover bead on outside of pipe.
- .2 Undercutting greater than 0.8 mm adjacent to root bead on inside of pipe.
- .3 Undercutting greater than 0.8 mm at combination of internal surface and external surface.
- .4 Incomplete penetration and incomplete fusion greater than total length of 38 mm in 1500 mm length of weld depth of such defects being greater than 0.8 mm.
- .5 Repair cracks and defects in excess of 0.8 mm in depth.
- .6 Repair defects whose depth cannot be determined accurately on basis of visual examination or radiographic particle tests.

3.6 REPAIR OF WELDS WHICH FAILED TESTS

.1 Re-inspect and re-test repaired or re-worked welds at Contractor's expense.

END OF SECTION

1 General

1.1 SUMMARY

.1 Section Includes:
  .1 Bronze - valves.
.2 Sustainable requirements for construction and verification.

1.2 REFERENCES

.1 American National Standards Institute (ANSI)/ American Society of Mechanical Engineers (ASME).
  .1 ANSI/ASME B1.20.1-1983 (R2001), Pipe Threads, General Purpose (Inch).
  .2 ANSI/ASME B16.18-2001, Cast Copper Alloy Solder Joint Pressure Fittings.

.2 American Society for Testing and Materials International, (ASTM).
  .1 ASTM A276-04, Specification for Stainless Steel Bars and Shapes.
  .2 ASTM B62-02, Specification for Composition Bronze or Ounce Metal Castings.
  .3 ASTM B283-99a, Specification for Copper and Copper Alloy Die Forgings (Hot-Pressed).
  .4 ASTM B505/B505M-02, Specification for Copper-Base Alloy Continuous Castings.

.3 Manufacturers Standardization Society of the Valve and Fittings Industry, Inc. (MSS).
  .1 MSS-SP-25-1998, Standard Marking System for Valves, Fittings, Flanges and Unions.
  .2 MSS-SP-80-2003, Bronze Gate Globe, Angle and Check Valves.
  .3 MSS-SP-110-1996, Ball Valves, Threaded, Socket-Welding, Solder Joint, Grooved and Flared Ends.

1.3 SUBMITTALS

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

.2 Product Data: submit WHMIS MSDS - Material Safety Data Sheets in accordance with Section 02 81 01 - Hazardous Materials.
  .1 Submit shop drawings and product data in accordance with Section 01 33 00 - Submittal Procedures.
  .2 Submit data for valves specified in this section.

.3 Closeout Submittals:
  .1 Submit maintenance data for incorporation into manual specified in Section 01 78 00 - Closeout Submittals.

1.4 QUALITY ASSURANCE

.1 Health and Safety:
  .1 Do construction occupational health and safety in accordance with Section 01 35 29.06 - Health and Safety Requirements.

2 Products

2.1 MATERIALS

.1 Valves:
- .1 Except for specialty valves, to be single manufacturer.
- .2 All products to have CRN registration numbers.

.2 End Connections:
- .1 Connection into adjacent piping/tubing:
  - .1 Steel pipe systems: Screwed ends to ANSI/ASME B1.20.1.
  - .2 Copper tube systems: Solder ends to ANSI/ASME B16.18.
  - .3 Provide flanged ends as indicated under 23 05 05, Installation of Pipework.

.3 Lockshield Keys:
- .1 Where lockshield valves are specified, provide 10 keys of each size: malleable iron cadmium plated.

.4 Gate Valves:
- .1 Requirements common to gate valves, unless specified otherwise:
  - .1 Standard specification: MSS SP-80.
  - .2 Bonnet: union with hexagonal shoulders.
  - .3 Connections: screwed with hexagonal shoulders.
  - .4 Inspection and pressure testing: to MSS SP-80. Tests to be hydrostatic.
  - .5 Packing: non-asbestos.
  - .6 Handwheel: non-ferrous.
  - .7 Handwheel Nut: bronze to ASTM B62.
- .2 NPS 2 and under, non-rising stem, solid wedge disc, Class 125
  - .1 Body: with long disc guides, screwed bonnet with stem retaining nut.
  - .2 Operator: Handwheel.
- .3 NPS 2 and under, non-rising stem, solid wedge disc, Class 150:
  - .1 Body: with long disc guides, screwed bonnet with stem retaining nut.
  - .2 Operator: Handwheel.
- .4 NPS 2 and under, rising stem, split wedge disc, Class 125:
  - .1 Body: with long disc guides, screwed bonnet.
  - .2 Disc: split wedge, bronze to ASTM B283, loosely secured to stem.
  - .3 Operator: Handwheel.
- .5 NPS 2 and under, rising stem, solid wedge disc, Class 125:
  - .1 Body: with long disc guides, screwed bonnet.
  - .2 Operator: Handwheel.
- .6 NPS 2 and under, rising stem, solid wedge disc, Class 150:
  - .1 Body: with long disc guides, screwed bonnet.
  - .2 Operator: Handwheel.

.5 Globe Valves:
- .1 Requirements common to globe valves, unless specified otherwise:
  - .1 Standard specification: MSS SP-80.
  - .2 Bonnet: union with hexagonal shoulders.
  - .3 Connections: screwed with hexagonal shoulders.
  - .4 Pressure testing: to MSS SP-80. Tests to be hydrostatic.

.5 Stuffing box: threaded to bonnet with gland follower, packing nut, high grade non-asbestos packing.
.6 Handwheel: non-ferrous.
.7 Handwheel Nut: bronze to ASTM B62.

.2 NPS 2 and under, composition disc, Class 125:
.1 Body and bonnet: screwed bonnet.
.2 Disc and seat: renewable rotating PTFE disc, composition to suit service conditions, regrindable bronze seat, loosely secured to bronze stem to ASTM B505.
.3 Operator: Handwheel.

.3 NPS 2 and under, composition disc, Class 150:
.1 Body and bonnet: union bonnet.
.2 Disc and seat: renewable rotating PTFE disc in easily removable disc holder, regrindable bronze seat, loosely secured to bronze stem to ASTM B505.
.3 Operator: Handwheel.

.4 NPS 2 and under, plug disc, Class 150, screwed ends:
.1 Body and bonnet: union bonnet.
.2 Disc and seat ring: tapered plug type with disc stem ring of AISI S420 stainless steel to ASTM A276, loosely secured to stem.
.3 Operator: Handwheel.

.5 Angle valve, NPS 2 and under, composition disc, Class 150:
.1 Body and bonnet: union bonnet.
.2 Disc and seat: renewable rotating PTFE disc in slip-on easily removable disc holder having integral guides, regrindable bronze seat, loosely secured to stem.
.3 Operator: Handwheel.

.6 Check Valves:

.1 Requirements common to check valves, unless specified otherwise:
.1 Standard specification: MSS SP-80.
.2 Connections: screwed with hexagonal shoulders.

.2 NPS 2 and under, swing type, bronze disc, Class 125:
.1 Body: Y-pattern with integral seat at 45 degrees, screw-in cap with hex head.
.2 Disc and seat: renewable rotating disc, two-piece hinge disc construction; seat: regrindable.

.3 NPS 2 and under, swing type, bronze disc:
.1 Body: Y-pattern with integral seat at 45 degrees, screw-in cap with hex head.
.2 Disc and seat: renewable rotating disc, two-piece hinge disc construction; seat: regrindable.

.4 NPS 2 and under, swing type, composition disc, Class 200:
.1 Body: Y-pattern with integral seat at 45 degrees, screw-in cap with hex head.
.2 Disc: renewable rotating disc of number 6 composition to suit service conditions, bronze two-piece hinge disc construction.

.5 NPS 2 and under, horizontal lift type, composition disc, Class 150:
.1 Body: with integral seat, union bonnet ring with hex shoulders, cap.
.2 Disc: renewable PTFE rotating disc in disc holder having guides top and bottom, of bronze to ASTM B62.

.6 NPS 2 and under, vertical lift type, bronze disc, Class 125:
.1 Disc: rotating disc having guides top and bottom, disc guides, retaining rings.

.7 Silent Check Valves:
.1 NPS 2 and under:
.1 Body: cast high tensile bronze to ASTM B62 with integral seat.
.2 Pressure rating: Class 125.
.3 Connections: screwed ends to ANSI B1.20.1 and with hex shoulders.
.4 Disc and seat: renewable rotating disc.
.5 Stainless steel spring, heavy duty.
.6 Seat: regrindable.

.8 Ball Valves:
.1 NPS 2 and under:
.1 Body and cap: cast high tensile brass to C37700.
.2 Pressure rating: Class 150 WSP/600 WOG.
.3 Connections: Screwed ends to ANSI B1.20.1 and with hexagonal shoulders or solder ends to ANSI.
.4 Stem: tamperproof ball drive.
.5 Stem packing nut: external to body.
.6 Ball and seat: replaceable solid hard chrome full port ball and teflon seals.
.7 Stem seal: TFE with external packing nut.
.8 Operator: removable lever handle.

3 Execution

3.1 INSTALLATION

.1 Install rising stem valves in upright position with stem above horizontal.

.2 Remove internal parts before soldering.

.3 Install valves with unions or flanges at each piece of equipment arranged to allow servicing, maintenance, and equipment removal. Refer to 23 05 05 - Installation of Pipework.

END OF SECTION

1 General

1.1 SUMMARY

.1 Section Includes:
  .1 Valves, gate, globe, and check.
.2 Sustainable requirements for construction and verification.

1.2 REFERENCES

.1 American National Standards Institute (ANSI)/American Society of Mechanical Engineers (ASME).
  .1 ANSI/ASME B16.1-1998, Cast Iron Pipe Flanges and Flanged Fittings.

.2 American Society for Testing and Materials International (ASTM).
  .1 ASTM A49-01, Specification for Heat-Treated Carbon Steel Joint Bars.
  .2 ASTM A126-95 (2001), Specification for Gray Iron Castings for Valves, Flanges, and Pipe Fittings.
  .3 ASTM B61-93, Specification for Steam or Valve Bronze Castings.
  .4 ASTM B62-93, Specification for Composition Bronze or Ounce Metal Castings.
  .5 ASTM B85-03, Specification for Aluminum-Alloy Die Castings.
  .6 ASTM B209-04, Specification for Aluminum and Aluminum-Alloy Sheet and Plate.

.3 Manufacturers Standardization Society of the Valve and Fittings Industry, Inc. (MSS).
  .1 MSS SP-70-1998, Cast Iron Gate Valves, Flanged and Threaded Ends.
  .2 MSS SP-71-1997, Grey Iron Swing Check Valves, Flanged and Threaded Ends.
  .3 MSS SP-82-1992, Valve Pressure Testing Methods.
  .4 MSS SP-85-2002, Cast Iron Globe and Angle Valves, Flanged and Threaded Ends.

1.3 SUBMITTALS

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

.2 Product Data: submit WHMIS MSDS - Material Safety Data Sheets in accordance with Section 02 81 01 - Hazardous Materials.
  .1 Submit shop drawings and product data in accordance with Section 01 33 00 - Submittal Procedures.
  .2 Submit data for valves specified in this section.

.3 Closeout Submittals:
  .1 Submit maintenance data for incorporation into manual specified in Section 01 78 00 - Closeout Submittals.

1.4 QUALITY ASSURANCE

.1 Health and Safety:
  .1 Do construction occupational health and safety in accordance with Section 01 35 29.06 - Health and Safety Requirements.

2 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 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 aluminum 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 bosses in body and bonnet for taps and drains, full length disc guides designed to ensure correct re-assembly. Class 300.
- .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 Disc: solid offset taper wedge, cast iron to ASTM A126 Class B, secured to wrought steel stem.
- .6 Seat: Integral with body.
- .7 Stem: wrought steel.
- .8 Operator: Handwheel.

.2 NPS 2 1/2-8, outside screw and yoke (OS&Y), bronze trim, solid wedge disc:
- .1 Body and multiple-bolted bonnet: with bosses in body and bonnet for taps and drains, full length disc guides designed to ensure correct re-assembly, yoke, yoke hub, yoke sleeve and nut. Class 300.
- .2 Disc: solid offset taper wedge, bronze to ASTM B62 up to NPS 3, cast iron with bronze disc rings on other sizes, secured to stem through integral forged T-head disc-stem connection.
- .3 Seat rings: renewable bronze screwed into body.
- .4 Stem: nickel-plated steel.
- .5 Disc: solid offset taper all-cast iron, secured to stem through integral forged T-head disc-stem connection.

.6 Seat rings: integral with body.
.7 Stem: nickel-plated steel.
.8 Pressure-lubricated operating mechanism.
.9 Operator: Handwheel.
.10 Bypass: complete with union and NPS globe valve as Section 23 05 05 - Installation of Pipework.

2.3 UNDERWRITERS APPROVED GATE VALVE

.1 NPS 2 1/2 - 14, OS&Y:
.1 Approvals: UL and FM approved for fire service.
.2 UL and FM Label: on valve yoke.
.3 Body, Bonnet: cast iron to ASTM A126 Class B. Wall thicknesses to ANSI B16.1 and ULC 262 (B).
.4 Bonnet bushing, yoke sleeve: bronze, to FM requirements.
.5 Packing gland: bronze.
.6 Stem: manganese bronze. Diameter to ULC C-262 (B).
.7 Stuffing box dimensions, gland bolt diameter: to ULC C-262 (B).
.8 Bosses for bypass valve, drain: on NPS 4 and over.
.9 Disc: solid taper wedge. Up to NPS 3: bronze. NPS 4 and over: cast iron with bronze disc rings.
.10 Disc seat ring: self-aligning, Milwood undercut on NPS 3 - 12.
.11 Pressure rating:
.1 NPS 2-1/2 - 12: 1.7 Mpa CWP.
.12 Operator: handwheel.
.13 Bypass: complete with union and NPS globe valve as Section 23 05 23.01 - Valves - Bronze.

2.4 GLOBE VALVES

.1 NPS 2 1/2 - 10, OSY:
.1 Body: with multiple-bolted bonnet, Class 300.
.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.

2.5 BYPASSES FOR GATE AND GLOBE VALVES

.1 Locations: on valves as indicated.

.2 Position of bypass valve on main valves.

.3 Size of bypass valve:
.1 Main valve up to NPS 8: NPS 3/4.

.4 Type of bypass valves:
.1 On gate valve: globe, with composition disc, bronze trim, to Section 23 05 23.01 - Valves - Bronze. Pressure rating to match main valve.
.2 On globe valve: globe, with composition disc, bronze trim, to Section 23 05 23.01 - Valves - Bronze. Pressure rating to match main valve.

2.6 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.

2.7 CHECK VALVES

.1 Swing check valves, Class 300:
- .1 Body and bolted cover: cast iron to ASTM A126 Class B with tapped and plugged opening on each side for hinge pin.
- .2 Flanged ends: 2 mm raised face with serrated finish.
- .3 Rating: 300 psi steam; 500 psi CWP.
- .4 Disc: rotating for extended life.
  - .1 Up to NPS 3: bronze to ASTM B61.
  - .2 NPS 4 - 8: Iron faced with ASTM B61 bronze.
- .5 Seat rings: renewable bronze to ASTM B61, screwed into body.
- .6 Hinge pin, bushings: renewable, bronze to ASTM B61.
- .7 Hinge: galvanized malleable iron.
- .8 Identification tag: fastened to cover.

3 Execution

3.1 INSTALLATION

.1 Install rising stem valves in upright position with stem above horizontal.

.2 Install valves with unions or flanges at each piece of equipment arranged to allow servicing, maintenance and equipment removal. Refer to Section 23 05 05 Installation of Pipework.

END OF SECTION

1 General

1.1 SUMMARY

.1 Section Includes:
- .1 Valves Cast Steel, gate, globe, and check.

1.2 REFERENCES

.1 American National Standards Institute (ANSI)/American Society of Mechanical Engineers (ASME).
- .1 ANSI/ASME B16.5-2003, Pipe Flanges and Flanged Fittings.
- .2 ANSI/ASME B16.10-1992, Face-to-Face and End-to-End Dimensions Valves.
- .3 ANSI/ASME B16.25-1997, Buttwelding Ends.
- .4 ANSI/ASME B16.34-1996, Valves - Flanged, Threaded and Welding End.

.2 American Petroleum Institute (API).
- .1 API 598-1996, Valve Inspection and Testing.

.3 American Society for Testing and Materials International, (ASTM).
- .1 ASTM A49-01, Specification for Heat-Treated Carbon Steel Joint Bars.
- .2 ASTM A193/A193M-04, Specification for Alloy-Steel and Stainless Steel Bolting Materials for High-Temperature Service.
- .3 ASTM A194/A194M-03b, Specification for Carbon and Alloy Steel Nuts for Bolts for High-Pressure and High-Temperature Service.
- .4 ASTM A216/A216M-1993 (03), Specification for Steel Castings, Carbon Suitable for Fusion Welding for High-Temperature Service.
- .5 ASTM B85-03, Specification for Aluminum-Alloy Die Castings.

.4 Manufacturers Standardization Society of the Valve and Fittings Industry, Inc. (MSS).
- .1 MSS SP-25-1998, Standard Marking System for Valves, Fittings, Flanges and Unions.
- .2 MSS SP-61-2003, Pressure Testing of Steel Valves.

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 81 01 - Hazardous Materials.
- .1 Submit shop drawings and product data in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Submit data for valves specified this section.
- .3 Submit product data in accordance with Section 01 33 00 - Submittal Procedures.

.3 Closeout Submittals:
- .1 Submit maintenance data for incorporation into manual specified in 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 29.06 - Health and Safety Requirements.

2 Products

2.1 MATERIAL

.1 Valves:
- .1 Except for specialty valves, to be of single manufacturer.
- .2 Valves to be individually tested.

.2 Requirements common to valves, unless specified otherwise:
- .1 Pressure-temperature ratings: to ANSI B16.34.
- .2 Inspections and tests: to API 598.
- .3 Pressure Testing: to MSS SP-61.
- .4 Flanged valves:
  - .1 Face-to-face dimensions: to ANSI B16.10.
  - .2 Flange dimensions: to ANSI B16.5 with 1.6 mm raised face.
- .5 Butt-weld valves:
  - .1 End-to-end dimensions: to ANSI B16.10.
  - .2 End dimensions: to ANSI B16.25 bored for standard pipe schedule.
- .6 Handwheel: non-heating type with raised rim of die-cast aluminum alloy to ASTM B85 or malleable iron to ASTM A49.
- .7 Markings: to MSS SP-25.
- .8 Identification:
  - .1 Plate showing catalogue number, size, material of body disc, stem seat, fluid, pressure-temperature rating.
  - .2 Body markings: manufacturer, size, primary service rating, material symbol.
- .9 CRN registration number required for all products.

2.2 GATE VALVES

.1 NPS 2 1/2 - 12, rising stem, OS&Y, solid flexible wedge disc, flanged or butt-weld ends, Class 300:
- .1 Body and multiple-bolted integral yoke and bonnet: cast steel to ASTM A216/A216M WCB, with full length disc guides designed to ensure correct re-assembly.
- .2 Body/bonnet joint: Flat face with corrugated metallic gasket.
- .3 Bonnet studs: to ASTM A193/A193M Type B7.
- .4 Bonnet nuts: to ASTM A194/A194M Type 2H.
- .5 Stuffing box: including non-galling two-piece ball jointed packing gland, with swing-type eye bolts and nuts.
- .6 Gland packing: containing corrosion inhibitor to prevent stem pitting.
- .7 Yoke sleeve: Ni-Resist, minimum melting point above 954 degrees C.
- .8 Hydraulic grease fitting: for lubrication of yoke sleeve bearing surfaces.
- .9 Disc: with disc stem ring to connect to stem, guided throughout its travel.
  - .1 NPS 2 1/2 - 6: Solid corrosion and heat resistant 13% chromium steel with minimum hardness of 350 HB.

.2 NPS 8 and larger: Carbon steel faced with corrosion and heat resistant 13 chromium steel with minimum hardness of 350 HB.

.10 Seat ring: seamless carbon steel with hard-faced cobalt-chromium-tungsten alloy seating surface, slipped in, seal welded, ground to match disc.

.11 Stem: heat treated corrosion and heat resistant 13% chromium steel with accurately-cut precision-machined Acme or 60 degrees V threads, top screwed for handwheel nut, T-head disc-stem connection.

.12 Operator: see elsewhere this section.

2.3 GLOBE VALVES

.1 NPS 2 1/2 - 12, rising stem, OS&Y, flanged or butt-weld ends, Class 300:

.1 Body and multiple-bolted integral yoke and bonnet: cast steel to ASTM A216/A216M WCB.

.2 Body/bonnet joint: Flat face with corrugated metallic gasket.

.3 Bonnet studs: to ASTM A193/A193M Type B7.

.4 Bonnet nuts: to ASTM A194/A194M Type 2H.

.5 Stuffing box: including non-galling two-piece ball-jointed packing gland, with swing-type eye bolts and nuts.

.6 Gland packing: containing corrosion inhibitor to prevent stem pitting.

.7 Yoke bushing: Ni-Resist, minimum melting point above 954 degrees C.

.8 Hydraulic grease fitting: for lubrication of yoke sleeve bearing surfaces.

.9 Disc: Plug type with 15 degrees taper seat and bottom guide or ball type with 35 degrees taper seat.

.10 Seat rings: with 1.6 mm thick cobalt-chromium-tungsten alloy facings with minimum hardness of 375 HB (cold), slipped in, seal welded, ground to match disc.

.11 Stem: heat treated corrosion and heat resistant 13% chromium steel with bonnet bushing, long engagement with yoke bushing for accurate seating, accurately-cut precision-machined Acme or 60 degrees V threads, top screwed for handwheel nut.

.12 Operator: see elsewhere this section.

2.4 VALVE OPERATORS

.1 Handwheel: on all 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 BYPASSES FOR GATE AND GLOBE VALVES

.1 Locations: on valves as indicated.

.2 Position of bypass valve on main valves.

.3 Size of bypass valve:

.1 Main valve up to NPS 8: NPS 3/4.

.4 Type of bypass valves:

.1 On gate valve: globe, with composition disc, bronze trim, to Section 23 05 22 - Valves - Bronze.

.2 On globe valve: globe, with composition disc, bronze trim, to Section 23 05 22 - Valves - Bronze.

2.6 CHECK VALVES

.1 NPS 2 1/2 and over, flanged or butt-weld ends, Class 300: swing check.
- .1 Body and multiple-bolted cap: cast steel to ASTM A216/A216M WCB.
- .2 Cap studs: to ASTM A193/A193M Type B7.
- .3 Cap nuts: to ASTM A194/A194M Type 2H.
- .4 Body/cap joint: male-female face with corrugated metallic gasket.
- .5 Disc: heat treated corrosion and heat resistant 13% chromium steel.
- .6 Seat rings: heat treated corrosion and heat resistant 13% chromium steel, slipped in, seal welded, ground to match disc.
- .7 Hinge: cast carbon steel.
- .8 Hinge pin: stainless steel (410).

2.7 SILENT CHECK VALVES

.1 Construction:
- .1 Body: Cast steel to ASTM A216 WCB with integral seat.
- .2 Pressure rating: Class 300.
- .3 Connections: Flanged or Wafer ends.
- .4 Double bronze disc with SS seat and stem. Renewable disc, seat, stem and spring. Spring rating must match system design for silent operation and installation.
- .5 Stainless steel spring, heavy duty.
- .6 Seat: regrindable.

3 Execution

3.1 INSTALLATION

.1 Install in accordance with manufacturer's recommendations in upright position with stem above horizontal.

.2 Install valves with unions or flanges to each piece of equipment arranged to allow servicing, maintenance, and equipment removal. Refer to Section 23 05 05 Installation of Pipework.

END OF SECTION

1 General

1.1 SUMMARY

.1 Section Includes:
  .1 Plug Valves - Lubricated plug valves, Eccentric plug valves.
.2 Sustainable requirements for construction and verification.

1.2 REFERENCES

.1 American National Standards Institute (ANSI)/ American Society of Mechanical Engineers (ASME).
  .1 ANSI/ASME B1.20.1-1983 (R2001), Pipe Threads, General Purpose (Inch).
  .2 ANSI/ASME B16.1-1998, Cast Iron Pipe Flanges and Flanged Fittings.
  .3 ANSI/ASME B16.11-2001, Forged Fittings, Socket-Welding and Threaded.
  .4 ANSI/ASME B16.25-1997, Buttwelding Ends.
  .5 ANSI/ASME B16.34-1996, Valves - Flanged, Threaded and Welding End.
  .6 ANSI/ASME B16.10-2000, Face to Face and End to End Dimensions of Valves.

.2 American Society for Testing and Materials International (ASTM).
  .1 ASTM A126-95 (2000), Specification for Gray Iron Castings for Valves, Flanges, and Pipe Fittings.
  .2 ASTM B62-02, Specification for Composition Bronze or Ounce Metal Castings.
  .3 ASTM B209-04, Specification for Aluminum and Aluminum-Alloy Sheet and Plate.

.3 Manufacturer's Standardization Society of the Valves and Fittings Industry Inc. (MSS).
  .1 MSS SP-78-1998, Cast Iron Plug Valves, Flanged and Threaded Ends.

1.3 SUBMITTALS

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

.2 Product Data: submit WHMIS MSDS - Material Safety Data Sheets in accordance with Section 02 81 01 - Hazardous Materials.
  .1 Submit shop drawings and product data in accordance with Section 01 33 00 - Submittal Procedures.
  .2 Submit product data in accordance with Section 01 33 00 - Submittal Procedures.
  .3 Submit data for valves specified this Section.

.3 Closeout Submittals:
  .1 Submit maintenance data for incorporation into manual specified in 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 29.06 - Health and Safety Requirements.

2 Products

2.1 MATERIAL

.1 Valves:
  .1 Except for specialty valves, to be of single manufacturer.
  .2 Products to have CRN registration number.

2.2 ECCENTRIC PLUG VALVES

.1 General:
- .1 Dead-tight shut-off on liquids and gases at pressure differentials up to 1.2 MPa in forward direction, 520 kPa in reverse direction.

.2 Up to NPS 2, screwed ends:
- .1 Body: cast iron to ASTM B209 Class B.
- .2 Plug:
  - .1 NPS 1/2 and 3/4: bronze to ASTM B62.
  - .2 NPS 1 to NPS 2: bronze to ASTM B62.
- .3 Bearings: permanently lubricated, bronze to ASTM B62 in upper and lower journals.
- .4 Seals: double-seal consisting of:
  - .1 Plastic seat coating between plug and body.
  - .2 Resilient seal moulded into groove in plug face.
  - .3 Seal materials: BUNA Stem seals with Neoprene (gas service) plug seals.
  - .4 VITON stem seals with Fluorinated hydrocarbon plug seals (over 149 deg.C).
  - .5 Isobutene Isoprene stem seal with isobutene-isoprene plug seals (up to 121 deg.C)
- .5 End connections: screwed.
- .6 Operators: lever with adjustable memory stop.

.3 NPS 2 1/2 to NPS 4, flanged ends:
- .1 Body: cast iron to ASTM B209 Class B.
- .2 Plug: nickel-plated cast iron to ANSI.
- .3 Bearings: permanently lubricated, bronze to ASTM B62 in upper and lower journals.
- .4 Seals: double-seal consisting of:
  - .1 Plastic seat coating between plug and body.
  - .2 Resilient seal moulded into groove in plug face.
  - .3 Seal materials: BUNA Stem seals with Neoprene plug seals (gas service)
  - .4 VITON stem seals with Fluorinated hydrocarbon plug seals (over 149 deg.C).
  - .5 Isobutene Isoprene stem seal with isobutene-isoprene plug seals (up to 121 deg.C)
- .5 End connections: flanged to ANSI B16.1 or roll grooved.
- .6 Operators: lever.

2.3 LUBRICATED PLUG VALVES

.1 Principle of operation:
- .1 Special sealing compound used to effect tight seal. When line pressure applied to valve in closed position, parallel plug forced against downstream side of valve. The metal-to-metal contact and sealing compound ensures leak-tight seal.

.2 Testing to specifications: MSS SP-78 for non-shock pressure at specified temperature.

.3 End connections:
- .1 NPS 1/2 to 2: screwed ends.
- .2 NPS 2½ to 12: flanged ends.

.4 Valve:
- .1 Body: cast iron to ASTM A126 Class B semi-steel.
- .2 Pressure rating: NPS 1/2 to 12:
  - .1 Screwed end valves: screwed to NPT standards.

.2 Flanged end valves: flanged to ANSI B16.1 Class 300. Flanged valves NPS 2-8 face dimensions in accordance with ANSI B16.10 short pattern, making them interchangeable with Class 300 flanged cast iron gate valves.

.3 Hydrostatic tests: body 300 psig. Seat: 100 psig.

.3 Plug: tapered, with regular pattern port - 90 degrees from full open to fully closed, complete with PFTE thrust ring: 100% full port.

.4 Number of ports: as required.

.5 Ends: with ends screwed to ANSI B1.20.1, butt welding to ANSI B16.25, socket-welding to ANSI B16.11.

.6 Lubrication system, nickel-plated.

.7 Lubricant: to suit type, temperature and pressure of contained fluid.

.8 Provide sealing compound injection gun designed for use with pre-packed sealing compound cartridges and valve fitted with button head nipples and combination sealing screws.

.9 Feeding system: lubricant forced into lubrication grooves between seating surfaces of plug and body to form positive seal, leakproof operation, and corrosion preventing film. Lubricant receptacle to hold additional lubricant. Lubricant screw for lubrication. Check valve to prevent reverse flow of lubricant. O-rings between body and plug.

.5 Operator:

.1 Up to NPS 5: manual lever.

.6 3 port and 4 port valves:

.1 To be supplied transflow pattern, to allow reduced flow through ports during rotation of plug from one position to another.

.2 Limit stops: to be provided.

.7 Accessories: lubricant gun.

3 Execution

3.1 INSTALLATION OF LUBRICATED PLUG VALVES

.1 Install with line pressure acting to hold plug against body ports which are to be cut-off from higher pressure.

END OF SECTION

1 General

1.1 SUMMARY

.1 Section Includes:
  .1 Butterfly Valves.
.2 Sustainable requirements for construction and verification.

1.2 REFERENCES

.1 American National Standards Institute (ANSI)/American Society of Mechanical Engineers (ASME).
  .1 ANSI/ASME B1.20.1-1983 (R2001), Pipe Threads, General Purpose (Inch).
  .2 ANSI/ASME B16.1-1998, Cast Iron Pipe Flanges and Flanged Fittings.
  .3 ANSI/ASME B16.5-03, Pipe Flanges and Flanged Fittings.
  .4 ANSI/ASME B16.11-01, Forged Fittings, Socket-Welding and Threaded.
  .5 ANSI/ASME B16.25-1997, Buttwelding Ends.
  .6 ANSI/ASME B16.34-1996, Valves - Flanged, Threaded and Welding Ends.

.2 American National Standards Institute (ANSI)/American Petroleum Institute (API).
  .1 ANSI/API 609-1997, Lug- and Water-Type Butterfly Valves.

.3 American Society for Testing and Materials International, (ASTM).
  .1 ASTM A126-95 (01), Specification for Gray Iron Castings for Valves, Flanges, and Pipe Fittings.
  .2 ASTM B62-02, Specification for Composition Bronze or Ounce Metal Castings.
  .3 ASTM B209M-04, Specification for Aluminum and Aluminum-Alloy Sheet and Plate.

.4 Manufacturers Standardization Society of the Valve and Fittings Industry, Inc. (MSS).
  .1 MSS SP-67-02, Butterfly Valves.

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 81 01 - Hazardous Materials.
  .1 Submit shop drawings and product data in accordance with Section 01 33 00 - Submittal Procedures.
  .2 Submit product data in accordance with Section 01 33 00 - Submittal Procedures.
  .3 Submit data for valves specified this section.

.3 Closeout Submittals:
  .1 Submit maintenance data for incorporation into manual specified in 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 29.06 - Health and Safety Requirements.

2 Products

2.1 BUTTERFLY VALVES - RESILIENT SEAT - 300 PSIG

.1 Sizes: Lug type: NPS 2 to 48.

.2 Pressure rating: 300 psig at 135 degrees C.

.3 Lug body: 300 ANSI bolt pattern.

.4 Full lug body (threaded).

.5 Application: for on-off service.

.6 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.
- .2 Install parallel or perpendicular to pipeline.

.7 Designed to comply with MSS SP-67 and API 609.

.8 Compatible with ANSI B16.1 Class 250 (iron) and ANSI B16.5 Class 300 (steel) flanges.

.9 Construction:
- .1 Body: ductile iron.
- .2 Disc: aluminum bronze.
- .3 Seat: EPDM.
- .4 Shaft: NPS 2 - 12: 416 stainless steel.
- .5 Taper pin: 316 SS.
- .6 Blowout proof stem.
- .7 O-Ring: Buna-N.
- .8 Bushings: teflon.
- .9 Disc shall not be pinned to shaft.
- .10 Bubble tight shutoff with downstream flanges removed, class 6 shutoff.

2.2 MOUNTING FLANGES

.1 Class 300 steel to B16.5 pipe flanges.

2.3 ELECTRIC ACTUATORS

.1 Operation: designed to provide precise quarter turn electric operation.
- .1 Torque range: up to 1.130 N-m and speed ranges from 10 seconds to 30 seconds to move from fully open to fully closed.
- .2 Gear train within actuator to provide smooth continuous rotary power stroke for accurate automatic valve positioning. Factory-set, field adjustable cam-actuated travel limit switches to provide precise control of shaft rotation.

.2 Construction:
- .1 Castings: heavy duty industrial grade for rugged use.

.2 Actuators: continuous duty with high efficiency single phase reversing capacitor motor with thermal overload protection.
.3 Gears and pinions constructed from hardened steel.
.4 Gear train to be permanently lubricated.
.5 Mechanical brake to ensure that gear is locked in precise position.

.3 Electrical:
.1 Standard voltage: 120 VAC. 60 Hz.
.2 Control options: 4-20 Ma DC or 0-10 V DC.
.3 CSA approved.
.4 Electrical rating: NEMA IV.

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.

3.3 ACTUATOR INSTALLATION

.1 Electrical connections to be made by actuator manufacturer.

.2 Cycle valve operation from fully closed to fully open then back to fully closed.

.3 At same time, check travel stop settings for proper disc alignment.

1 General

1.1 SUMMARY

.1 Section Includes:
- .1 Concrete housekeeping pads, hangers and supports for mechanical piping, ducting and equipment.

.2 Sustainable requirements for construction and verification.

1.2 REFERENCES

.1 American National Standards Institute/American Society of Mechanical Engineers (ANSI/ASME)
- .1 ANSI/ASME B31.1-04, Power Piping.

.2 American Society for Testing and Materials International (ASTM)
- .1 ASTM A125-1996 (R2001), Specification for Steel Springs, Helical, Heat-Treated.
- .2 ASTM A307-04, Specification for Carbon Steel Bolts and Studs, 60,000 PSI Tensile Strength.
- .3 ASTM A563-04a, Specification for Carbon and Alloy Steel Nuts.

.3 Factory Mutual (FM)

.4 Health Canada/Workplace Hazardous Materials Information System (WHMIS)
- .1 Material Safety Data Sheets (MSDS).

.5 Manufacturer's Standardization Society of the Valves and Fittings Industry (MSS)
- .1 MSS SP58-2002, Pipe Hangers and Supports - Materials, Design and Manufacture.
- .2 ANSI/MSS SP69-2003, Pipe Hangers and Supports - Selection and Application.
- .3 MSS SP89-2003, Pipe Hangers and Supports - Fabrication and Installation Practices.

.6 Underwriter's Laboratories of Canada (ULC)

1.3 SYSTEM DESCRIPTION

.1 Design Requirements:
- .1 Construct pipe hanger and support to manufacturer's recommendations utilizing manufacturer's regular production components, parts and assemblies.
- .2 Base maximum load ratings on allowable stresses prescribed by ASME B31.1 or MSS SP58.
- .3 Ensure that supports, guides, anchors do not transmit excessive quantities of heat to building structure.
- .4 Design hangers and supports to support systems under conditions of operation, allow free expansion and contraction, prevent excessive stresses from being introduced into pipework or connected equipment and prevent vibration.
- .5 Provide for vertical adjustments after erection and during commissioning. Amount of adjustment in accordance with MSS SP58.

.6 Pipe supports shall meet the requirements of ASME B31.1 Power Piping and ASME B31.9 Building Services Piping.
.7 Automatic sprinkler pipe supports shall meet the requirements of NFPA No. 13, Standard for Installation of Sprinkler Systems.
.8 Install supports of strength and rigidity to suit loading without unduly stressing building. Locate adjacent to equipment to prevent undue stresses in piping and equipment.
.9 Select hangers and supports for the service and in accordance with the manufacturer's recommended maximum loading. Hangers shall have a safety factor of 5 to 1.
.10 Fasten hangers and supports to building steel in accordance with the requirements of Structural or inserts in concrete construction. Equipment, piping and ductwork shall be supported from the top chords of trusses/beams, supporting off bottom is not permitted.
.11 Provide and set sleeves required for equipment, including openings required for placing equipment.
.12 Obtain approval prior to drilling for inserts and supports for piping systems.
.13 Obtain approval prior to using percussion type fastenings.
.14 Use of other piping or equipment for hanger supports is not permitted.
.15 Use of perforated band iron, wire or chain as hangers is not permitted.

1.4 QUALITY ASSURANCE

.1 Health and Safety:
.1 Do construction occupational health and safety in accordance with Section 01 35 29.06 - Health and Safety Requirements.

2 Products

2.1 GENERAL

.1 Fabricate hangers, supports and sway braces in accordance with ASME B31.1, ASME B31.9 and MSS SP58.

.2 Use components for intended design purpose only. Do not use for rigging or erection purposes.

.3 Design hangers so they cannot become disengaged by movements of supported pipe.

2.2 PIPE HANGERS

.1 Finishes:
.1 Pipe hangers and supports: galvanized after manufacture.
.2 Use electro-plating galvanizing process or hot dipped galvanizing process.
.3 Ensure steel hangers in contact with copper piping are copper plated.

.2 Upper attachment structural: suspension from lower flange of I-Beam:
.1 Cold piping NPS 2 maximum: malleable iron C-clamp with hardened steel cup point setscrew, locknut and carbon steel retaining clip.
.1 Rod: to be UL listed.

.2 Cold piping NPS 2 1/2 or greater, hot piping: malleable iron beam clamp, eye rod, jaws and extension with carbon steel retaining clip, tie rod, nuts and washers, UL listed to MSS-SP58 and MSS-SP69.

.3 Upper attachment structural: suspension from upper flange of I-Beam:
- .1 Cold piping NPS 2 maximum: ductile iron top-of-beam C-clamp with hardened steel cup point setscrew, locknut and carbon steel retaining clip, UL listed to MSS SP69.
- .2 Cold piping NPS 2 1/2 or greater, hot piping: malleable iron top-of-beam jaw-clamp with hooked rod, spring washer, plain washer and nut UL listed.

.4 Upper attachment to concrete:
- .1 Ceiling: carbon steel welded eye rod, clevis plate, clevis pin and cotters with weldless forged steel eye nut. Ensure eye 6 mm minimum greater than rod diameter.
- .2 Concrete inserts: wedge shaped body with knockout protector plate UL listed to MSS SP69.

.5 Shop and field-fabricated assemblies:
- .1 Trapeze hanger assemblies: Steel channels with welded spacers and hanger rods, cast iron roll and stand for hot pipe sizes 150 mm and over.
- .2 Steel brackets: Welded and wrought steel clamp.

.6 Hanger rods: threaded rod material to MSS SP58:
- .1 Ensure that hanger rods are subject to tensile loading only.
- .2 Provide linkages where lateral or axial movement of pipework is anticipated.
- .3 Threaded both ends, one end or continuous.

.7 Pipe attachments: material to MSS SP58:
- .1 Attachments for steel piping: carbon steel black.
- .2 Attachments for copper piping: copper plated black steel.
- .3 Use insulation shields for hot pipework.
- .4 Oversize pipe hangers and supports.

.8 Adjustable clevis: material to MSS SP69 UL listed, clevis bolt with nipple spacer and vertical adjustment nuts above and below clevis.
- .1 Ensure "U" has hole in bottom for rivetting to insulation shields.

.9 Yoke style pipe roll: carbon steel yoke, rod and nuts with cast iron roll, to MSS SP69.

.10 U-bolts: carbon steel to MSS SP69 with 2 nuts at each end to ASTM A563.
- .1 Finishes for steel pipework: black.
- .2 Finishes for copper, glass, brass or aluminum pipework: black, with formed portion plastic coated.

.11 Pipe rollers: cast iron roll and roll stand with carbon steel rod to MSS SP69.

.12 Wall Support:
- .1 Up to 75 mm: Cast iron hook.
- .2 100 mm and over: Welded steel bracket and wrought steel clamp.

.13 Floor Support:
- .1 Pipe sizes up to 100 mm and all cold pipe sizes: Cast iron adjustable pipe saddle, locknut nipple, floor flange and concrete pier to steel support.
- .2 Hot pipe sizes 150 mm and over: Adjustable cast iron roll and stand, steel screws and concrete pier or steel support.

.14 Insulation:
- .1 Supports shall be coordinated with requirements of insulation. Oversized hangars are required for all pipe systems that require insulation with a vapour barrier to maintain integrity of vapour barrier.
- .2 Oversized hangars shall also be required for steam pipe systems.

2.3 WIRE ROPE PIPE AND DUCT HANGERS

.1 Wire Rope Suspension Systems:
- .1 Wire rope suspension systems shall be ULC, CSA and SMACNA approved and tested.
- .2 Wire suspensions systems shall consist of a pre-formed wire rope sling with either a ferruled loop, permanently fixed threaded ¼" (or 3/8") stud, or permanently fixed nipple end with toggle, at one end or hook or eyelet. The end fixings and the wire must be of the same manufacturer. The system is secured and tensioned with a hanger self-locking grip at the other end. System shall incorporate pipe hangars. Pipe hangars shall not penetrate vapour barrier of chilled water pipe insulation.
- .3 Only wire and or supports supplied and or approved, shall be used with the system installed.
- .4 The Contractor shall select the correct specification of wire hanger to use for supporting each particular service from table 1 below. Each size is designated with a maximum Safe Working Load Limit (which incorporates a 5:1 safety factor). The correct specification of wire hanger required is determined using the following formula:

  Weight per metre of object suspended (kg) x Distance between suspension points (m) = Weight loading per hanger suspension point (kg)

  Table 1 Wire Hanger Safe Working Loads

Size	Working Load Limit (kg)	Working Load Limit (lbs)
No. 1	0 - 10 kg	0 - 22 lbs
No. 2	10.5 - 45.5 kg	23 - 100 lbs
No. 3	46 - 91 kg	101 - 200 lbs
No. 4	95.5 - 225 kg	210 - 495 lbs
No. 5	225.5 - 325 kg	496 - 715 lbs

- .5 Where the installed wire rope is not vertical then the working load limit shall be reduced in accordance with the recommendations given in the manufacturer's handbook.
- .6 The Contractor shall select and use the correct length of wire rope required to support the service.
- .7 No in-line joins shall be permitted in the rope.
- .8 Solid trapeze hangars may be used to suspend piping routed together, where wire support can be coordinated with ceiling and still ensure pipes are routed at highest point possible (tight to beams).

2.4 RISER CLAMPS

.1 Steel or cast iron pipe: black carbon steel to MSS SP58, type 42, UL listed.

.2 Copper pipe: carbon steel copper plated to MSS SP58, type 42.

.3 Bolts: to ASTM A307.

.4 Nuts: to ASTM A563.

2.5 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.

2.6 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.

2.7 VARIABLE SUPPORT SPRING HANGERS

.1 Vertical movement: 13 mm minimum, 50 mm maximum, use single spring pre-compressed variable spring hangers.

.2 Vertical movement greater than 50 mm: use double spring pre-compressed variable spring hanger with 2 springs in series in single casing.

.3 Variable spring hanger complete with factory calibrated travel stops. Provide certificate of calibration for each hanger.

.4 Steel alloy springs: to ASTM A125, shot peened, magnetic particle inspected, with +/-5 % spring rate tolerance, tested for free height, spring rate, loaded height and provided with CMTR.

2.8 EQUIPMENT SUPPORTS

.1 Fabricate equipment supports not provided by equipment manufacturer from structural grade steel meeting requirements of Section 05 50 00 - Metal Fabrications.

2.9 EQUIPMENT ANCHOR BOLTS AND TEMPLATES

.1 Provide templates to ensure accurate location of anchor bolts.

2.10 HOUSEKEEPING PADS

.1 Provide 100 mm high concrete housekeeping pads for base-mounted equipment; size pads 50 mm larger than equipment; chamfer pad edges.

.2 Concrete: to Section 03 30 00 - Cast-in-place Concrete.

2.11 SLEEVES

.1 Pipes through floors: Form with 18 gauge galvanized steel.

.2 Pipes through beams, walls, fire proofing, footings, potentially wet floor: Form with steel pipe or 18 gauge galvanized steel.

.3 Size large enough to allow for movement due to expansion and to provide for continuous insulation.

2.12 OTHER EQUIPMENT SUPPORTS

.1 Fabricate equipment supports from structural grade steel meeting requirements of Section 05 50 00 - Metal Fabrications.

.2 Submit structural calculations with shop drawings.

3 Execution

3.1 MANUFACTURER'S INSTRUCTIONS

.1 Compliance: comply with manufacturer's written recommendations or specifications, including product technical bulletins, handling, storage and installation instructions, and datasheet.

3.2 INSTALLATION

.1 Install in accordance with:
- .1 Manufacturer's instructions and recommendations.

.2 Vibration Control Devices:
- .1 Install on piping systems at pumps, at all vibration isolated equipment and as indicated.

.3 Clamps on riser piping:
- .1 Support independent of connected horizontal pipework using riser clamps and riser clamp lugs welded to riser.
- .2 Bolt-tightening torques to industry standards.
- .3 Steel pipes: install below coupling or shear lugs welded to pipe.
- .4 Cast iron pipes: install below joint.

.4 Clevis plates:
.1 Attach to concrete with 4 minimum concrete inserts, one at each corner.

.5 Provide supplementary structural steelwork where structural bearings do not exist or where concrete inserts are not in correct locations.

.6 Use approved constant support type hangers where:
.1 Vertical movement of pipework is 13 mm or more,
.2 Transfer of load to adjacent hangers or connected equipment is not permitted.

.7 Use variable support spring hangers where:
.1 Transfer of load to adjacent piping or to connected equipment is not critical.
.2 Variation in supporting effect does not exceed 25% of total load.

.8 Installation of Exposed Pipe and Duct Hangers:
.1 Exposed pipe and duct shall be any pipe/duct visible to the occupants. This does not include piping and ductwork routing above dropped ceilings.
.2 Exposed Pipe and Duct hangers shall be a Wire Rope Suspension System.

3.3 INSERTS

.1 Use inserts for suspending hangers for reinforced concrete slabs and sides of reinforced concrete beams wherever practicable.

.2 Set inserts in position in advance of concrete work. Provide reinforcement rod in concrete for inserts carrying pipe over 100 mm.

.3 Where concrete slabs form finished ceiling, finish inserts flush with slab surface.

.4 Where inserts are omitted, drill through concrete slab from below and provide rod with recessed square steel plate and nut above slab.

3.4 HANGER SPACING

.1 Plumbing piping: to Canadian Plumbing Code, Provincial Code, authority having jurisdiction.

.2 Fire protection: to applicable Fire Code.

.3 Copper piping: up to NPS 1/2: every 1.5 m.

.4 Flexible joint roll groove pipe: in accordance with table below, but not less than one hanger at joints.

.5 Within 300 mm of each elbow.

Maximum Pipe Size : NPS	Maximum Spacing Steel	Maximum Spacing Copper	Rod Diameter
up to 32 mm	1.8 m	1.8 m	9.5 mm
38 mm	1.8 m	1.8 m	9.5 mm

Maximum Pipe Size : NPS	Maximum Spacing Steel	Maximum Spacing Copper	Rod Diameter
50 mm and 63 mm	3.0 m	3.0 m	9.5 mm
75 mm - 100 mm	3.6 m	3.0 m	15.8 mm
150 mm - 200 mm	4.3 m	4.3 m	22.2 mm

.6 Install hangers to provide a minimum 12 mm clear space between finished covering and adjacent work.

3.5 HANGER INSTALLATION

.1 Install hanger so that rod is vertical under operating conditions.

.2 Adjust hangers to equalize load.

.3 Support from structural members. Where structural bearing does not exist or inserts are not in suitable locations, provide supplementary structural steel members.

.4 Use hangers which are vertically adjustable 38 mm minimum after piping is erected.

.5 Support horizontal soil pipe near each hub, with 1.5 m maximum spacing between hangers.

.6 Support vertical piping at every other floor. Support vertical soil pipe at each floor at hub.

.7 Where several pipes can be installed in parallel and at same elevation, provide multiple or trapeze hangers.

.8 Where practical, support riser piping independently of connected horizontal piping.

.9 Hangers: Pipe sizes 12 mm to 38 mm: Adjustable wrought steel ring.

.10 Hangers: Pipe sizes 50 mm to 100 mm and Cold Pipe Sizes: Adjustable wrought steel clevis.

3.6 SLEEVES

.1 Set sleeves in position in advance of concrete work. Provide suitable reinforcing around sleeves.

.2 Extend sleeves through potentially wet floors 25 mm above finished floor level. Caulk sleeves full depth and provide floor plate.

.3 Where piping passes through floor, ceiling or wall close off space between pipe or duct and construction with non-combustible insulation. Provide tight fitting metal caps on both sides and caulk.

.4 Install chrome plated escutcheons where piping passes through finished surfaces.

.5 All penetrations through fire rated walls, floors or partition assemblies shall be sealed/fire stopped with fire stop materials that will remain in place and prevent the passage of smoke, toxic gases, flame, etc., when subjected to the standard test method Can 4-S115, "Standard Method of Fire Tests for Firestop Systems" for a period of time equal to fire protection rating required for the grade of fire separation of the penetrated wall or floor.

.6 Acceptable Product: According to instructions provided, all penetrations in fire rated walls, floors, or partition assemblies shall be sealed/fire stopped with:
- .1 3M Brand Intumescent, "Fire Barrier" Caulk CP-25, Putty 303, Penetration Sealing Systems 7902 or 7904 Series, Composite Sheet CS-195, or Wrap Strip FS-195.
- .2 Tremco Firestop Systems: Fyresil, Fyreshield for penetrations and perimeters. Dymeric ULC, THC 900 ULC

3.7 HORIZONTAL MOVEMENT

.1 Angularity of rod hanger resulting from horizontal movement of pipework from cold to hot position not to exceed 4 degrees from vertical.

.2 Where horizontal pipe movement is less than 13 mm, offset pipe hanger and support so that rod hanger is vertical in the hot position.

3.8 FINAL ADJUSTMENT

.1 Adjust hangers and supports:
- .1 Ensure that rod is vertical under operating conditions.
- .2 Equalize loads.

.2 Adjustable clevis:
- .1 Tighten hanger load nut securely to ensure proper hanger performance.
- .2 Tighten upper nut after adjustment.

.3 C-clamps:
- .1 Follow manufacturer's recommended written instructions and torque values when tightening C-clamps to bottom flange of beam.

.4 Beam clamps:
- .1 Hammer jaw firmly against underside of beam.

END OF SECTION

1 General

1.1 SECTION INCLUDES

.1 Inertia bases.
.2 Vibration isolation.

1.2 PERFORMANCE REQUIREMENTS

.1 Provide vibration isolation on all mechanical motor driven equipment plus connected piping and ductwork.

.2 Supply vibration isolation equipment and materials by one supplier. Consider side loading of equipment and inertia bases when calculating maximum loads on isolators.

.3 Ensure equipment is sufficiently rigid for isolator point loading.

.4 Provide and install mechanical equipment so that Average Noise Criteria Curves, as outlined in ASHRAE Guide, are not exceeded.

.5 Consider upper floor locations critical unless otherwise indicated.

.6 Use concrete inertia bases where indicated and for fans having static pressure in excess of 0.85 kPa or motors in excess of 30 kW, and on base mounted pumps over 7.5 kW.

1.3 SUBMITTALS

.1 Section 01 33 00: Procedures for submittals.

.2 Shop Drawings: Indicate inertia bases and locate vibration isolators, with static and dynamic load on each.

.3 Product Data: Provide schedule of vibration isolator type with location and load on each.

.4 Manufacturer's Installation Instructions: Indicate special procedures and setting dimensions.

.5 Manufacturer's Certificate: Certify that isolators are properly installed and adjusted to meet or exceed specified requirements.

1.4 PROJECT RECORD DOCUMENTS

.1 Section 01 78 00: Submittals for project closeout.

.2 Record actual locations of isolation including attachment points.

2 Products

2.1 VIBRATION ISOLATORS

.1 Open Spring Isolators:
- .1 Spring Isolators:
  - .1 For Exterior and Humid Areas: Provide hot dipped galvanized housings and neoprene coated springs.
  - .2 Code: Colour code springs for load carrying capacity.
- .2 Springs: Minimum horizontal stiffness equal to 75 percent vertical stiffness, with working deflection between 0.3 and 0.6 of maximum deflection.
- .3 Spring Mounts: Provide with levelling devices, minimum 6 mm thick neoprene sound pads, and zinc chromate plated hardware.
- .4 Sound Pads: Size for minimum deflection of 1.2 mm; meet requirements for neoprene pad isolators.

.2 Restrained Spring Isolators:
- .1 Spring Isolators:
  - .1 For Exterior and Humid Areas: Provide hot dipped galvanized housings and neoprene coated springs.
  - .2 Code: Colour code springs for load carrying capacity.
- .2 Springs: Minimum horizontal stiffness equal to 75 percent vertical stiffness, with working deflection between 0.3 and 0.6 of maximum deflection.
- .3 Spring Mounts: Provide with levelling devices, minimum 6 mm thick neoprene sound pads, and zinc chromate plated hardware.
- .4 Sound Pads: Size for minimum deflection of 1.2 mm; meet requirements for neoprene pad isolators.
- .5 Restraint: Provide heavy mounting frame and limit stops.

.3 Closed Spring Isolators:
- .1 Spring Isolators:
  - .1 For Exterior and Humid Areas: Provide hot dipped galvanized housings and neoprene coated springs.
  - .2 Code: Colour code springs for load carrying capacity.
- .2 Type: Closed spring mount with top and bottom housing separated with neoprene rubber stabilizers.
- .3 Springs: Minimum horizontal stiffness equal to 75 percent vertical stiffness, with working deflection between 0.3 and 0.6 of maximum deflection.
- .4 Housings: Incorporate neoprene isolation pad meeting requirements for neoprene pad isolators, and neoprene side stabilizers with minimum 7 mm clearance.

.4 Restrained Closed Spring Isolators:
- .1 Spring Isolators:
  - .1 For Exterior and Humid Areas: Provide hot dipped galvanized housings and neoprene coated springs.
  - .2 Code: Colour code springs for load carrying capacity.
- .2 Type: Closed spring mount with top and bottom housing separated with neoprene rubber stabilizers.
- .3 Springs: Minimum horizontal stiffness equal to 75 percent vertical stiffness, with working deflection between 0.3 and 0.6 of maximum deflection.

.4 Housings: Incorporate neoprene isolation pad meeting requirements for neoprene pad isolators, and neoprene side stabilizers with minimum 7 mm clearance and limit stops.

.5 Spring Hanger:
- .1 Spring Isolators:
  - .1 For Exterior and Humid Areas: Provide hot dipped galvanized housings and neoprene coated springs.
  - .2 Code: Colour code springs for load carrying capacity.
- .2 Springs: Minimum horizontal stiffness equal to 75 percent vertical stiffness, with working deflection between 0.3 and 0.6 of maximum deflection.
- .3 Housings: Incorporate neoprene isolation pad meeting requirements for neoprene pad isolators.
- .4 Misalignment: Capable of 20 degree hanger rod misalignment.

.6 Neoprene Pad Isolators:
- .1 Rubber or neoprene waffle pads.
  - .1 30 durometer.
  - .2 Minimum 13 mm thick.
  - .3 Maximum loading 275 kPa.
  - .4 Height of ribs: maximum 0.7 times width.
- .2 Configuration: Single layer.

.7 Rubber Mount or Hanger: Moulded rubber designed for 13 mm deflection with threaded insert.

.8 Glass Fibre Pads: Neoprene jacketed pre-compressed moulded glass fibre.

3 Execution

3.1 INSTALLATION

.1 Install to manufacturer's written instructions.

.2 Install isolation for mechanical motor driven equipment throughout, unless specifically noted otherwise

.3 Install spring hangers without binding.

.4 On closed spring isolators, adjust so side stabilizers are clear under normal operating conditions.

.5 Prior to making piping connections to equipment with operating weights substantially different from installed weights, block up equipment with temporary shims to final height. When full load is applied, adjust isolators to load to allow shim removal.

.6 Provide pairs of horizontal limit springs on fans with more than 1.5 kPa static pressure, and on hanger supported, horizontally mounted axial fans.

.7 Provide resiliently mounted equipment, piping, and ductwork with seismic snubbers. Provide each inertia base with minimum of four seismic snubbers located close to isolators. Snub equipment designated for post disaster use to 1.5 mm maximum clearance. Provide other snubbers with clearance between 4 mm and 7 mm.

.8 Support piping connections to isolated equipment resiliently for scheduled distance.
- .1 Up to 100 mm Diameter: First three points of support.
- .2 125 to 200 mm Diameter: First four points of support.
- .3 250 mm Diameter and Over: First six points of support.
- .4 Static deflection of first point shall be twice deflection of equipment. The next two hangers closest to vibration source shall have the greater deflection of 25 mm static deflection or static deflection of isolated equipment. Select remaining isolators for minimum 25 mm static deflection or 1/2 static deflection of isolated equipment.

.9 Connect wiring to isolated equipment with flexible hanging loop.

3.2 MANUFACTURER'S FIELD SERVICES

.1 Examine systems to Section 01 45 00.

.2 Inspect isolated equipment after installation and submit report. Include static deflections.

3.3 EQUIPMENT ISOLATION SCHEDULE

	ISOLATED EQUIPMENT	BASE Thickness	ISOLATOR Type	Deflection
.1	Outdoor Condensing Units	On concrete pad	Rubber	
.2	Fans	Suspended	Spring	2"

END OF SECTION

1 General

1.1 SECTION INCLUDES

.1 Materials and requirements for the identification of piping systems, duct work, valves and controllers, including the installation and location of identification systems

1.2 REFERENCES

.1 ASME A13.1 - Scheme for the Identification of Piping Systems.

1.3 SUBMITTALS

.1 Section 01 33 00: Procedures for submittals.

.2 Submit list of wording, symbols, letter size, and colour coding for mechanical identification.

.3 Submit valve chart and schedule, including valve tag number, location, function, and valve manufacturer's name and model number.

.4 Product Data: Provide manufacturers catalogue literature for each product required.

1.4 PROJECT RECORD DOCUMENTS

.1 Section 01 78 00: Submittals for project closeout.

.2 Record actual locations of tagged valves.

2 Products

2.1 LANGUAGE

.1 Identification in English.

2.2 PIPING SYSTEMS GOVERNED BY CODES

.1 Identification of Natural gas: to CSA/CGA B149.1 and authority having jurisdiction.

.2 Identification of Sprinkler System: to NFPA 13

2.3 NAMEPLATES

.1 3 mm thick laminated plastic or white anodized aluminum, matte finish, with square corners, letters accurately aligned and machine engraved into core.

.2 Colours:
- .1 Hazardous: red letters, white background
- .2 Elsewhere: black letters, white background (except where required otherwise by applicable Codes)

.3 Sizes: Conform to following table using a maximum of 25 characters per line.

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

Description: Laminated three-layer plastic with engraved black letters on light contrasting background colour.

2.4 TAGS

.1 Plastic Tags: Laminated three-layer plastic with engraved black letters on light contrasting background colour. Tag size minimum 40 mm diameter.

.2 Control Tag: Laminated plastic card with black letters on light contrasting background colour in multiple lines. Tag size minimum 85mm x 55mm. Inscriptions to include function and (where appropriate) fail-safe position

.3 Metal Tags: Brass with stamped letters; tag size minimum 40 mm diameter with smooth edges.

.4 Chart: Typewritten letter size list in anodized aluminum frame.

2.5 STENCILS

.1 Stencils: With clean cut symbols and letters of following size:

- .1 20-30 mm Outside Diameter of Insulation or Pipe: 200 mm long colour field, 15 mm high letters.
- .2 40-50 mm Outside Diameter of Insulation or Pipe: 200 mm long colour field, 20 mm high letters.
- .3 65-150 mm Outside Diameter of Insulation or Pipe: 300 mm long colour field, 30 mm high letters.
- .4 200-250 mm Outside Diameter of Insulation or Pipe: 600 mm long colour field, 65 mm high letters.
- .5 Over 250 mm Outside Diameter of Insulation or Pipe: 800 mm long colour field, 90 mm high letters.
- .6 Ductwork and Equipment: 65 mm high letters.

.2 Stencil Paint: As specified in Section 09 91 23.

2.6 PIPE MARKERS

.1 Colour: Conform to ASME A13.1.

.2 Plastic Pipe Markers: Factory fabricated, flexible, semi- rigid plastic, preformed to fit around pipe or pipe covering; minimum information indicating flow direction arrow and identification of fluid being conveyed.

.3 Plastic Tape Pipe Markers: Flexible, vinyl film tape with pressure sensitive adhesive backing and printed markings.

.4 Underground Plastic Pipe Markers: Bright coloured continuously printed plastic ribbon tape, minimum 150 mm wide by 0.10 mm thick, manufactured for direct burial service.

2.7 CEILING TACKS

.1 Description: Steel with 20 mm diameter colour coded head.

.2 Colour code as follows:
- .1 Yellow - HVAC equipment
- .2 Red - Fire dampers/smoke dampers
- .3 Green - Plumbing valves
- .4 Blue - Heating/cooling valves

2.8 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: where required to Workplace Hazardous Materials Information System (WHMIS) regulations.

.3 Legend: 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 Extent of background colour marking.

.7 Materials for background colour marking, legend, arrows:
- .1 Pipes and tubing 20 mm and smaller: waterproof and heat-resistant pressure sensitive plastic marker tags.
- .2 Other pipes: pressure sensitive plastic-coated cloth or vinyl with protective overcoating, waterproof contact adhesive undercoating, suitable for ambient of 100% RH and continuous operating temperature of 150 degrees C and intermittent temperature of 200 degrees C

.8 Colours and Legends:
- .1 Where not listed, obtain direction from Departmental Representative.

.2 Colours for legends, arrows: to following table:

Background colour:	Legend, arrows:
Yellow	BLACK
Green	WHITE
Red	WHITE

.3 Background colour marking and legends for piping systems:

Contents	Background colour marking	Legend
City water	Green	CITY WATER
Heating water Supply	Yellow	HEATING SUPPLY
Heating water Return	Yellow	HEATING RETURN
Low temp heating water supply	Yellow	LTHW SUPPLY
Low temp heating water return	Yellow	LTHW RETURN
Safety valve vent	Yellow	STEAM VENT
Domestic hot soft water	Green	DOM. HSW
Dom. Hot water recirculation	Green	DOM. HW CIRC
Domestic cold hard water supply	Green	DOM. CHW
Domestic cold soft water supply	Green	DOM. CSW
Sanitary	Green	SAN
Plumbing vent	Green	SAN. VENT
Natural gas	to Codes	
Gas regulator vents	to Codes	
Fire protection water	Red	FIRE PROT. WTR
Sprinklers	Red	SPRINKLERS

2.9 IDENTIFICATION OF DUCTING SYSTEMS

.1 50 mm high stencilled letters and directional arrows 150 mm long x 50 mm high.

.2 Colours: back, or co-ordinated with base colour to ensure strong contrast

2.10 VALVES AND CONTROLLERS

.1 Valves to be complete with brass tags with 12 mm stamped identification data filled with black paint coordinated with Valve Tag List.

.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.

.3 Controllers to be complete with controls laminated identification tag.

.4 Identify all control systems components including but not limited to equipment, components, controls, sensors with control tags specified in this section.

2.11 FIRE DAMPERS

.1 All new fire dampers shall be tagged with unique tag (FD-1, FD-2 etc.), 12 mm stamped identification data filled with black paint. Contractor shall compile a Fire Damper Tag List and include in O&M. List to identify fire damper tag and location in building.

2.12 EQUIPMENT WITHIN CEILING SPACE

.1 Provide identification (equipment labels and colour coded dots) on the ceiling for all equipment concealed within a ceiling space in addition to identification on equipment.

.2 Equipment Labels:

- .1 Colours: Black lettering on transparent background.
- .2 Height of letter: 5 mm.
- .3 T-bar ceilings: Label shall be located on the metal ceiling grid beside the ceiling tile that provides service access to the equipment. The label shall include the equipment tag and an arrow indicating the ceiling tile to remove for servicing and access to the equipment.
- .4 Solid ceilings: Label shall be located on the trim of the access panel used for servicing the equipment and include the equipment tag.

.3 Colour Coded Dots:

- .1 Confirm site standard colour coding with the Departmental Representative prior to commencing work. Coordinate with all trades.
- .2 Provide a Legend in the operating and maintenance manual identifying the colour coding utilized on site.
- .3 T-bar ceilings: Dot shall be located on the metal ceiling grid beside the ceiling tile that provides service access to the equipment.
- .4 Solid ceilings: Dot shall be located on the trim of the access panel used for servicing the equipment.

3 Execution

3.1 PREPARATION

.1 Degrease and clean surfaces to receive adhesive for identification materials.

.2 Prepare surfaces to Section 09 91 23 for stencil painting.

3.2 INSTALLATION

.1 Perform work in accordance with CAN/CGSB-24.3 except as specified otherwise.

.2 Install plastic nameplates with corrosive-resistant mechanical fasteners, or adhesive. Apply with sufficient adhesive to ensure permanent adhesion and seal with clear lacquer.

.3 Install tags with corrosion resistant chain.

.4 Apply stencil painting to Section 09 91 23.

.5 Install plastic pipe markers to manufacturer's written instructions.

.6 Install plastic tape pipe markers complete around pipe to manufacturer's written instructions.

.7 Install underground plastic pipe markers 150 to 200 mm below finished grade, directly above buried pipe.

.8 Identify equipment including air handling units, pumps, heat transfer equipment, tanks, and water treatment devices with plastic nameplates. Small devices, such as small in-line pumps, may be identified with tags.

.9 Identify control panels and major control components outside panels with control tags.

.10 Identify thermostats relating to terminal boxes or valves with nameplates.

.11 Identify valves in main and branch piping with tags.

.12 Identify air terminal units and radiator valves with numbered tags.

.13 Tag automatic controls, instruments, and relays. Key to control schematic.

.14 Identify piping, concealed or exposed, with plastic pipe markers. Identify service, flow direction, and pressure. Install in clear view and align with axis of piping. Location of identification not to exceed 6 m on straight runs including risers and drops, adjacent to each valve and Tee, adjacent to each change in direction, at each side of penetration of structure or enclosure, and at each obstruction. Provide additional identification at point immediately upstream of major manually operated or automatically controlled valves, and dampers. Where this is not possible, place identification as close as possible, preferably on upstream side

.15 Identify ductwork with stencilled painting. Identify with air handling unit identification number and area served. Locate identification at air handling unit, at each side of penetration of structure or enclosure, and at each obstruction.

.16 Provide ceiling tacks to locate valves or dampers above T-bar type panel ceilings. Locate in corner of panel closest to equipment.

.17 Identify electric starting switches and remote push button stations with nametags.

.18 Provide identification on the ceiling for all equipment concealed within a ceiling space in addition to identification on the equipment.

.19 Tag new fire dampers sequentially and record on Fire Damper Tag List.

3.3 VALVE, 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 Owner. Provide one copy (reduced in size if required) in each operating and maintenance manual.

.3 Number valves in each system consecutively.

1 General

1.1 SECTION INCLUDES

.1 Testing, adjustment and balance of air systems.
.2 Testing, adjustment and balance of water systems.

1.2 SUMMARY

.1 TAB is used throughout this Section to describe the process, methods and requirements of testing, adjusting and balancing for HVAC.

.2 TAB means to test, adjust and balance to perform in accordance with requirements of Contract Documents and to do other work as specified in this section.

1.3 QUALIFICATIONS OF TAB PERSONNEL

.1 Submit names of personnel to perform TAB to Consultant within 90 days of award of contract.

.2 Personnel performing TAB shall be qualified to standards of AABC and/or NEBB

.3 Provide documentation confirming qualifications, successful experience.

.4 TAB: performed in accordance with the requirements of standard under which TAB Firm's qualifications are approved:
  .1 Associated Air Balance Council, (AABC) National Standards for Total System Balance, MN-1-2002.
  .2 National Environmental Balancing Bureau (NEBB) TABES, Procedural Standards for Testing, Adjusting, Balancing of Environmental Systems-1998.
  .3 Sheet Metal and Air Conditioning Contractors' National Association (SMACNA), HVAC TAB HVAC Systems - Testing, Adjusting and Balancing-2002.

.5 Recommendations and suggested practices contained in the TAB Standard: mandatory.

.6 Use TAB Standard provisions, including checklists, and report forms to satisfy Contract requirements.

.7 Use TAB Standard for TAB, including qualifications for TAB Firm and Specialist and calibration of TAB instruments.

.8 Where instrument manufacturer calibration recommendations are more stringent than those listed in TAB Standard, use manufacturer's recommendations.

.9 TAB Standard quality assurance provisions such as performance guarantees form part of this contract.
  .1 For systems or system components not covered in TAB Standard, use TAB procedures developed by TAB Specialist.
  .2 Where new procedures, and requirements, are applicable to Contract requirements have been published or adopted by body responsible for TAB Standard used (AABC, NEBB, or TABB), requirements and recommendations contained in these procedures and requirements are mandatory.

1.4 PURPOSE OF TAB

.1 Test to verify proper and safe operation, determine actual point of performance, evaluate qualitative and quantitative performance of equipment, systems and controls at design, average and low loads using actual or simulated loads

.2 Adjust and regulate equipment and systems to meet specified performance requirements and to achieve specified interaction with other related systems under normal and emergency loads and operating conditions.

.3 Balance systems and equipment to regulate flow rates to match load requirements over full operating ranges.

1.5 CO-ORDINATION

.1 Schedule time required for TAB (including repairs, re-testing) into project construction and completion schedule to ensure completion before acceptance of project.

.2 Do TAB of each system independently and subsequently, where interlocked with other systems, in unison with those systems.

1.6 EXCEPTIONS

.1 TAB of systems and equipment regulated by codes, standards to satisfaction of authority having jurisdiction.

1.7 PRE-TAB REVIEW

.1 Review contract documents before project construction is started confirm in writing to Consultant adequacy of provisions for TAB and other aspects of design and installation pertinent to success of TAB.

.2 Review specified standards and report to Consultant in writing proposed procedures which vary from standard.

.3 During construction, co-ordinate location and installation of TAB devices, equipment, accessories, measurement ports and fittings.

1.8 START-UP

.1 Follow start-up procedures as recommended by equipment manufacturer unless specified otherwise.

.2 Follow special start-up procedures specified elsewhere in Division 23.

1.9 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.

1.10 START OF TAB

.1 Notify Consultant 7 days prior to start of TAB.
.2 Start TAB when building is essentially completed, including:

.3 Installation of ceilings, doors, windows, other construction affecting TAB.

.4 Application of weatherstripping, sealing, and caulking.

.5 Pressure, leakage, other tests specified elsewhere Division 23.

.6 Provisions for TAB installed and operational.

.7 Start-up, verification for proper, normal and safe operation of mechanical and associated electrical and control systems affecting TAB including but not limited to:
- .1 Proper thermal overload protection in place for electrical equipment.
- .2 Air systems:
  - .1 Filters in place, clean.
  - .2 Duct systems clean.
  - .3 Ducts, air shafts, ceiling plenums are airtight to within specified tolerances.
  - .4 Correct fan rotation.
  - .5 Fire, smoke, volume control dampers installed and open.
  - .6 Coil fins combed, clean.
  - .7 Access doors, installed, closed.
  - .8 Outlets installed, volume control dampers open.
- .3 Liquid systems:
  - .1 Flushed, filled, vented.
  - .2 Correct pump rotation.
  - .3 Strainers in place, baskets clean.
  - .4 Isolating and balancing valves installed, open.
  - .5 Calibrated balancing valves installed, at factory settings.
  - .6 Chemical treatment systems complete, operational.

1.11 APPLICATION TOLERANCES

.1 Do TAB to following tolerances of design values:
- .1 Laboratory HVAC systems: plus 10 %, minus 0 %.
- .2 Other HVAC systems: plus 5 %, minus 5 %.
- .3 Hydronic systems: plus or minus 10 %.

1.12 ACCURACY TOLERANCES

.1 Measured values accurate to within plus or minus 2 % of actual values.

1.13 INSTRUMENTS

.1 Use accurate instruments for measurements. Prior to TAB, submit to Consultant list of instruments used together with serial numbers.

.2 Calibrate in accordance with requirements of most stringent of referenced standard for either applicable system or HVAC system.

.3 Calibrate within 3 months of TAB. Provide certificate of calibration to Consultant.

.4 Provide calibration histories for each instrument. Re-calibration or use of other instruments may be requested when accuracy of readings is questionable.

1.14 SUBMITTALS

.1 Submit, prior to commencement of TAB:

.2 Submit proposed methodology and procedures for performing TAB if different from referenced standard.

1.15 PRELIMINARY TAB REPORT

.1 Submit for checking and approval of Consultant, prior to submission of formal TAB report, sample of rough TAB sheets. Include:
- .1 Details of instruments used.
- .2 Details of TAB procedures employed.
- .3 Calculations procedures.
- .4 Summaries.

1.16 TAB REPORT

.1 Format in accordance with referenced standard.

.2 TAB report to show results in SI units and to include:
- .1 Project record drawings.
- .2 System schematics.

.3 Submit 4 copies of TAB Report to Consultant for verification and approval, in English in D-ring binders, complete with index tabs.

1.17 VERIFICATION

.1 Reported results subject to verification by Consultant.

.2 Provide personnel and instrumentation to verify up to 30 % of reported results.

.3 Number and location of verified results as directed by Consultant.

.4 Pay costs to repeat TAB as required to satisfaction of Consultant.

1.18 SETTINGS

.1 After TAB is completed to satisfaction of Departmental Representative, 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. Do not eradicate or cover markings.

1.19 COMPLETION OF TAB

.1 TAB considered complete when final TAB Report received and approved by Consultant.

1.20 AIR SYSTEMS

.1 Measurements: to include as appropriate for systems, equipment, components, controls: air velocity, static pressure, flow rate, pressure drop (or loss), temperatures (dry bulb, wet bulb, dewpoint), duct cross-sectional area, RPM, electrical power, voltage, noise, vibration.

.2 Locations of equipment measurements: to include as appropriate:
- .1 Inlet and outlet of dampers, filter, coil, humidifier, fan, other equipment causing changes in conditions.
- .2 At controllers, controlled device.

.3 Locations of systems measurements to include as appropriate: main ducts, main branch, sub-branch, run-out (or grille, register or diffuser).

1.21 OTHER TAB REQUIREMENTS

.1 Measurement of noise from equipment specified in Division 23.
- .1 As specified elsewhere or as required to prove Noise Performance when operating performance is questioned.

1.22 CLOSEOUT SUBMITTALS

.1 Section 01 33 00: Submission procedures.

.2 Provide copies of complete final TAB report for Operation and Maintenance manual

1.23 BALANCE REPORTS

.1 Balance reports to include the following at minimum (data shall always include design and actual measured data):
- .1 Title Page: Company Name, Address, and Telephone Number; Project Name, Location, Architect, Engineer, and Project Contractor.
- .2 Include types, serial number and dates of calibration of instruments used.
- .3 Air Handling Units: Location, Local Identification, Manufacturer, Model, Size, Arrangement, discharge and class, Supply Air Flow, Return Air Flow, Outside Air Flow, Static Pressures, Fan RPM, inlet and outlet dry bulb and wet bulb temperatures.
- .4 Duct air quantities: Mains, Branches, Outside Air and Exhausts (Maximum and Minimum), Duct sizes; Number of pressure readings; Sum of velocity measurements; Average velocity; duct air flow rate.
- .5 Exhaust Fan Data: Location, Manufacturer, Model, Specified and Actual Air Flow, Static Pressure, and Fan RPM.
- .6 Electric Motors: Manufacturer, HP/BHP, Phase, Voltage, Amperage (maximum operating and full load), RPM, Service Factor, Starter Heater Elements.
- .7 V-Belt Drive: Identification/Location, Driven Sheave Diameter and RPM belt Size and Quantity, Motor Sheave Diameter and RPM.
- .8 Air Distribution: Terminal Number, Room Number/Location, Terminal Type and Size, Area Factor, Design Velocity and Air Flow, Test Velocity and Air Flow.
- .9 Air Inlets and Outlets: Outlet identification location and Designation; Manufacturer's catalogue identification and type; Application factors; air velocities; air flow rates; Deflector vane or diffuser cone settings.
- .10 Pump Data: Location, Identification/Number, Manufacturer, Size/Model, Drive type, Motor type, Flow Rate, Head, BHP, Discharge and Suction Pressure (full flow and no flow).
- .11 Coil Data: Location, Identification/Number, Service, Manufacturer, Element type, Air Flow Rate, Entering Air and Leaving Air Temperatures (dry bulb and wet bulb), Water Flow rate and Pressure Drop, Entering and Leaving Water Temperatures, energy transfer rate.
- .12 Terminal Heating/Cooling Equipment with fans (unit heaters, force flows, unit ventilators, fan coils etc.): Location, Identification/Number, Manufacturer, Model, Heat transfer rate, Entering and Leaving Water Temperatures, Water Pressure drops, Water Flow Rates, air flow. If a steam system include steam pressure, temperature and condensate temperature. If a heating/cooling system provide data for both modes of operation.
- .13 Terminal Heating/Cooling Equipment (radiation, panels, in-floor etc.): Location, Element Type, Designation, Manufacturer, Entering and Leaving Water Temperatures, Length of Fin, Water Pressure drops, Water Flow Rates. If a steam system include steam pressure, temperature and condensate temperature. If a heating/cooling system provide data for both modes of operation. Provide total flow for in-floor manifold.

2 Products

2.1 NOT USED

3 Execution

3.1 PREPARATION

.1 Before adjusting and balancing, verify that systems are complete and operable. Ensure temperature control systems are complete and operable, thermal overload protection is in place, final filters installed, hydronic systems, flushed, filled, and vented.

.2 Provide instruments required for testing, adjusting, and balancing operations. Make instruments available to Consultant to facilitate spot checks during testing.

.3 Recorded data shall represent actually measured, or observed condition.

3.2 GENERAL PROCEDURES

.1 Balance to maximum measured flow, allowable deviation as specified.

.2 Permanently mark settings on valves, splitters, dampers, and other adjustment devices.

.3 Subsequent to correctional work, take measurements to verify balance has not been disrupted or that any such disruption has been rectified.

.4 At final inspection, re-check random selections of data recorded in report. Re-check points of areas as selected and witnessed by the Owner.

.5 Check and adjust systems approximately six (6) months after final acceptance and submit report.

.6 The Balancing Contractor shall include the cost of sheave changes necessary to achieve specified air flow within limits specified.

3.3 AIR SYSTEM PROCEDURES

.1 Adjust air handling and distribution systems to provide required or design supply, return and exhaust air quantities. Permanently mark settings of damper and other adjustment devices allowing settings to be restored.

.2 Make air quantity measurements in ducts by Pitot tube traverse of entire cross-sectional area of duct.

.3 Measure air quantities at each air inlet and outlet. Use volume control devices to regulate air quantities.

.4 Vary total system air quantities by adjustment of fan speeds. Where Variable Frequency Drives (VFDs) are installed, utilize VFDs to adjust fan speed. Provide drive changes where required.

.5 Where modulating dampers are provided, take measurements and balance at extreme conditions. Balance variable volume systems at maximum air flow rate - full cooling, and at minimum air flow rate - full heating.

.6 Provide system schematic with required and actual air quantities recorded at each outlet or inlet.

.7 Measure static air pressure conditions on air supply units, including filter and coil pressure drops, and total pressure across the fan. Make allowances for 50 percent loading of filters.

3.4 WATER SYSTEM PROCEDURE

.1 Adjust water systems to provide required or design quantities. Permanently mark settings of valves and other adjustment devices allowing settings to be restored. Set and lock memory stops.

.2 Use calibrated venturi tubes, orifices, or other metered fittings and pressure gauges in conjunction with permanent and portable type flow meters to determine flow rates for system balance. Where flow metering devices are not installed, base flow balance on temperature difference across various heat transfer elements in the system.

.3 Adjust systems to provide specified pressure drops and flows through heat transfer elements prior to thermal testing. Perform balancing by measurement of temperature differential in conjunction with air balancing.

.4 Effect system balance with automatic control valves fully open to heat transfer elements.

.5 Effect adjustment of water distribution systems by means of balancing cocks, valves and fittings. Do not use service or shut-off valves for balancing unless indexed for balance point.

.6 Where pump capacity available is less than total flow requirements or individual system parts, full flow in any part may be simulated by temporary restriction of flow to other parts.

.7 Where flow restrictors are used provide record data of air and water inlet and outlet temperatures at design conditions.

END OF SECTION

1 General

1.1 SUMMARY

.1 Section Includes:
- .1 Materials and methods for pressure testing ducts over 5 m in length, forming part of a supply, return or exhaust ductwork system directly or indirectly connected to air handling equipment.
- .2 Sustainable requirements for construction and verification.

1.2 REFERENCES

.1 Health Canada/Workplace Hazardous Materials Information System (WHMIS)
- .1 Material Safety Data Sheets (MSDS).

.2 Sheet Metal and Air Conditioning Contractor's National Association (SMACNA)
- .1 SMACNA HVAC Air Duct Leakage Test Manual, 1985.

1.3 SUBMITTALS

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

.2 Test Reports: submit test reports indicating compliance with specifications for specified performance characteristics and physical properties. Include pressure test information and results as follows:
- .1 Submit proposed report form and test report format to Departmental Representative for approval at least three months before proposed date of first series of tests. Do not start tests until approval received in writing from Departmental Representative.
- .2 Prepare report of results and submit to Departmental Representative within 7 days of completion of tests. Include:
  - .1 Schematic of entire system.
  - .2 Schematic of section under test showing test site.
  - .3 Required and achieved static pressures.
  - .4 Orifice differential pressure at test sites.
  - .5 Permissible and actual leakage flow rate (L/s) for test sites.
  - .6 Witnessed certification of results.
- .3 Include test reports in final TAB report.
- .4 Certificates: submit certificates signed by manufacturer certifying that materials comply with specified performance characteristics and physical properties.
- .5 Instructions: submit manufacturer's installation instructions.
- .6 Manufacturer's field reports specified.

1.4 QUALITY ASSURANCE

.1 Pre-Installation Meetings:
- .1 Convene pre-installation meeting one week prior to beginning work of this Section and on-site installations in accordance with Section 01 32 16 - Construction Progress Schedules - Bar (GANTT) Chart.
  - .1 Verify project requirements.
  - .2 Review installation conditions.
  - .3 Co-ordination with other building subtrades.

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

.2 Health and Safety:

.1 Do construction occupational health and safety in accordance with Section 01 35 29.06 - Health and Safety Requirements.

2 Products

2.1 TEST INSTRUMENTS

.1 Test apparatus to include:

.1 Fan capable of producing required static pressure.

.2 Duct section with calibrated orifice plate mounted and accurately located pressure taps.

.3 Flow measuring instrument compatible with the orifice plate.

.4 Calibration curves for orifice plates used.

.5 Flexible duct for connecting to ductwork under test.

.6 Smoke bombs for visual inspections.

.2 Test apparatus: accurate to within +/- 3 % of flow rate and pressure.

.3 Submit details of test instruments to be used to Departmental Representative at least one month before anticipated start date.

.4 Test instruments: calibrated and certificate of calibration deposited with Departmental Representative no more than 28 days before start of tests.

.5 Re-calibrated every six months thereafter.

3 Execution

3.1 MANUFACTURER'S INSTRUCTIONS

.1 Compliance: comply with manufacturer's written recommendations or specifications, including product technical bulletins, handling, storage and installation instructions, and datasheet.

3.2 PREPARATION

.1 Do not conceal or cover ductwork or equipment until inspected by consultant and tested.

.2 Provide equipment, materials and labour for tests and pay expenses. Use test instruments by approved laboratory or manufacturer and furnish certificate showing degree of accuracy.

.3 Test instruments shall have been calibrated within one year.

.4 Install permanent gauges and thermometers just prior to tests to avoid changes in calibration.

.5 Before adjusting and balancing, verify that systems are complete and operable. Ensure temperature control systems are complete and operable, thermal overload protection is in place, final filters installed, hydronic systems, flushed, filled, and vented.

.6 Provide instruments required for testing, adjusting, and balancing operations. Make instruments available to Consultant to facilitate spot checks during testing.

.7 Recorded data shall represent actually measured, or observed condition. And shall be included in O&M Manual

3.3 TEST PROCEDURES

.1 Maximum lengths of ducts to be tested consistent with capacity of test equipment.

.2 Section of duct to be tested to include:
.1 Fittings, branch ducts, tap-ins, fire dampers.

.3 Repeat tests until specified leakage at test pressures are attained. Bear costs for repairs and repetition to tests.

.4 Base partial system leakage calculations on SMACNA HVAC Air Duct Leakage Test Manual.

.5 Seal leaks that can be heard or felt, regardless of their contribution to total leakage.

3.4 SITE TOLERANCES

.1 Allowable system leakage tolerances are to follow SMACNA Leakage standards as specified under ductwork.

.2 Evaluation of test results to use surface area of duct and pressure in duct as basic parameters.

3.5 TESTING

.1 Test ducts before installation of insulation or other forms of concealment.

.2 Test after seals have cured.

.3 Test when ambient temperature will not affect effectiveness of seals and gaskets.

.4 Low Pressure Ducts: Test for tightness such that leakage is inaudible and not detectable by feel. Check for audible leaks at 250 Pa above duct design operating pressure.

.5 Medium and High Pressure Ductwork: Check for audible leaks. Test for tightness as specified by the SMACNA Manuals at a duct leakage classification of 3 with a static pressure equal to 2 times the external static pressure of the associated air system.

3.6 FIELD QUALITY CONTROL

.1 Performance Verification:
.1 Departmental Representative to witness tests and to verify reported results.
.2 To be certified by same TAB agency approved by Departmental Representative to undertake TAB on this project.

1 General

1.1 REFERENCES

.1 American Society of Heating, Refrigeration and Air Conditioning Engineers (ASHRAE)
- .1 ANSI/ASHRAE/IESNA 90.1-01, SI; Energy Standard for Buildings Except Low-Rise Residential Buildings.

.2 American Society for Testing and Materials International, (ASTM)
- .1 ASTM B209M, Specification for Aluminum and Aluminum Alloy Sheet and Plate (Metric).
- .2 ASTM C335, Test Method for Steady State Heat Transfer Properties of Horizontal Pipe Insulation.
- .3 ASTM C411, Test Method for Hot-Surface Performance of High-Temperature Thermal Insulation.
- .4 ASTM C449/C449M, Standard Specification for Mineral Fiber-Hydraulic-Setting Thermal Insulating and Finishing Cement.
- .5 ASTM C547, Specification for Mineral Fiber Pipe Insulation.
- .6 ASTM C553, Specification for Mineral Fiber Blanket Thermal Insulation for Commercial and Industrial Applications.
- .7 ASTM C612, Specification for Mineral Fiber Block and Board Thermal Insulation.
- .8 ASTM C795, Specification for Thermal Insulation for Use with Austenitic Stainless Steel.
- .9 ASTM C921-(1998)e1, Standard Specification for Thermal Insulation for Use in Contact with Austenitic Stainless Steel.

.3 Canadian General Standards Board (CGSB)
- .1 CGSB 51-GP-52Ma, Vapour Barrier, Jacket and Facing Material for Pipe, Duct and Equipment Thermal Insulation.

.4 Thermal Insulation Association of Canada (TIAC): National Insulation Standards (R1999).

.5 Underwriters Laboratories of Canada (ULC)
- .1 CAN/ULC-S102, Surface Burning Characteristics of Building Materials and Assemblies.
- .2 CAN/ULC-S701, Thermal Insulation Polyotrene, Boards and Pipe Covering.

1.2 DEFINITIONS

.1 For purposes of this section:
- .1 "CONCEALED" - insulated mechanical services and equipment in suspended ceilings and non-accessible chases and furred-in spaces.
- .2 "EXPOSED" - will mean "not concealed" as defined herein.
- .3 Insulation systems - insulation material, fasteners, jackets, and other accessories.

.2 TIAC Codes:
- .1 CRD: Code Round Ductwork,
- .2 CRF: Code Rectangular Finish.

1.3 SHOP DRAWINGS

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

.2 Submit for approval manufacturer's catalogue literature related to installation, fabrication for duct jointing recommendations.

1.4 MANUFACTURERS' INSTRUCTIONS

.1 Submit manufacturer's installation instructions in accordance with Section 01 33 00 - Submittal Procedures.

.2 Installation instructions to include procedures used, and installation standards achieved.

1.5 QUALITY ASSURANCE

.1 Installer: specialist in performing work of this section, and have at least 3 years successful experience in this size and type of project, qualified to standards of TIAC.

.2 Materials: UL listed; flame spread/smoke developed rating of 25/50 in accordance with ASTM E84.

.3 Do work to TIAC standards.

.4 Deliver material to job site in original non-broken factory packaging, labelled with manufacturer's density and thickness.

.5 Perform work at ambient and equipment temperatures as recommended by the adhesive manufacturer. Make good separation of joints or cracking of insulation due to thermal movement or poor workmanship.

2 Products

2.1 FIRE AND SMOKE RATING

.1 In accordance with CAN/ULC-S102:
- .1 Maximum flame spread rating: 25.
- .2 Maximum smoke developed rating: 50.

2.2 INSULATION

.1 Mineral fibre: as specified includes glass fibre, rock wool, slag wool.

.2 Thermal conductivity ("k" factor) not to exceed specified values at 24 deg.C mean temperature when tested in accordance with ASTM C335. Maximum “K” factor to be 0.035 W/m. deg.K (0.24 BTU in/hr/sq.ft. Deg.K) to ASTM C5553.

.3 TIAC Class C-1: Rigid mineral fibre board to ASTM C612, unfaced or faced with vapour retarder jacket; ksi value of 0.035 at 24 degrees C.

.4 TIAC Code C-2: mineral fibre blanket to ASTM C553 with or without factory applied vapour retarder jacket; ksi value of 0.035 at 24 degrees C

.5 Flexible Duct Liner: Flexible non-combustible mineral fiber blanket to ASTM C 1071 Type 1; ksi value of 0.035 at 24 degrees C, 24 kg/cu m minimum density; coated air side for maximum 20.3 m/s air velocity. Minimum NRC value of 0.65 at 25mm to ASTM 423.

.6 Rigid Duct Liner: semi-rigid non-combustible mineral fiber to ASTM C 1071 Type 2; ksi value of 0.035 at 24 degrees C, 48 kg/cu m minimum density; coated air side for maximum 20.3 m/s air velocity. Minimum NRC value of 0.7 at 25mm to ASTM 423.

2.3 JACKETS

.1 Interior Applications:
- .1 Vapour Barrier Jackets: to CGSB 51-GP-52Ma.
- .2 PVC Jackets: One piece, high-gloss pre-moulded type, 0.8 mm (30mls) thick. Jackets exposed to outdoor use or flourescent lighting shall be ultra-violet ray resistant.
- .3 Canvas Jackets: ULC listed treated cotton fabric, 220 g/sq.m. to ASTM C 921
- .4 Aluminum Jackets: 0.51 mm thick; stucco embossed.

.2 Exterior Applications:
- .1 Aluminum Jackets: 0.51 mm thick; stucco embossed.
- .2 Stainless Steel Jackets: Type 304 stainless steel; 0.25 mm thick, stucco embossed
- .3 Outdoor Jacket: Coated glass fibre sheet, 16 kg/sq m.

2.4 ACCESSORIES

.1 Bands: 20 mm wide; 0.38 mm thick stainless steel.

.2 Insulating Cement: Hydraulic setting on mineral wool.

.3 Fibrous Glass Cloth: Untreated; 305 g/sq m weight.

.4 Adhesives: Compatible with insulation, waterproof, fire-retardant type.

.5 Impale Anchors: Galvanized steel, 2 mm diameter with 35mm diameter head, length as required for insulation.

.6 Joint Tape: self adhesive reinforced aluminum, minimum 50mm wide

.7 Tie Wire: stainless steel, 1.5 mm.

.8 Outdoor vapour retarder mastic:
- .1 Vinyl emulsion type acrylic, compatible with insulation
- .2 Fibrous glass cloth

3 Execution

3.1 PRE-INSTALLATION REQUIREMENTS

.1 Pressure testing of ductwork systems complete, witnessed and certified.

.2 Surfaces clean, dry, free from foreign material.

3.2 INSTALLATION

.1 Install in accordance with TIAC National Standards

.2 Apply materials in accordance with manufacturer's instructions and as indicated.

.3 Use 2 layers with staggered joints when required nominal thickness exceeds 75 mm.

.4 Maintain uninterrupted continuity and integrity of vapour retarder jacket and finishes.
- .1 Ensure hangers, and supports are outside vapour retarder jacket.

.5 Fasteners: install at 300 mm on centre in horizontal and vertical directions, minimum 2 rows each side.

.6 Apply high compressive strength insulation where insulation may be compressed by weight of ductwork.

.7 Locate insulation or cover seams in least visible location.

.8 Provide recovering jackets on exposed insulation throughout, including equipment room. Insulation located in crawl spaces, shafts and suspended ceiling spaces is not considered exposed. Use pre-sized paper under recovering at uneven insulated surfaces.

.9 External Duct Insulation:
- .1 Secure insulation with vapour barrier with wires and seal jacket joints with vapour barrier adhesive or tape to match jacket.
- .2 Secure insulation without vapour barrier with staples, tape, or wires.
- .3 Install without sag on underside of duct work. Use adhesive or mechanical fasteners to prevent sagging. Seal vapour barrier penetrations with vapour barrier adhesive. Stop and point insulation around access doors and damper operators.

.10 Exposed Rectangular: Secure rigid insulation with 50% coverage of adhesive and 12 gauge galvanized impale anchor tabs on 400 mm (16") centres. Seal joints and breaks with 250 mm (10") wide strips of open mesh glass cloth or tape imbedded between 2 coats of vapour barrier sealant. Point up other joints and breaks with hydraulic setting cement.

.11 Round Duct and Concealed Rectangular Duct: Adhere flexible insulation to ductwork with adhesive applied in 150 mm (6") wide strips on 400 mm (16") centres. Provide 16 gauge annealed tie wire tied, spiral wound or half hitched at 200 mm (8") centres for securing duct insulation until adhesive sets. Butt insulation and seal joints and breaks with 50 mm (2") lap of foil adhered over joint.

.12 Acoustic lining: Apply to interior of ducts where shown.
- .1 Adhere insulation with adhesive for 100 percent coverage. Secure insulation with mechanical fasteners on 375 mm centres maximum on top and side of duct work with dimension exceeding 500 mm. Seal and smooth joints. Seal vapour barrier penetrations with vapour barrier adhesive. Cut off excess fastener length and cover with brush coat of mastic.
- .2 Use 25 mm (1") thick insulation unless otherwise noted.

.3 Provide vapour barrier located on the warm side for outside air intakes.
.4 Ducts with acoustic insulation do not require external thermal insulation
.5 Ductwork dimensions indicated on drawings include insulation thickness.

3.3 INSTALLATION - JACKETS

.1 Install in accordance with TIAC standards and manufacturers written requirements.

.2 Provide recovering jackets on exposed insulation throughout, including equipment room. Insulation located in crawl spaces, shafts and suspended ceiling spaces is not considered exposed. Use pre-sized paper under recovering at uneven insulated surfaces.

3.4 DUCTWORK INSULATION SCHEDULE

.1 Insulation types and thicknesses: conform to following table:

System	TIAC Code	Vapour Retarder	Thickness (mm)
Rectangular cold and dual temperature supply air ducts	C-1	yes	50
Round cold and dual temperature supply air ducts	C-2	yes	50
Supply, return and exhaust ducts exposed in space being served	none, unless indicated otherwise on drawings		
Mixing plenums	C-1	yes	50
Exhaust duct between fan and louvre/discharge	C-1	Yes	50
Acoustically lining	none		25

.2 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 TIAC codes noted in table:

	Rectangular	Round
Indoor, concealed	none	none
Indoor, exposed within mechanical room	CRF/1	CRD/2
Indoor, exposed elsewhere	CRF/2	CRD/3
Outdoor, exposed to precipitation	CRF/3	CRD/4
Outdoor, elsewhere	CRF/4	CRD/5

END OF SECTION

1. General

1.1 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 (ASTM International)
- .1 ASTM B209M-01, Specification for Aluminum and Aluminum Alloy Sheet and Plate.
- .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, Specification for Mineral Fiber-Hydraulic-Setting Thermal Insulating and Finishing Cement.
- .5 ASTM C533-95 (2001), Specification for Calcium Silicate Block and Pipe Thermal Insulation.
- .6 ASTM C547-00, Specification for Mineral Fiber Pipe Insulation.
- .7 ASTM C553-00, Specification for Mineral Fiber Blanket Thermal Insulation for Commercial and Industrial Applications.
- .8 ASTM C612-00a, Specification for Mineral Fiber Block and Board Thermal Insulation.
- .9 ASTM C795-92 (1998)e1, Standard Specification for Thermal Insulation for Use in Contact with Austenitic Stainless Steel.
- .10 ASTM C921-89 (R1996), 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 CGSB 51-GP-53M-95, Poly (Vinyl Chloride) Jacketing Sheet, for Insulated Pipes, Vessels and Round Ducts.

.4 Thermal Insulation Association of Canada (TIAC)
- .1 National Insulation Standards 1992(R1999).

.5 Underwriters Laboratories of Canada (ULC)
- .1 CAN/ULC-S102-M88 (R2000), Surface Burning Characteristics of Building Materials and Assemblies.

1.2 PRODUCT DATA

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

1.3 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.

1.4 MANUFACTURER'S INSTRUCTIONS

.1 Submit manufacturer's installation instructions in accordance with 01 33 00 - Submittal Procedures.

.2 Installation instructions to include procedures to be used, installation standards to be achieved.

1.5 QUALITY ASSURANCE

.1 Applicator: Company specializing in mechanical insulation application with three years minimum experience.

.2 Materials: UL listed; flame spread/smoke developed rating of 25/50 in accordance with ASTM E84.

.3 Do work to TIAC standards.

.4 Deliver material to job site in original non-broken factory packaging, labelled with manufacturer's density and thickness.

.5 Perform work at ambient and equipment temperatures as recommended by the adhesive manufacturer. Make good separation of joints or cracking of insulation due to thermal movement or poor workmanship.

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 and rock wool. Insulation on steam equipment to be rock wool only, glass fibre is not permitted.

.2 Rock wool shall be utilized on steam systems.
- .1 TIAC Code A-1; rigid pre-moulded mineral fibre to ASTM C 547 with or without factory applied vapour retarder jacket; ksi value of 0.035 at 24 deg.C
- .2 TIAC Code A-2: rigid moulded calcium silicate to ASTM C533 in sections and blocks, and with special shapes to suit project requirements, asbestos free; ksi value of 0.060 at 147 degrees C

.3 TIAC Code A-3: rigid pre-moulded mineral fibre to ASTM C 547 with or without factory applied vapour retarder jacket for high temperature applications; ksi value of 0.072 at 260 degrees C

.4 TIAC Code A-6: flexible unicellular tubular elastomer to ASTM C534; ksi value of 0.04 at 24 degrees C

.5 TIAC Class C-1: Rigid mineral fibre board to ASTM C612, unfaced or faced with CGSB 51-GP-52Ma vapour retarder jacket; ksi value of 0.035 at 24 deg.C.

.6 TIAC Code C-2: mineral fibre blanket to ASTM C553 with or without factory applied vapour retarder jacket. Thermal conductivity; ksi value of 0.04 at 24 degrees C.

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 INSULATION SECUREMENTS

.1 Tape: Self-adhesive, aluminum, plain, reinforced, 50 mm wide minimum.

.2 Contact adhesive: Quick setting.

.3 Canvas adhesive: Washable.

.4 Tie wire: 1.5 mm diameter stainless steel.

.5 Bands: Stainless steel, 19 mm wide, 0.5 mm thick.

.6 Fasteners: 2 mm diameter pins with 35 mm diameter clips. Length of pin to suit thickness of insulation.

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.

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 materials in accordance with manufacturer's instructions and TIAC National standards.

.2 In exposed equipment in finished areas, locate insulation and cover seams in least visible locations.

.3 Provide insulation with vapour barrier when medium may be below ambient temperature and as noted on schedules.

.4 Neatly finish insulation at supports, protrusions, and interruptions.

.5 Apply insulation with edges tightly butted, joints staggered and secured in place by steel bands. Where necessary weld on suitable anchors.

.6 Provide sufficient clearance around openings for normal operation of equipment.

.7 Finish hot surface insulation with 25 mm galvanized hexagonal mesh and coat with hydraulic setting insulation cement.

.8 Finish cold surface insulation joints with 100 mm wide strips of vapour barrier sealed with vapour barrier adhesive finish insulation with heavy coat of vapour barrier mastic applied over whole body. Finish with a final coat of cement containing 25% by weight of Portland Cement. Recover and provide an extra coat of lagging adhesive.

.9 Maintain uninterrupted continuity and integrity of vapour retarder jacket and finishes.
- .1 Hangers, supports outside vapour retarder jacket.

.10 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 INSULATION SCHEDULES

.1 Insulation for equipment to match requirements for associated piping or ductwork serving equipment unless otherwise specified.

.2 Thickness of insulation, refer to Section 23 07 15 Thermal Insulation for Piping and 23 07 13 Duct Insulation.

.3 Finishes:
- .1 Exposed indoors: canvas
- .2 Exposed in mechanical rooms: Aluminum jacket.
- .3 Concealed, indoors: canvas on valves, fittings. No further finish.
- .4 Use vapour retarder jacket on TIAC code A-3, A-6 and C-2 insulation compatible with insulation.
- .5 Outdoors: water-proof aluminum jacket.
- .6 Finish attachments: SS screws, at 150 mm on centre. Seals: wing.
- .7 Installation: to appropriate TIAC code.

END OF SECTION

1 General

1.1 SUMMARY

.1 Section Includes:
- .1 Thermal insulation for piping and piping accessories.

1.2 REFERENCES

.1 American Society of Heating, Refrigeration and Air Conditioning Engineers (ASHRAE)
- .1 ASHRAE Standard 90.1-01, Energy Standard for Buildings Except Low-Rise Residential Buildings (IESNA co-sponsored; ANSI approved; Continuous Maintenance Standard).

.2 American Society for Testing and Materials International (ASTM)
- .1 ASTM B209M-04, Standard Specification for Aluminum and Aluminum Alloy Sheet and Plate Metric.
- .2 ASTM C335-04, Standard Test Method for Steady State Heat Transfer Properties of Horizontal Pipe Insulation.
- .3 ASTM C411-04, Standard Test Method for Hot-Surface Performance of High-Temperature Thermal Insulation.
- .4 ASTM C449/C449M-00, Standard Specification for Mineral Fiber-Hydraulic-Setting Thermal Insulating and Finishing Cement.
- .5 ASTM C533-2004, Calcium Silicate Block and Pipe Thermal Insulation.
- .6 ASTM C547-2003, Mineral Fiber Pipe Insulation.
- .7 ASTM C795-03, Standard Specification for Thermal Insulation for Use in Contact with Austenitic Stainless Steel.
- .8 ASTM C921-03a, Standard Practice for Determining the Properties of Jacketing Materials for Thermal Insulation.

.3 Canadian General Standards Board (CGSB)
- .1 CGSB 51-GP-52Ma-89, Vapour Barrier, Jacket and Facing Material for Pipe, Duct and Equipment Thermal Insulation.
- .2 CAN/CGSB-51.53-95, Poly (Vinyl Chloride) Jacketting Sheet, for Insulated Pipes, Vessels and Round Ducts

.4 Department of Justice Canada (Jus)
- .1 Canadian Environmental Assessment Act (CEAA), 1995, c. 37.
- .2 Canadian Environmental Protection Act (CEPA), 1999, c. 33.
- .3 Transportation of Dangerous Goods Act (TDGA), 1992, c. 34.

.5 Health Canada/Workplace Hazardous Materials Information System (WHMIS)
- .1 Material Safety Data Sheets (MSDS).

.6 Manufacturer's Trade Associations
- .1 Thermal Insulation Association of Canada (TIAC): National Insulation Standards (Revised 2004).

.7 Underwriters' Laboratories of Canada (ULC)
- .1 CAN/ULC-S102-03, Surface Burning Characteristics of Building Materials and Assemblies.
- .2 CAN/ULC-S701-01, Thermal Insulation, Polystyrene, Boards and Pipe Covering.
- .3 CAN/ULC-S702-1997, Thermal Insulation, Mineral Fibre, for Buildings
- .4 CAN/ULC-S702.2-03, Thermal Insulation, Mineral Fibre, for Buildings, Part 2: Application Guidelines.

1.3 DEFINITIONS

.1 For purposes of this section:
- .1 "CONCEALED" - insulated mechanical services in suspended ceilings and non-accessible chases and furred-in spaces.
- .2 "EXPOSED" - will mean "not concealed" as specified.

.2 TIAC ss:
- .1 CRF: Code Rectangular Finish.
- .2 CPF: Code Piping Finish.

1.4 QUALITY ASSURANCE

.1 Applicator: Company specializing in mechanical insulation application with three years minimum experience.

.2 Materials: UL listed; flame spread/smoke developed rating of 25/50 in accordance with ASTM E84.

.3 Do work to TIAC standards.

.4 Deliver material to job site in original non-broken factory packaging, labelled with manufacturer's density and thickness.

.5 Perform work at ambient and equipment temperatures as recommended by the adhesive manufacturer. Make good separation of joints or cracking of insulation due to thermal movement or poor workmanship.

2 Products

2.1 FIRE AND SMOKE RATING

.1 In accordance with CAN/ULC-S102.
- .1 Maximum flame spread rating: 25.
- .2 Maximum smoke developed rating: 50.

2.2 INSULATION

.1 Mineral fibre specified includes glass fibre and rock wool. Insulation on steam lines to be rock wool only, glass fibre is not permitted.
- .1 TIAC Code A-1; rigid pre-moulded mineral fibre to ASTM C 547 with or without factory applied vapour retarder jacket; ksi value of 0.035 at 24 degrees

.2 TIAC Code A-2: rigid moulded calcium silicate to ASTM C533 in sections and blocks, and with special shapes to suit project requirements, asbestos free; ksi value of 0.060 at 147 deg.C.

.3 TIAC Code A-3: rigid pre-moulded mineral fibre to ASTM C 547 with or without factory applied vapour retarder jacket for high temperature applications; ksi value of 0.072 at 260 degrees C

.4 TIAC Code A-6: flexible unicellular tubular elastomer to ASTM C534; ksi value of 0.04 at 24 degrees C

.5 TIAC Class C-1: Rigid mineral fibre board to ASTM C612, unfaced or faced with CGSB 51-GP-52Ma vapour retarder jacket; ksi value of 0.035 at 24 deg.C.

.6 TIAC Code C-2: mineral fibre blanket to ASTM C553 with or without factory applied vapour retarder jacket. Thermal conductivity; ksi value of 0.04 at 24 deg.C

2.3 REMOVABLE, PRE-FABRICATED INSULATING ENCLOSURES

.1 Use of insulating materials other than those stated in this specification requires Departmental Representative's approval. Standard of acceptance for re-usable insulation blankets shall be Reflex Re-usable flexible insulation covers.

.2 All materials shall be of flame resistant materials.

.3 Re-usable flexible insulation blanket outer jacket material shall be 0.26 kg/m2. Teflon coated fibreglass cloth.

.4 Material used to secure seams and attachments on re-usable flexible insulation blankets shall be 10 strand stainless steel thread with polyester wrap.

.5 Re-usable flexible insulation blanket liner material shall be 560 grams/m2 Teflon coated fibreglass cloth for operating temperatures up to 232 deg.C.

.6 Minimum insulation thickness shall be 25 mm insulation for operating temperatures up to 232 deg.C.

.7 Insulation materials shall be Type E needled fibreglass mat containing no organic binders and no less than 11 pound density for operating temperatures up to 538 deg.C.

.8 Fasteners shall be velcro closures incorporated with seam flaps in conjunction with sewn on straps and stainless steel D rings.

.9 Flaps shall be used to cover all closing seams and cover slots. The flaps shall be 50 mm wide plain flaps for operating temperatures up to 232 deg.C.

.10 6 mm matrix braded Nomex draw-cord closures shall be used on cover openings over 50 mm in diameter. Close the ends of covers over adjacent insulation or piping.

.11 Quilting fasteners shall be 14 gauge stainless steel quilt pins and locking washers.

.12 A stainless steel drain grommet, 11 mm in diameter, shall be installed at the low point on the cover.

.13 A permanent stainless steel or aluminum identification tag shall be attached to each blanket. Tags shall be secured to the re-usable blanket with aluminum rivets and shall be installed in the most visible location on the blanket.

2.4 ACCESSORIES

.1 Bands: 20 mm wide; 0.38 mm thick stainless steel.

.2 Insulating Cement: Hydraulic setting on mineral wool.

.3 Fibrous Glass Cloth: Untreated; 305 g/sq m weight.

.4 Adhesives: Compatible with insulation, waterproof, fire-retardant type.

.5 Impale Anchors: Galvanized steel, 2 mm diameter with 35mm diameter head, length as required for insulation.

.6 Joint Tape: self adhesive reinforced aluminum, minimum 50mm wide

.7 Tie Wire: stainless steel, 1.5 mm.

.8 Outdoor vapour retarder mastic:
- .1 Vinyl emulsion type acrylic, compatible with insulation
- .2 Fibrous glass cloth

2.5 JACKETS

.1 Interior Applications:
- .1 Vapour Barrier Jackets: to CGSB 51-GP-52Ma.
- .2 PVC Jackets: One piece, high-gloss pre-moulded type, 0.8 mm (30mls) thick. Jackets exposed to outdoor use or flourescent lighting shall be ultra-violet ray resistant.
- .3 Canvas Jackets: ULC listed treated cotton fabric, 220 g/sq.m. to ASTM C 921
- .4 Aluminum Jackets: 0.51 mm thick; stucco embossed.

.2 Exterior Applications:
- .1 Aluminum Jackets: 0.51 mm thick; stucco embossed.
- .2 Stainless Steel Jackets: Type 304 stainless steel; 0.25 mm thick, stucco embossed
- .3 Outdoor Jacket: Coated glass fibre sheet, 16 kg/sq m.

3 Execution

3.1 MANUFACTURER'S INSTRUCTIONS

.1 Compliance: comply with manufacturer's written recommendations or specifications, including product technical bulletins, handling, storage and installation instructions, and datasheet.

3.2 PRE-INSTALLATION REQUIREMENT

.1 Pressure testing of piping systems and adjacent equipment to be complete, witnessed and certified.

.2 Surfaces clean, dry, free from foreign material.

3.3 INSTALLATION ON PIPING

.1 Install materials in accordance with manufacturer's instructions and TIAC National standards.

.2 Continue insulation with vapour barrier through penetrations. pack around pipes with fire proof self-supporting insulation material, properly sealed.

.3 In exposed piping, locate insulation and cover seams in least visible locations.

.4 Provide insulation with vapour barrier when medium conveyed may be below ambient temperature and as noted on schedules.

.5 Insulate fittings and valves on pipe systems.

.6 On insulated piping with vapour barrier, insulate fittings, valves, unions, flanges, strainers, flexible connections, and expansion joints. Cover with open mesh glass cloth sealed with vapour barrier sealant.

.7 On insulated piping without vapour barrier and piping conveying fluids 60 degrees C or less, do not insulate flanges and unions at equipment, but bevel and seal ends of insulation at such locations.

.8 Provide an insert of cork or other heavy density material not less than 150 mm long, of same thickness and contour as adjoining insulation, between support shield and piping, but under the finish jacket, on piping 50 mm diameter or larger.

.9 Neatly finish insulation at supports, protrusions, and interruptions.

.10 Handicap Plumbing Fixtures: Insulate trap and drain with 25 mm (1") fibreglass insulation complete with high gloss white PVC jacket. Refer to Plumbing specifications.

.11 Each and every chilled water pipe fitting and accessories located outside of the mechanical room shall be insulated to prevent sweating on exposed parts, this includes all unions, balancing valves, strainers, drains, air vent stems, etc. All parts utilized in maintaining the system shall be insulated with removable insulation. In mechanical rooms, insulation may be omitted on equipment where drain pans are provided including pumps and associated inlet valves.

3.4 REMOVABLE, PRE-FABRICATED, INSULATION AND ENCLOSURES

.1 Removable insulation bags must be provided for the following: control valves, unions or flanges at equipment, steam traps and flanged valves.

.2 Design: to permit movement of expansion joint and to permit periodic removal and replacement without damage to adjacent insulation.

.3 Blankets on flanged valves and equipment shall be designed to cover adjacent mating flanges and overlap line insulation by a minimum of 50 mm. Allowance of stud length plus 25 mm from the back of the mating flange shall be used to calculate the cut back distance of line insulation. Draw-cold flaps shall not be considered as part of the overlap.

.4 Blankets on valves shall be designed to cover the valve body and the bonnet flange of the valve.

.5 Blankets for pressure gauges include block and bleed valve.

.6 Blankets for PSV's shall include the outlet flange. Blanket shall cover entire spring chamber.

.7 All blankets shall be fitted with an identification tag clearly marked with the following information:

.1	Equipment size and type	i.e. 6" 300# Control Valve
.2	Equipment location and tag number	i.e. 21-PV-129
.3	Manufacturer's Serial Number	i.e SN01010

.8 All equipment shall be field measured by blanket supplier. Measurements shall be performed after equipment is installed. All necessary allowances for the blankets shall be coordinated between the blanket supplier and the mechanical, electrical and insulation Contractors.

.9 Re-usable flexible insulation blanket construction:

.1 Blankets up to 25 mm thick shall be inside seam construction with double stitching, with the liner and jacket material sewn together to form the insulation pocket.

.1 Perimeter flaps shall be formed as an extension of the liner and jacket, and shall not be attached to blanket as separate pieces.

.2 All blankets up to 25 mm thick must be double stitched. First stitch will be performed with cloth layers sewn together inside out. Blanket will then be turned right side out and top stitched around all penetrations and around the perimeter of the insulation pocket to create a separation between the insulation pocket and the perimeter flaps.

.3 All draw-cord and closure flaps, required inside the perimeter of the blanket shall be attached inside the seam, between the liner and jacket layers of the blanket.

.2 Blankets over 25 mm thick shall be constructed using boxed corners and gussets in order to maintain consistent thickness across the entire area of the blanket.

.1 Perimeter flaps shall be formed as an extension of the outer jacket, and shall not be attached to the blanket as separate pieces.

.2 All draw-cord and closure flaps, required inside the perimeter of the blanket, shall be attached inside the seam, between the liner and jacket layers of the blanket.

3.5 INSTALLATION - JACKETS

.1 Install in accordance with TIAC standards and manufacturers written requirements.

.2 Indoor, Concealed Pipes: Apply pipe insulation with an integral all-service jacket complete with vapour barrier if specified. Secure jacketing using appropriate fastenings on approximately 100mm centres. Cover longitudinal and circumferential joints with jacket finishing tape neatly applied. Alternately secure jacketing using integral self-sealing lap and self-sealing circumferential joint strips. Fittings, (valves and strainers if specified) not finished with PVC covers shall be covered with a hard coat cement and finish with treated fitting fabric applied with fabric adhesive. Finish jackets as scheduled.

.3 Indoor, Exposed Applications: Insulate as for concealed applications. Finish jacket to be as indicated in schedule. Where indicated by Architect to be painted, finish insulation with canvas jacket; size for finish painting.

.4 Exterior Applications: Vapour barrier jacket, covered with aluminum jacket with seams located on bottom side of horizontal piping. insulate fittings, joints, and valves with insulation of like material and thickness as adjoining pipe, and finish with glass mesh reinforced vapour barrier cement. Lap joints 75 mm (3") minimum and seal with compatible waterproof lap cement.

.5 Provide recovering jackets on exposed insulation throughout, including equipment room. Insulation located in crawl spaces, shafts and suspended ceiling spaces is not considered exposed. Use pre-sized paper under recovering at uneven insulated surfaces.

.6 Metal Jackets: Over the pipe insulation apply metal jacketing using necessary fastenings on approximately 150mm centres. Over insulated fittings, (valve bodies, valve bonnets, strainers and flanges etc. as specified) apply metal jacket or preformed metal fitting covers to provide a complete jacket system. Secure with necessary fastenings.

.7 PVC Jackets: Over the pipe insulation apply PVC jacketing using necessary fastenings on approximately 100mm centres. Cover longitudinal and circumferential joints with finishing tape neatly applied. Over insulated fittings, valve bodies, valve bonnets, strainers and flanges if specified) apply PVC jacket or preformed PVC fitting covers to provide a complete jacket system. Secure with appropriate fastenings and jacket finishing tape.

3.6 PIPING INSULATION SCHEDULES

.1 Includes valves, valve bonnets, strainers, flanges, fittings and all associated equipment unless otherwise specified.

.2 TIAC Code: A-1.
- .1 Seals: lap seal adhesive, lagging adhesive.
- .2 Installation: TIAC Code 1501-H.

.3 TIAC Code: A-3.
- .1 Seals: VR lap seal adhesive, VR lagging adhesive.
- .2 Installation: TIAC Code: 1501-C.

.4 TIAC Code: A-6.
- .1 Seals: lap seal adhesive, lagging adhesive.
- .2 Installation: to TIAC standards.

.5 TIAC Code: C-2 vapour retarder jacket.
- .1 Seals: lap seal adhesive, lagging adhesive.
- .2 Installation: TIAC Code: 1501-C.

.6 TIAC Code: A-2.
- .1 Seals: lap seal adhesive, lagging adhesive.
- .2 Installation: TIAC Code: 1501-H.

.7 Thickness of insulation as listed in following table.
- .1 Run-outs to individual units and equipment not exceeding 4000 mm long.
- .2 Do not insulate exposed runouts to plumbing fixtures, chrome plated piping, valves, fittings.
- .3 Chilled water insulation thicknesses are listed such that a minimum of 25mm is maintained over all fittings, valves and accessories.
- .4 Note that in accordance with the National Energy Code of Canada for Buildings HVAC piping located outside the building envelope shall be insulated to the thickness specified for steam over 175 Deg.C. This requirement does not alter the TIAC Code defining the type of insulation to be used.

Application (mm)	Temp deg.C.	TIAC code	Pipe sizes (NPS) & insulation thickness					
		Run out	to 1	1 1/4 to 2	2 1/2 to 4	5 to 6	8 & over	
Steam	up to 175	A-1	38	50	65	75	90	90
Condensate Return	60 - 94	A-1	25	38	38	38	38	
Hot Water	60 - 94	A-1	25	38	38	38	38	38
Hot Water	up to 59	A-1	25	25	25	25	38	38
Hot Water Equipment	All Temp.	A-1	38	38	38	38	38	38
Dual Temp.	4 - 94	A-3	25	38	38	38	38	38
Cold Water		A-3	25	25	25	25	25	25
Refrigerant	4 - 13	A-6	25	25	25	25	25	25
Refrigerant	below 4	A-6	25	25	38	38	38	38
RWL and RWP		C-2	25	25	25	25	25	25
(with no associated heating loop, insulate rainwater from roof to exterior discharge)								
RWL and RWP		C-2	50	50	50	50	50	50
(with associated heating loop, insulate rainwater from roof to exterior discharge)								
Cooling Coil cond. drain and pan		C-2	25	25	25	25	25	25

.8 Finishes:
- .1 Exposed indoors: canvas or PVC
- .2 Exposed in mechanical rooms: PVC jacket.
- .3 Concealed, indoors: canvas on valves, fittings. No further finish.
- .4 Use vapour retarder jacket on TIAC code A-3, A-6 and C-2 insulation compatible with insulation.
- .5 Outdoors: water-proof aluminum jacket.
- .6 Finish attachments: SS screws, at 150 mm on centre. Seals: wing.
- .7 Installation: to appropriate TIAC code CRF/1 through CPF

3.3 CLEANING

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

.2 Upon completion and verification of performance of installation, remove surplus materials, excess materials, rubbish, tools and equipment.

END OF SECTION

1 General

1.1 REFERENCES

.1 American Society for Testing and Materials International (ASTM)
  .1 ASTM E202-04, Standard Test Methods for Analysis of Ethylene Glycols and Propylene Glycols.

1.2 CLEANING AND START-UP OF MECHANICAL PIPING SYSTEMS

.1 In accordance with Section 23 08 02 - Cleaning and Start-up of Mechanical Piping Systems.

2 Products

2.1 NOT USED

.1 Not Used.

3 Execution

3.1 PREPARATION

.1 Do not conceal or cover piping, fixtures or equipment until inspected by consultant and tested.

.2 Provide equipment, materials and labour for tests and pay expenses. Use test instruments by approved laboratory or manufacturer and furnish certificate showing degree of accuracy.

.3 Test instruments shall have been calibrated within one year

.4 Install permanent gauges and thermometers just prior to tests to avoid changes in calibration.

.5 Carry out hydraulic tests for 8 hours and maintain pressure. Where leakage occurs, repair and re-test.

.6 Before adjusting and balancing, verify that systems are complete and operable. Ensure temperature control systems are complete and operable, thermal overload protection is in place, final filters installed, hydronic systems, flushed, filled, and vented.

.7 Provide instruments required for testing, adjusting, and balancing operations. Make instruments available to Consultant to facilitate spot checks during testing.

.8 Recorded data shall represent actually measured, or observed condition.

3.2 PRESSURE TESTS

.1 Heating Water Piping: Test to 1-1/2 times maximum working pressure or minimum 1034 kPa (150 psi) water pressure.

.2 Domestic Water Piping: Test to 1-1/2 times maximum working pressure or 1034 kPa (150 psi) water pressure measured at system low point.

.3 Drainage Systems: Test by filling with water to produce water pressure of 30 kPa (10') minimum and 75 kPa (25') maximum. Check for proper grade and obstruction by ball test.

.4 Standpipe System: Test to 2070 kPa water pressure at the valve.

.5 Sprinkler System: Test as required by authorities having jurisdiction.

.6 Control Air Piping: Test to 345 kPa air pressure. Maintain pressure 1 hour with maximum 7 kPa pressure drop.

.7 Refrigerant Piping: Test with nitrogen to 2070 kPa on high pressure side and 1035 kPa on low side and refrigerant halide torch test.

.8 Inslab piping: Test to 275 kPa (40 psi) with air for minimum of 24 hours prior to installation of concrete, and during topping pour.

.9 Gas Piping: Test as required by authority having jurisdiction.

.10 Check system during application of test pressure including visual check for leakage of water test medium, soap bubble test for air or nitrogen test medium and halide torch for refrigerant medium.

.11 During heating and cooling piping system tests, check linear expansion at elbows, U bends, expansion joints, and offsets for proper clearance.

.12 When using water as test medium for system not using water or steam, evacuate and dehydrate the piping and certify the lines are dry. Use agency specializing in this type of work.

.13 Should tests indicate defective work or variance with specified requirements, make changes immediately to correct the defects. Correct leaks by remaking joints in screwed fittings, cutting out and rewelding welded joints, remaking joints in copper lines. Do not caulk.

.14 Sprinkler system: Test as required by authorities having jurisdiction.

3.3 PERFORMANCE TESTS

.1 Conduct performance tests to demonstrate equipment and systems meet specified requirements after mechanical installations are completed and pressure tested. Conduct tests as soon as conditions permit. Make changes, repairs, and adjustments required as tests may indicate prior to operating tests.

.2 Lubricate bearings, adjust and/or replace and set direct and "V" belt drives for proper alignment and tension.

.3 Calibrate and adjust thermostats, thermometers, gauges, linkage and dampers. Control valves shall operate freely.

.4 Operate and test motors and speed switches for correct wiring and sequences. Check overload heaters in motor starters.

.5 Replace disposable filters with new testing filters and remove, clean and reinstall washable filters prior to conducting testing.

.6 Clean fan wheel and coils prior to conducting tests.

.7 Remove, clean, and reinstall strainers prior to conducting tests.

.8 Fasten loose and rattling pieces of equipment. Unit heaters, pumps and other equipment shall operate quietly.

.9 Make operating tests for minimum of 5 days during heating season and cooling season of first year of operation and at times when directed, for proper setting of controls under peak load conditions.

.10 Provide services of mechanics and manufacturer's representatives, ladders, tools and associated equipment required to assist the Owner in final tests.

.11 Conduct final operating tests in presence of the Owner. Vary loads to illustrate start-up and shut-down sequence and simulate emergency Conditions for safety shut-downs, with automatic and manual reset. Repair and test defects until satisfactory. Make final adjustments to suit exact building conditions.

.12 Provide manufacturer’s start-ups and reports as specified under specific equipment. Provide copies reports in the Operation and Maintenance Manuals.

.13 Subject gas fired appliances rated in excess of 117 kW to an operational test established by the authority having jurisdiction and to pass this test before being approved for operation.

3.4 HYDRONIC SYSTEMS - PERFORMANCE VERIFICATION (PV)

.1 Perform hydronic systems performance verification after cleaning is completed and system is in full operation.

.2 When systems are operational, perform following tests:

- .1 Conduct full scale tests at maximum design flow rates, temperatures and pressures for continuous consecutive period of 48 hours to demonstrate compliance with design criteria.
- .2 Verify performance of hydronic system circulating pumps as specified, recording system pressures, temperatures, fluctuations by simulating maximum design conditions and varying.
  - .1 Pump operation.

.2 Heating Plant and Chilled Water Plant operation (only as pertains to supplying energy to modified systems in scope).
.3 Maximum heating demand.
.4 Maximum cooling demand.

3.5 HYDRONIC SYSTEM CAPACITY TEST

.1 Perform hydronic system capacity tests 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.
.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 After system has stabilized, record chilled water flow rates and supply and return temperatures simultaneously.

3.6 STEAM SYSTEMS

.1 Performance verification:
.1 When systems are operational, perform relevant tests of steam and condensate return piping systems as specified under hydronic systems.
.2 Verify operation of components of steam system including:
.1 Steam traps by:
.1 Measuring temperature of condensate return and/or
.2 Using audio-sensing devices.
.3 Use of other approved methods.
.2 Thermostatic vents.
.3 Verify performance of condensate return system to ensure return of maximum quantity of condensate return water at with minimum temperature drop.
.4 Adjust piping system as required to eliminate water hammer.

.2 Monitor system continuously until acceptance for proper operation of components including steam traps, thermostatic vents, flash tanks and condensate pumping units.

3.7 POTABLE WATER SYSTEMS

.1 When cleaning is completed and system filled:
- .1 Verify performance of equipment and systems as specified elsewhere in Division 22, 23 or 25.
- .2 Check for proper operation of water hammer arrestors. Run one outlet for 10 seconds, then shut of water immediately. If water hammer occurs, replace water hammer arrestor or recharge air chambers. Repeat for each outlet and flush valve.
- .3 Confirm water quality consistent with supply standards, verifying that no residuals remain resulting from flushing and/or cleaning.

3.8 WET AND DRY PIPE SPRINKLER SYSTEM, STANDPIPE AND HOSE SYSTEMS

.1 Cleaning, testing, start-up, performance verification of equipment, systems, components, and devices is specified elsewhere in Division 23.

.2 Verification of controls, detection devices, alarm devices is specified Division 26.

.3 Demonstrate that fire hose will reach to most remote location regardless of partitions, and obstructions.

.4 Verify operation of interlocks between HVAC systems and fire alarm systems as required by Code or specified.

3.9 SANITARY AND STORM DRAINAGE SYSTEMS

.1 Ensure that traps are fully and permanently primed.

.2 Ensure that fixtures are properly anchored, connected to system.

.3 Operate flush valves and operate each fixture to verify drainage and no leakage.

.4 Cleanouts: refer to Section 22 42 03 - Commercial Washroom Fixtures.

.5 Roof drains:
- .1 Refer to Section 22 42 03 - Commercial Washroom Fixtures.
- .2 Remove caps as required.

3.10 REPORTS

.1 Include record of all tests in Operation and Maintenance Manuals.

3.11 TRAINING

.1 In accordance with Section 21 05 01 - Common Work Results Mechanical.

END OF SECTION

1 General

1.1 SUMMARY

.1 Section Includes:
  .1 Procedures and cleaning solutions for cleaning mechanical piping systems.

1.2 REFERENCES

.1 American Society for Testing and Materials International (ASTM)
  .1 ASTM E202-00, Standard Test Methods for Analysis of Ethylene Glycols and Propylene Glycols.

.2 Health Canada/Workplace Hazardous Materials Information System (WHMIS)
  .1 Material Safety Data Sheets (MSDS).

1.3 SUBMITTALS

.1 Product Data:
  .1 Submit manufacturer's printed product literature, specifications and datasheet in accordance with Section 01 33 00 - Submittal Procedures. Include product characteristics, performance criteria, and limitations.

.2 Quality assurance submittals: submit following in accordance with Section 01 33 00 - Submittal Procedures.
  .1 Instructions: submit manufacturer's installation instructions.

1.4 QUALITY ASSURANCE

.1 Health and Safety:
  .1 Do construction occupational health and safety in accordance with Section 01 35 29.06 - Health and Safety Requirements.

2 Products

2.1 GENERAL REQUIREMENTS

.1 Provide on-site start-up services and support services as required during first year of operation to maintain chemical treatment program.

.2 Materials which may contact finish areas through leakage shall be colourless.

.3 It is the Contractor’s full responsibility for providing suitable working systems especially and in accordance with the requirements of the boiler/chiller manufacturer and equipment construction (copper, aluminum, cast iron, etc.).

2.2 CLOSED HYDRONIC SYSTEM

.1 Cleaning:
  .1 Buffered liquid alkaline compound with emulsifying agents and detergents to remove grease and petroleum products; sodium tripoly phosphate and sodium molybdate.

.2 Biocide, chlorine release agents such as sodium hypochlorite or calcium hypochlorite, or microbiocides such as quarternary ammonia compounds, tributyl tin oxide, methylene bis (thiocyanate), or isothiazolones.

.2 Glycol:

.1 Refer to equipment schedule for type of glycol and percentage of solution. Contractor shall ensure glycol utilized meets Manufacturers requirements for the installed equipment.

2.3 POT FEEDER

.1 1.9L (2 quart) capacity cast iron or welded steel with quick opening cap for working pressure of 1200 kPa.

2.4 SIDESTREAM FILTER

.1 Refer to Section 23 21 14 Hydronic Specialties.

2.5 WATER METER

.1 Displacement type cold water meter with sealed, tamper-proof magnetic drive, impulse contact register, single pole, double throw dry contact switch.

2.6 SOLENOID VALVES

.1 Forged brass body globe pattern, normally open or closed as required, general purpose solenoid enclosure, and continuous duty coil.

2.7 GLYCOL SYSTEM

.1 Refer to equipment schedule.

.2 Packaged glycol mixing and fill system complete with following standard components:

.1 storage/mixing tank with cover
.2 Power supply: cord and plug for standard 115 VAC plug.
.3 Pressure pump capable of running dry without damage.
.4 Low level pump cut-out.
.5 Pump suction hose with inlet strainer and check valve.
.6 feeder system shall be compatible with glycol solutions up to 50%.
.7 Manual diverter valve for purging air and agitating contents of storage tank.
.8 Unit to be complete with Low Level Alarm Panel c/w Remote Monitoring Dry Contacts and Selectable Audible Alarm

2.8 HEAT TRANSFER FLUID

.1 Refer to equipment schedule for percentage by volume solution of inhibited glycol based heat transfer fluid and type of glycol.

.2 Heating Water Systems: Heat transfer fluid shall be in accordance with the type/construction of the boiler being installed (copper, aluminum, cast iron, stainless steel, etc.) and in accordance with the boiler manufacturer's requirements. The contractor shall ensure that the chemical treatment Agency has all necessary information regarding the boiler system. All chemicals used and system maintenance information shall be provided and included in the maintenance manuals. For boilers with aluminium

heat exchangers, glycol with multi-metal additives such as produced by Rhogard, Brenntag, Ashland or Furnox shall be used according to the boiler manufacturer.

.3 Dilution Water: Glycol supplier shall identify the optimum dilution water quality required to complement the glycol solution. If different than specified below, this shall be submitted to the Consultant for review. In general, water used to dilute the concentration of glycol must be either distilled, de-ionized, and contain less than 25 ppm of chloride and sulfite, and less than 50ppm each of hard water ions (calcium and magnesium as calcium carbonate) with a total hardness not to exceed 100ppm. If good quality water is not available, the glycol supplier shall provide the heat transfer fluid and water to meet the specifications of the system.

2.9 TEST EQUIPMENT

.1 Provide test kits as required to determine proper systems treatment and not limited to the following:
- .1 System Test Kit: P & M Alkalinity, scale inhibitor, nitrite, sulphite, molybdate, Ph and hardness.
- .2 Refractormeter to measure freezing protection of glycol mixture.
- .3 Alkalinity titration test kit.
- .4 Chloride titration test kit.
- .5 Sulphite titration test kit.
- .6 Total hardness titration test kit.
- .7 Low phosphate test kit.
- .8 Conductivity bridge, range 0 - 10,000 microhms.
- .9 Creosol red pH slide complete with reagent.
- .10 High nitrite test kit.

3 Execution

3.1 PREPARATION

.1 Ensure reasonable care is exercised in preventing debris, dirt and other foreign material from entering piping system during construction.

.2 Cleaning procedures:
- .1 Provide detailed report outlining proposed cleaning procedures at least 2 weeks prior to proposed starting date. Report to include:
  - .1 Cleaning procedures, flow rates, elapsed time.
  - .2 Chemicals and concentrations 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 used to ensure water will not damage systems or equipment

.3 Systems to be operational, filled, started, and vented prior to cleaning.

.4 Place terminal control valves in open position during cleaning.

.5 Verify that electric power is available and of the correct characteristics.

.6 Provide adequate drain connections to completely drain systems in one hour. Use water meter to record gallonage (litres) in each system.

.7 Remove strainer screens from system during cleaning. Protect or remove control devices from systems being cleaned. Terminal control valves shall be in open position during cleaning.

.8 System pumps may be used for cleaning provided that new set of seals are provided and installed, and pumps are dismantled and inspected. Replace worn parts, install new gaskets and turnover used seals.

3.2 INSTALLATION

.1 Install equipment to manufacturer's written instructions and as per schematics and drawings.

3.3 CLEANING SEQUENCE

.1 Concentration: As recommended by manufacturer.

.2 Flush velocity in system mains and branches shall be sufficient to ensure removal of debris.

.3 Hot Water Heating Systems:
- .1 Apply heat while circulating, slowly raising temperature to 71 degrees C and maintain for 12 hours minimum.
- .2 Remove heat and circulate to 37.8 degrees C or less; drain systems as quickly as possible and refill with clean water.
- .3 Circulate for 6 hours at design temperatures, then drain.
- .4 Refill with clean water and test. Repeat flush and test until traces of system cleaner is removed to satisfaction of the Departmental Representative.
- .5 Refill system with water or water/glycol solution as specified.

.4 Use neutralizer agents on recommendation of system cleaner supplier and approval of Consultant.

.5 Inspect, remove sludge, and flush low points with clean water after cleaning process is completed. Include disassembly of components as required.

.6 When cleaning is completed, submit report, complete with certificate of compliance with specifications of cleaning component supplier.

3.4 CLOSED SYSTEM TREATMENT

.1 Provide one bypass feeder in conjunction with sidestream filters on each system. Install isolating and drain valves and necessary piping. Install around balancing valve downstream of circulating pumps unless indicated otherwise.

.2 Introduce closed system treatment through bypass feeder when required or indicated by test.

.3 An analysis of the closed system water shall be taken and recorded by the contractor after completion of work clearly indicating the following: tests proving glycol concentration, tests showing inhibitor strength, tests indicating Ph levels and water quality, Test reports shall identify specified requirements of system and manufacturers requirements for installed equipment and clearly show that water quality, pH, and inhibitor strength all meet identified requirements. This report shall be recorded in the maintenance manual. Refer to ASTM E202.

.1 Perform tests before system is turned over to the Owner.
.2 Provide test prior to end of guarantee and replenish as required.
.3 Provide written test results for review for all tests.

.4 Provide antifreeze solution lost from the systems from any cause other than neglect by the Owner during the first year of operation.

.5 Provide two extra 204 litre (45 gallon) drums of specified glycol following

3.5 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.
.7 Check water level / pressure 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, shut down system, re-align, repeat start-up procedures.
.15 Re-tighten bolts 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 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

3.6 MANUFACTURER'S INSTRUCTIONS

.1 Compliance: comply with manufacturer's written recommendations or specifications, including product technical bulletins, handling, storage and installation instructions, and datasheet.

END OF SECTION

1 General

1.1 SUMMARY

.1 Section Includes:
  .1 Copper piping valves and fittings for hydronic systems.
.2 Sustainable requirements for construction and verification.

1.2 REFERENCES

.1 American National Standards Institute (ANSI)/American Welding Society (AWS)
  .1 ANSI/AWS A5.8/A5.8M-04, Specification Filler Metals for Brazing and Bronze Welding.

.2 American Society of Mechanical Engineers (ASME)
  .1 ANSI/ASME B16.4-98, Gray-Iron Threaded Fittings.
  .2 ANSI/ASME B16.15-1985 (2004), Cast Bronze Threaded Fittings.
  .3 ANSI B16.18-2001, Cast Copper Alloy, Solder Joint Pressure Fittings.
  .4 ANSI/ASME B16.22-2001, Wrought Copper and Copper-Alloy Solder Joint Pressure Fittings.

.3 American Society for Testing and Materials International (ASTM)
  .1 ASTM B32-04, Standard Specification for Solder Metal.
  .2 ASTM B61-02, Standard Specification for Steam or Valve Bronze Castings.
  .3 ASTM B62-02, Standard Specification for Composition Bronze or Ounce Metal Castings.
  .4 ASTM B88M-03, Standard Specification for Seamless Copper Water Tube Metric.
  .5 ASTM E202-04, Standard Test Methods for Analysis of Ethylene Glycols and Propylene Glycols.

.4 Health Canada/Workplace Hazardous Materials Information System (WHMIS)
  .1 Material Safety Data Sheets (MSDS).

.5 Manufacturers Standardization Society (MSS)
  .1 MSS SP67-2002a, Butterfly Valves.
  .2 MSS SP70-1998, Cast Iron Gate Valves, Flanged and Threaded Ends.
  .3 MSS SP71-1997, Grey Iron Swing Check Valves, Flanged and Threaded Ends.
  .4 MSS SP80-2003, Bronze Gate, Globe, Angle and Check Valves.
  .5 MSS SP85-2002, Cast Iron Globe and Angle Valves, Flanged and Threaded Ends.

1.3 QUALITY ASSURANCE

.1 Regulatory Requirements: ensure Work is performed in compliance with applicable Provincial /Territorial regulations.

.2 Health and Safety:
  .1 Do construction occupational health and safety in accordance with Section 01 35 29.06 - Health and Safety Requirements.

1.4 DELIVERY, STORAGE, AND HANDLING

.1 Packing, shipping, handling and unloading:
  .1 Deliver, store and handle in accordance with manufacturer's written instructions and Section 01 61 00 - Common Product Requirements.

2 Products

2.1 TUBING

.1 Type A hard drawn copper tubing: to ASTM B88M.

2.2 FITTINGS

.1 Cast bronze threaded fittings: to ANSI/ASME B16.15.

.2 Wrought copper and copper alloy solder joint pressure fittings: to ANSI/ASME B16.22.

.3 Cast iron threaded fittings: to ANSI/ASME B16.4.

.4 Cast copper alloy solder joint pressure fittings: to ANSI B16.18.

2.3 FLANGES

.1 Brass or bronze: threaded.

.2 Cast iron: threaded.

.3 Orifice flanges: slip-on, raised face, 2100 kPa.

2.4 JOINTS

.1 Solder, tin-antimony, 95:5: to ASTM B32.

.2 Silver solder BCUP: to ANSI/AWS A5.8.

.3 Brazing: as indicated.

2.5 VALVES

.1 Connections:
  .1 NPS 2 and smaller: ends for soldering.
  .2 NPS 2 1/2 and larger: flanged or grooved ends.

.2 Gate Valves Application: isolating equipment, control valves, pipelines:
  .1 NPS 2 and under:
    .1 Mechanical Rooms: Class 125, rising stem split wedge disc, as specified Section 23 05 23.01 - Valves - Bronze.
    .2 Elsewhere: Class 125, non-rising stem, solid wedge disc, as specified Section 23 05 23.01 - Valves - Bronze.

.3 Butterfly valves: application: isolating each section of multiple component equipment (eg. multi-section coils):
.1 NPS 2 1/2 and over: lug type, grooved ends: as specified Section 23 05 17 - Pipe Welding.

.4 Globe valves: application: throttling, flow control, emergency bypass:
.1 NPS 2 and under:
.1 Mechanical Rooms: with PFTE disc, as specified Section 23 05 23.01 - Valves - Bronze.
.2 Elsewhere: with composition disc, as specified Section 23 05 23.01 - Valves - Bronze.

.5 Balancing, for TAB:
.1 Sizes: calibrated balancing valves, as specified.
.2 NPS 2 and under:
.1 Automatic flow control device.

.6 Drain valves: gate, Class 125, non-rising stem, solid wedge disc, as specified Section 23 05 23.01 - Valves - Bronze.

.7 Swing check valves:
.1 NPS 2 and under:
.1 Class 125, swing, with composition disc, as specified Section 23 05 23.01 - Valves - Bronze.
.2 NPS 2 1/2 and over:
.1 Flanged, Grooved ends: as specified Section 23 05 23.02 - Valves - Cast Iron.

.8 Silent check valves:
.1 NPS 2 and under:
.1 As specified Section 23 05 23.01 - Valves - Bronze.

.9 Ball valves:
.1 NPS 2 and under: as specified Section 23 05 23.01 - Valves - Bronze.

3 Execution

3.1 MANUFACTURER'S INSTRUCTIONS

.1 Compliance: comply with manufacturer's written recommendations or specifications, including product technical bulletins, handling, storage and installation instructions, and datasheet.

3.2 PIPING INSTALLATION

.1 Refer to Section 23 05 05 Installation of Pipework

.2 Connect to equipment in accordance with manufacturer's instruction unless otherwise indicated.

.3 Install concealed pipes close to building structure to keep furring space to minimum. Install to conserve headroom and space. Run exposed piping parallel to walls. Group piping where ever practical.

.4 Slope piping in direction of drainage and for positive venting.

.5 Use eccentric reducers at pipe size change installed to provide positive drainage or positive venting.

.6 Provide clearance for installation of insulation and access for maintenance of equipment, valves and fittings.

.7 Assemble piping using fittings manufactured to ANSI standards.

3.3 VALVE INSTALLATION

.1 Refer to Section 23 05 05 - Installation of Pipework.

.2 Install rising stem valves in upright position with stem above horizontal.

.3 Install butterfly valves on chilled water and condenser water lines only.

.4 Install gate, ball or butterfly valves at branch take-offs and to isolate each piece of equipment, and as indicated.

.5 Install globe valves for balancing and in by-pass around control valves as indicated.

.6 Install swing check valves in horizontal lines on discharge of pumps and as indicated.

.7 Install chain operators on valves NPS 2 1/2 and over where installed more than 2400 mm above floor in Boiler Rooms and Mechanical Equipment Rooms.

.8 Install ball valves for glycol service.

3.4 BALANCING VALVES

.1 Install flow measuring stations and flow balancing valves as indicated.

.2 Remove handwheel after installation and TAB is complete.

.3 Tape joints in prefabricated insulation on valves installed in chilled water mains.

3.5 AUTOMATIC CONTROL VALVES

.1 Install where indicated.

.2 Record flow or valve identification tag.

.3 Flow to be within 10% of specified value.

3.6 FLUSHING AND CLEANING

.1 Flush and clean in presence of Departmental Representative.

.2 Flush after pressure test for a minimum of 4h.

.3 Fill with solution of water and non-foaming, phosphate-free detergent 3% solution by weight. Circulate for minimum of 8h.

.4 Refill system with clean water. Circulate for at least 4h. Clean out strainer screens/baskets regularly. Then drain.

.5 Refill system with clean water. Circulate for at least 2h. Clean out strainer screens/baskets regularly. Then drain.

.6 Drainage to include drain valves, dirt pockets, strainers, low points in system.

.7 Re-install strainer screens/baskets only after obtaining Departmental Representative's approval.

3.7 FILLING OF SYSTEM

.1 Refill system with clean water/glycol solution, adding water treatment as specified.

3.8 FIELD QUALITY CONTROL

.1 Testing:
- .1 Test system in accordance with Section 230801 Performance Verification Mechanical Piping Systems.

.2 Balancing:
- .1 Balance water systems to within plus or minus 5% of design output.

.3 Glycol Charging:
- .1 Provide mixing tank and positive displacement pump for glycol charging.
- .2 Retest for concentration to ASTM E202 after cleaning.
- .3 Provide report to Departmental Representative.

END OF SECTION

1 General

1.1 SUMMARY

.1 Section Includes.
- .1 Materials and installation for steel piping, valves and fittings for hydronic systems in building services piping.
- .2 Sustainable requirements for construction and verification.

1.2 REFERENCES

.1 American Society of Mechanical Engineers (ASME).
- .1 ASME B16.1-98, Cast Iron Pipe Flanges and Flanged Fittings.
- .2 ASME B16.3-98, Malleable Iron Threaded Fittings.
- .3 ASME B16.5-03, Pipe Flanges and Flanged Fittings.
- .4 ASME B16.9-01, Factory-Made Wrought Buttwelding Fittings.
- .5 ASME B18.2.1-03, Square and Hex Bolts and Screws (Inch Series).
- .6 ASME B18.2.2-87 (R1999), Square and Hex Nuts (Inch Series).

.2 American Society for Testing and Materials International, (ASTM).
- .1 ASTM A47/A47M-99, Standard Specification for Ferritic Malleable Iron Castings.
- .2 ASTM A53/A53M-02, Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc Coated Welded and Seamless.
- .3 ASTM A536-84 (1999)e1, Standard Specification for Ductile Iron Castings.
- .4 ASTM B61-02, Standard Specification for Steam or Valve Bronze Castings.
- .5 ASTM B62-02, Standard Specification for Composition Bronze or Ounce Metal Castings.
- .6 ASTM E202-00, Standard Test Method for Analysis of Ethylene Glycols and Propylene Glycols.

.3 American Water Works Association (AWWA).
- .1 AWWA C111-00, Rubber-Gasket Joints for Ductile-Iron Pressure Pipe and Fittings.

.4 Canadian Standards Association (CSA International).
- .1 CSA B242-M1980 (R1998), Groove and Shoulder Type Mechanical Pipe Couplings.
- .2 CAN/CSA W48-01, Filler Metals and Allied Materials for Metal Arc Welding (Developed in cooperation with the Canadian Welding Bureau).

.5 Manufacturer's Standardization of the Valve and Fittings Industry (MSS).
- .1 MSS-SP-67-025, Butterfly Valves.
- .2 MSS-SP-70-98, Cast Iron Gate Valves, Flanged and Threaded Ends.
- .3 MSS-SP-71-97, Cast Iron Swing Check Valves Flanged and Threaded Ends.
- .4 MSS-SP-80-03, Bronze Gate, Globe, Angle and Check Valves.
- .5 MSS-SP-85-02, Cast Iron Globe and Angle Valves, Flanged and Threaded Ends.

1.3 SUBMITTALS

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

.2 Closeout Submittals.
.1 Provide maintenance data for incorporation into manual specified in Section 01 78 00 - Closeout Submittals and include following:
.1 Special servicing requirements.

1.4 QUALITY ASSURANCE

.1 Health and Safety.
.1 Do construction occupational health and safety in accordance with Section 01 35 29.06 - Health and Safety Requirements.

1.5 MAINTENANCE

.1 Extra Materials.
.1 Provide following spare parts:
.1 Valve seats: one for every ten valves, each size. Minimum one.
.2 Discs: one for every ten valves, each size. Minimum one.
.3 Stem packing: one for every ten valves, each size. Minimum one.
.4 Valve handles: two of each size.
.5 Gaskets for flanges: one for every ten flanges.

2 Products

2.1 PIPE

.1 Steel pipe: to ASTM A53/A53M, Grade B, as follows:
.1 To NPS6.

2.2 PIPE JOINTS

.1 NPS2 and under: screwed fittings with PTFE tape.

.2 NPS2-1/2 and over: flanges to CAN/CSA W48.

.3 Roll grooved: standard coupling to CSA B242.

.4 Flanges: plain or raised face, slip-on weld neck to AWWA C111.

.5 Orifice flanges: slip-on raised face, 2100 kPa.

.6 Flange gaskets: to AWWA C111.

.7 Pipe thread: taper.

.8 Bolts and nuts: to ASME B18.2.1 and ASME B18.2.2.

.9 Roll grooved coupling gaskets: type EPDM.

2.3 FITTINGS

.1 Screwed fittings: malleable iron, to ASME B16.3, Class 150.

.2 Pipe flanges and flanged fittings:
.1 Cast iron: to ASME B16.1, Class 125.
.2 Steel: to ASME B16.5.

.3 Butt-welding fittings: steel, to ASME B16.9.

.4 Unions: malleable iron, to ASTM A47/A47M and ASME B16.3.

.5 Fittings for roll grooved piping: malleable iron to ASTM A47/A47M, ductile iron to ASTM A536.

2.4 VALVES

.1 Connections:
- .1 NPS2 and smaller: screwed ends.
- .2 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 23.01 - Valves - Bronze.
  - .2 Elsewhere: Class 125, non-rising stem, solid wedge disc, as specified Section 23 05 23.01 - Valves - Bronze.
- .2 NPS21/2 and over:
  - .1 Mechanical Rooms: non-rising stem, solid wedge disc, lead free bronze trim, as specified Section 23 05 23.02 - Valves - Cast Iron.
    - .1 Operators: handwheel.
  - .2 Elsewhere: Non-rising stem, solid wedge disc, lead free bronze trim, as specified Section 23 05 23.02 - Valves - Cast Iron.
    - .1 Operators: handwheel.

.3 Butterfly valves: to MSS-SP-67 Application: Isolating cells or section of multiple component equipment (eg. multi section coils, multi-cell cooling towers):
- .1 NPS21/2 and over: Lug type, Grooved ends: as specified Section 23 05 17 - Pipe Welding.

.4 Globe valves: to MSS-SP-80, 85 Application: Throttling, flow control, emergency bypass:
- .1 NPS2 and under:
  - .1 Mechanical Rooms: with PTFE disc, as specified Section 23 05 23.01 - Valves - Bronze.
  - .2 Elsewhere: Globe, with composition disc, as specified Section 23 05 23.01 - Valves - Bronze.
- .2 NPS21/2 and over:
  - .1 With composition lead free, bronze disc, lead free, bronze trim, as specified Section 23 05 23.02 - Valves - Cast Iron.
  - .2 Operators: handwheel.

.5 Balancing, for TAB:
- .1 Sizes: Calibrated balancing valves, as specified this section.
- .2 NPS2 and under:
  - .1 Automatic flow control device where specified.
  - .2 Circuit setter where specified.

.6 Drain valves: Gate, Class 125, non-rising stem, solid wedge disc, as specified Section 23 05 23.01 - Valves - Bronze.

.7 Swing check valves: to MSS-SP-71.

.1 NPS2 and under:
.1 Class 125, swing, with composition disc, as specified Section 23 05 23.01 - Valves - Bronze.
.2 NPS21/2 and over:
.1 Flanged or Grooved ends: as specified Section 23 05 23.02 - Valves - Cast Iron.

.8 Silent check valves:
.1 NPS2 and under:
.1 As specified Section 23 05 23.01 - Valves - Bronze.
.2 NPS21/2 and over:
.1 Flanged or Grooved ends: as specified Section 23 05 23.02 - Valves - Cast Iron.

.9 Ball valves:
.1 NPS2 and under: as specified Section 23 05 23.01 - Valves - Bronze.

.10 Lubricated Plug Valves
.1 NPS21/2 and over:
.1 As specified Section 23 05 23.02 - Valves - Cast Iron.

3 Execution

3.1 PIPING INSTALLATION

.1 Install pipework in accordance with Section 23 05 05 - Installation of Pipe Work.

3.2 BALANCING VALVES

.1 Install flow measuring stations and flow balancing valves as indicated.

.2 Remove handwheel after installation and when TAB is complete.

.3 Tape joints in prefabricated insulation on valves installed in chilled water mains.

3.3 CLEANING, FLUSHING AND START-UP

.1 In accordance with Section 23 08 02 - Cleaning and Start-Up of Mechanical Piping Systems.

3.4 TESTING

.1 Test system in accordance with Section 23 05 00 Common Work Results for Mechanical.
.2 For glycol systems, retest with propylene glycol to ASTM E202, inhibited, for use in building system after cleaning. Repair leaking joints, fittings or valves.

3.5 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.

3.6 GLYCOL CHARGING

.1 Provide mixing tank and positive displacement pump for glycol charging.

.2 Retest for concentration to ASTM E202 after cleaning.

3.7 PERFORMANCE VERIFICATION

.1 In accordance with Section 23 08 01 - Performance Verification of Mechanical Piping.

END OF SECTION

1 General

1.1 SECTION INCLUDES

.1 Expansion tanks.
.2 Air vents.
.3 Air separators.
.4 Strainers.
.5 Pump suction fittings.
.6 Combination fittings.
.7 Flow indicators, controls, meters.
.8 Radiator valves.
.9 Relief valves.
.10 Glycol specialties.

1.2 QUALITY ASSURANCE

.1 Comply with Provincial Regulations and have CSA approval.

.2 Grooved joint piping specialties shall be of the same manufacturer as the adjoining couplings.

.3 Construct pressure tanks to ASME Code for unfired pressure vessels.

1.3 REFERENCES

.1 ASME - SEC 8D - Boilers and Pressure Vessels Code - Rules for Construction of Pressure Vessels.

1.4 SUBMITTALS

.1 Section 01 33 00: Procedures for submittals.

.2 Product Data: Provide product data for manufactured products and assemblies required for this project. Include component sizes, rough-in requirements, service sizes, and finishes. Include product description, model and dimensions.

.3 Manufacturer's Installation Instructions: Indicate hanging and support methods, joining procedures.

.4 Provide operating and service procedures for expansion tank, including setting tank pressure, replacing bladder etc.

1.5 PROJECT RECORD DOCUMENTS

.1 Section 01 78 00: Submittals for project closeout.

.2 Record actual locations of flow controls.

1.6 OPERATION AND MAINTENANCE DATA

.1 Section 01 78 00: Submittals for project closeout.

.2 Maintenance Data: Include installation instructions, assembly views, lubrication instructions, and replacement parts list.

2 Products

2.1 EXPANSION TANKS

.1 Construction: Welded steel with heavy duty butyl air/water interface, tank style to match equipment schedule. Tank shall be cleaned, prime coated, and supplied with steel support saddles; with tappings for installation of accessories.
- .1 Pressure rating: 860 kPa.
- .2 Size: As noted on equipment schedule.

.2 Tank shall be tested and stamped to ASME SEC 8-D.

.3 Quick Connect Air Inlet:
- .1 Expansion Tank: Inlet tire check valve, manual air vent, tank drain, and pressure relief valve.

.4 Automatic Cold Water Fill Assembly: Pressure reducing valve, reduced pressure double check back flow preventer, test cocks, strainer, vacuum breaker, and valved bypass.

.5 Hot Water Heating System:
- .1 Select expansion tank pressure relief valve to match boiler..
- .2 Set pressure reducing valve at select 35 kPa.

.6 Precharge air side to 84 kPa (12 PSI) initial fill pressure of system.

2.2 AIR VENTS

.1 Manual Type: Short vertical sections of 50 mm diameter pipe to form air chamber, with 12mm (1/2") full port ball valve at top of chamber. Discharge to u-bend copper, PEX or plastic tubing of sufficient length to permit discharge to 5 gallon pail. Where pipe sizes are less than 64mm (2-1/2") air chamber shall be line size.

.2 Float Type:
- .1 Cast iron body and cover, with stainless steel, brass and EPDM internal components, and NPS 19 mm inlet connection, 9.5 mm discharge and rated at 1034 kPa working pressure.
- .2 Float: solid material suitable for system operating temperature and pressure. Minimum temperature to be 121 Deg.C.
- .3 Provide isolating valve before inlet.

2.3 SEPARATORS

.1 Combination Air Separators/Strainers:
- .1 Centrifugal air separator, steel, tested and stamped to ANSI/ASME SEC 8-D; for 860 kPa operating pressure, with integral galvanized steel strainer with 5mm perforations, tangential inlet and outlet flanged or grooved connections, and internal stainless steel air collector tube.

2.4 SUCTION DIFFUSER

.1 Fitting: Angle pattern, cast-iron body, threaded for 50 mm and smaller, flanged for 65 mm and larger, rated for 1200 kPa working pressure, with full length straightening vanes, cylinder strainer with 5 mm diameter openings, disposable fine mesh stainless steel strainer to fit over cylinder strainer, and permanent magnet located in flow stream and removable for cleaning.

.2 Accessories: Adjustable foot support, 25mm (1") blowdown tapping in bottom, pressure gauge tappings.

2.5 COMBINATION PUMP INLET AND STRAINER FITTING

.1 Provide angle type suction guide fitting with flanged cast iron or grooved (inlet) ductile iron body, stainless steel, steel or cast iron guide vanes and removable stainless steel strainer. Design based on Victaulic Series 731-I

.2 Accessories: drain tapping in bottom, pressure gauge tappings

2.6 COMBINATION PUMP DISCHARGE VALVES

.1 Triple-Duty Valve Assembly: Shall not be permitted.

2.7 CIRCUIT SETTER (STATIC BALANCING)

.1 Provide bronze (copper alloy), ductile iron or cast iron with bronze or copper alloy disc, complete with pressure tappings, memory lock and insulation blocks.

2.8 AUTOMATIC FLOW RESTRICTOR

.1 Automatic flow control valve complete with isolation and strainer, sized for design flow rate

.2 Construction: Forged or cast brass or bronze body with union on inlet, temperature and pressure test ports on inlet and outlet.

.3 Control flow within 5 percent of selected rating, over operating pressure range of 10 times minimum pressure required for control, maximum minimum pressure 13.7 kPa.

.4 Control Mechanism: Stainless steel or nickel plated brass piston or regulator cup, operating against stainless steel helical or wave formed spring.

.5 In-line strainer with 20 mesh stainless steel filter screen and drain valve.

.6 Isolation Valve: Ball valve with Teflon seats, refer to valve specifications.

2.9 RELIEF VALVES

.1 Bronze body, teflon seat, stainless steel stem and springs, automatic, direct pressure actuated, capacities ASME certified and labelled.

2.10 RADIATOR BALANCING VALVES

.1 Angle or straight pattern, rising stem, inside screw globe valve for 860 kPa working pressure, with bronze body and integral union for screwed connections, renewable composition disc.

.2 Provide stainless steel indicating dial plate and lockable balancing yoke.

.3 Provide automatic flow restrictors and/or circuit setters where indicated on details.

2.11 IN FLOOR PIPING MANIFOLD

.1 Shall be of cast bronze construction and shall have integral circuit balancing valves, individual circuit control valves and electric actuators. Manifolds shall be provided complete with support brackets, pipe bend supports, and end caps

2.12 SIDE-STREAM FILTRATION SYSTEM

.1 System: Flow indicator, filter housing with cartridge filter, shut-off valves, and flow control valve.

.2 Performance: Design flow 0.25 L/sec with maximum pressure drop of 20.7 kPa.

.3 Hot Water and Glycol Filter Housing: Glass reinforced nylon plastic suitable for 105 degrees C and 1380 kPa operating conditions.

.4 Chilled Water Filter Housing: Reinforced polypropylene plastic housing suitable for 52 degrees C and 860 kPa operating conditions.

.5 Cartridges: 0.03 mm for start-up and 0.005 mm for system operation.

.6 Provide one case of thirty 20-micron cartridges and one case of thirty 5-micron cartridges.

3 Execution

3.1 INSTALLATION

.1 Install specialties to manufacturer's written instructions.

.2 Clean and flush glycol system before adding glycol solution. Refer to Section 23 25 00.

3.2 EXPANSION TANKS

.1 Support tanks inside building from building structure.
.2 Refer to equipment schedule and drawings for size and configuration.

.3 Adjust expansion tank pressure to suit actual site conditions.

.4 Install lockshield type valve at inlet to tank.

3.3 AIR VENTS

.1 Provide manual air vents at system high points and as indicated.

.2 Install automatic air vents at system air separator, heating units and system high points not readily accessible for servicing.

.3 Install gate valve on automatic air vent inlet. Run discharge to nearest drain or service sink.

.4 For automatic air vents in ceiling spaces or other concealed locations, provide vent tubing to nearest drain.

.5 Where large air quantities can accumulate, provide enlarged air collection standpipes.

3.4 SEPARATOR

.1 Provide in line air separator on suction side of system circulation pump.

3.5 RELIEF VALVES

.1 Provide relief valves on pressure tanks, low pressure side of reducing valves, heat exchangers, expansion tanks and where indicated.

.2 Select system relief valve capacity so that it is greater than make-up pressure reducing valve capacity. Select equipment relief valve capacity to exceed rating of connected equipment.

.3 Pipe relief valve outlet to nearest floor drain.

.4 Where one line vents several relief valves, make cross sectional area equal to sum of individual vent areas.

3.6 PUMP FITTINGS

.1 Provide pump suction fitting and strainer on suction side of centrifugal pumps. Remove temporary strainers after cleaning systems.

.2 Combination strainer and suction fitting may be utilized in lieu of individual suction diffuser and strainer.

.3 Provide balancing device on discharge of pump, refer to details for style.

.4 A combination balance, check, and isolation valve may be used on pump discharge where indicated or required to conserve space.

.5 Support pump fittings with floor mounted pipe and flange supports to eliminate undue stress on pump connection

3.7 RADIATOR BALANCING VALVES

.1 Angle or straight pattern, rising stem, inside screw globe valve for 860 kPa working pressure, with bronze body and integral union for screwed connections, renewable composition disc.

.2 Provide stainless steel indicating dial plate and lockable balancing yoke.

3.8 HYDRONIC BALANCING VALVES

.1 Provide balancing valves on all heating and cooling equipment and all hydronic terminal devices to facilitate system balancing.

.2 Provide balancing valves on branch lines, as indicated, to facilitate system balancing.

.3 Provide circuit setters on heating and cooling equipment as indicated on details and schematics.

.4 Provide automatic flow restrictors on heating and cooling equipment as indicated on details and schematics.

3.9 IN FLOOR MANIFOLD

.1 Install in locations indicated on drawings complete with access covers. Configuration to suit number of zones.

3.10 SIDE STREAM FILTER

.1 Provide side-stream filtration system for each and every separate closed loop hydronic system. Install across main circulating pumps with flow from pump discharge to pump suction.

END OF SECTION

1 General

1.1 SECTION INCLUDES

.1 In-line circulators.
.2 Vertical in-line pumps.
.3 Close coupled pumps.
.4 Base mounted pumps.

1.2 REFERENCES

.1 UL 778 - Motor-Operated Water Pumps.

1.3 PERFORMANCE REQUIREMENTS

.1 Ensure pumps operate at specified system fluid temperatures without vapour binding and cavitation, are non-overloading in parallel or individual operation, and operate within 25 percent of midpoint of published maximum efficiency curve.

1.4 SUBMITTALS

.1 Section 01 33 00: Procedures for submittals.

.2 Product Data: Provide certified pump curves showing performance characteristics with pump and system operating point plotted. Include NPSH curve when applicable. Include electrical characteristics and connection requirements.

.3 Manufacturer's Installation Instructions: Indicate hanging and support requirements and recommendations.

.4 Millwright's Certificate: Certify that base mounted pumps have been aligned.

1.5 OPERATION AND MAINTENANCE DATA

.1 Section 01 78 00: Submittals for project closeout.

.2 Operation and Maintenance Data: Include installation instructions, assembly views, lubrication instructions, and replacement parts list.

1.6 QUALITY ASSURANCE

.1 Manufacturer: Company specializing in manufacture, assembly, and field performance of pumps with minimum three years experience.

.2 Alignment: Align base mounted pumps by qualified millwright.

1.7 REGULATORY REQUIREMENTS

.1 Products Requiring Electrical Connection: Listed and classified by ULC as suitable for the purpose specified and indicated.

2 Products

2.1 GENERAL REQUIREMENTS

.1 Statically and dynamically balance rotating parts.

.2 Construction shall permit complete servicing without breaking piping or motor connections.

.3 Pumps shall operate at 1750 RPM unless specified otherwise.

.4 Pump connections shall be flanged.

.5 Heating pumps shall be suitable for handling water at 110 deg.C (230 deg.F).

.6 Refer to equipment schedules for pump size, capacity, and minimum efficiency.

.7 Pumps to be complete with suction and discharge gauge ports.

.8 Pumps shall be rated for greater of 862 kPa (125 psi) or 1.5 times maximum working pressure.

2.2 SYSTEM LUBRICATED CIRCULATORS

.1 Type: Horizontal shaft, single stage, direct connected with multiple speed wet rotor motor for in-line mounting, 110 degrees C maximum water temperature.

.2 Casing: Cast iron with flanged pump connections.

.3 Impeller, Shaft, Rotor: Stainless Steel.

.4 Bearings: Metal Impregnated carbon (graphite) and ceramic.

.5 Starter housing and terminal box to be aluminum.

.6 Motor: Impedance protected single speed or multiple speed with external speed selector as indicated on equipment schedule.

2.3 IN-LINE CIRCULATORS

.1 Type: Horizontal shaft, single stage, direct connected, with resiliently mounted motor for in-line mounting, oil lubricated.

.2 Casing: Cast iron, with flanged pump connections.

.3 Impeller: Cadmium plated steel or bronze, keyed to shaft.

.4 Bearings: Two, oil lubricated bronze sleeves.

.5 Shaft: Alloy or stainless steel with copper or bronze sleeve, integral thrust collar.

.6 Seal: Carbon rotating against a stationary ceramic seat, viton fitted, 135 degrees C maximum continuous operating temperature.

.7 Drive: Flexible coupling.

2.4 VERTICAL IN-LINE PUMPS

.1 Type: Vertical, single stage, close coupled, radially or horizontally split casing, for in-line mounting, suitable for horizontal or vertical operation.

.2 Casing: Cast iron, with suction and discharge gauge port, casing wear ring, seal flush connection, drain plug, flanged suction and discharge.

.3 Impeller: Bronze, fully enclosed, keyed directly to motor shaft or extension and secured with locknut.

.4 Shaft: Stainless steel or carbon steel with bronze or stainless steel sleeve through seal chamber.

.5 Seal Options:
- .1 Carbon rotating against a stationary ceramic seat, viton fitted, 107 degrees C maximum continuous operating temperature.
- .2 Packing gland with minimum four rings graphite impregnated packing and bronze lantern rings, 110 degrees C maximum continuous operating temperature.

2.5 CLOSE COUPLED PUMPS

.1 Type: Horizontal shaft, single stage, close coupled, radially split casing, for 860 kPa maximum working pressure.

.2 Casing: Cast iron, with suction and discharge gauge ports, renewable bronze casing wearing rings, seal flush connection, drain plug, flanged suction and discharge.

.3 Impeller: Bronze, fully enclosed, keyed to motor shaft extension.

.4 Shaft: Stainless steel.

.5 Seal options:
- .1 Carbon rotating against a stationary ceramic seat, 107 degrees C] maximum continuous operating temperature.
- .2 Carbon rotating against a stationary ceramic seat, viton fitted, 135 degrees C maximum continuous operating temperature.
- .3 Packing gland with minimum four rings graphite impregnated packing and bronze lantern rings, 110 degrees C maximum continuous operating temperature.

2.6 BASE MOUNTED PUMPS

.1 Type: Horizontal shaft, single stage, direct connected, radially or horizontally split casing.

.2 Casing: Cast iron, split volute, with suction and discharge gauge ports, renewable bronze casing wearing rings, seal flush connection, drain plug, flanged suction and discharge.

.3 Impeller: Bronze, fully enclosed, keyed to shaft.

.4 Bearings: Oil lubricated roller or ball bearings.

.5 Shaft: Alloy steel with copper, bronze, or stainless steel shaft sleeve.

.6 Seal options:
- .1 Carbon rotating against a stationary ceramic seat, 107 degrees C] maximum continuous operating temperature.
- .2 Carbon rotating against a stationary ceramic seat, Viton fitted, 135 degrees C maximum continuous operating temperature.
- .3 Packing gland with minimum four rings graphite impregnated packing and bronze lantern rings, 110 degrees C maximum continuous operating temperature.

.7 Drive: Flexible coupling with coupling guard.

.8 Baseplate: High grade heat treated cast iron or reinforced heavy steel with integral drain rim.

2.7 INTEGRAL VARIABLE SPEED PUMPS

.1 The self-sensing product shall consist of a factory prepackaged and preprogrammed pump, drive, motor, and integral controls package. Note that controller shall be mounted remotely from pump.

.2 The drive shall be mounted on wall and wired to the motor. It shall be mounted with rubber vibration mounts. The mounting and packing of the drive shall be done in a manner that transmitted acceleration levels will be three times below the allowable limits published by the drive manufacturer. These limits will apply to a frequency range of 0-10,000 HZ.

.3 The performance speed of this package shall 1750 RPM nominal as standard. Exceptions for 3600 RPM will be noted in the schedules. 3600 RPM shall NOT be an allowable substitution for a specified 1750 PRM package. 3600 RPM products might be considered as a substitution for 1750 RPM only if that manufacturer provides a spare motor, drive, and seal for each pumping unit.

.4 Pump logic controller, variable frequency drives, sensor/transmitters and related equipment shall be installed by the mechanical contractor as shown on the plans. Electrical shall wire power to controller and from controller to pump motor.

.5 Pump Logic Controller:
- .1 The controller operation shall operate the system using a tested and proven program that safeguards against undesirable or damaging conditions including:
  - .1 Motor overload
  - .2 Pump flow surges
  - .3 Hydraulic cycling (hunting).
  - .4 End of curve unstable operation: The pump logic controller, through a factory pre-programmed algorithm, shall be capable of protecting the pumps from hydraulic damage due to operation beyond their published end-of-curve. This feature requires a flow meter for activation. The operator interface shall include an owner adjustable flow set point to set the parameters for this routine.
- .2 The pump logic controller shall be capable of starting, unloading, and stopping pumps based on a system performance program that will minimize energy consumption, provide reliable performance and bumpless transitions.

.3 The integrated logic controller shall be capable of running four different hydronic optimization sub-routines

.1 Setup one: This subroutine shall allow the pump package to track a quadratic system curve and will optimize a secondary distribution loop. It shall use a technology that allows the pump, drive, and motor package to translate the hydronic data from both a pump and system curve and translate it to electrical data. This allows the drive to know exactly where it is in the hydronic world.

.2 Setup two: This subroutine shall allow two pumps to run as backup for each other and shall alternate the pumps based on a real time clock.

.3 Setup three: This subroutine shall allow the package to run in a customer defined flow rate. The package will always seek to run at the user defined flow even with fouling causing system changes. It shall use a technology that allows the pump, drive, and motor package to translate the hydronic data from both a pump and system curve and translate it to electrical data. This allows the drive to know exactly where it is in the hydronic world.

.4 Setup four: This subroutine shall incorporate a traditional external sensing and control platform. It shall allow the option of controlling the pumps with three zones of differential pressure or central plant differential temperature. This optional setup shall allow the owner the option of external sensing without adding an external controller.

.4 The control platform shall include a subroutine equal to allow for the automatic balancing of secondary system distribution pumps. The package shall automatically run system distribution pumps to a user defined duty point and will recognize that duty point and hold the pumps at a speed that matches the actual installed system quadratic system curve. The package will then use this data to set up a new duty point as the max point for the quadratic control curve. Use of external balancing devices will not be needed.

.5 The package shall serve as a flow metering device and will display pump flow at the user interface.

.6 Variable Frequency Drives:

.1 The VFD shall convert incoming fixed frequency three-phase ac power into an adjustable frequency and voltage for controlling the speed of three-phase ac motors. The motor current shall closely approximate a sine wave. Motor voltage shall be varied with frequency to maintain desired motor magnetization current suitable for the driven load and to eliminate the need for motor derating. When properly sized, the VFD shall allow the motor to produce full rated power at rated motor voltage, current, and speed without using the motor's service factor. VFDs utilizing sine weighted/coded modulation (with or without 3rd harmonic injection) must provide data verifying that the motors will not draw more than full load current during full load and full speed operation.

.1 The VFD shall include an input full-wave bridge rectifier and maintain a fundamental (displacement) power factor near unity regardless of speed or load.

.2 The VFD shall have a dual 5% impedance DC link reactor on the positive and negative rails of the dc bus to minimize power line harmonics and protect the VFD from power line transients. The chokes shall be non-saturating. Swinging chokes that do not provide full harmonic filtering throughout the entire load range are not acceptable. VFDs with saturating (non-linear) dc link reactors shall require an additional 3% AC line reactor to provide acceptable harmonic performance at full load, where harmonic performance is most critical.

.3 The VFD's full load output current rating shall meet or exceed nec table 430-150. The VFD shall be able to provide full rated output current continuously, 110% of rated current for 60 seconds and 120% of rated torque for up to 0.5 second while starting.

.4 The VFD shall provide full motor torque at any selected frequency from 20 hz to base speed while providing a variable torque v/hz output at reduced speed. This is to allow driving direct drive fans without high speed derating or low speed excessive magnetization, as would occur if a constant torque v/hz curve was used at reduced speeds. Breakaway current of 160% shall be available.

.5 A programmable automatic energy optimization selection feature shall be provided standard in the VFD. This feature shall automatically and continuously monitor the motor's speed and load to adjust the applied voltage to maximize energy savings.

.6 The VFD must be able to produce full torque at low speed to operate direct drive fans.

.7 Output power circuit switching shall be able to be accomplished without interlocks or damage to the VFD.

.8 An automatic motor adaptation algorithm shall measure motor stator resistance and reactance to optimize performance and efficiency. It shall not be necessary to run the motor or de-couple the motor from the load to perform the test.

.9 Galvanic isolation shall be provided between the VFD's power circuitry and control circuitry to ensure operator safety and to protect connected electronic control equipment from damage caused by voltage spikes, current surges, and ground loop currents. VFDs not including either galvanic or optical isolation on both analog i/o and discrete digital i/o shall include additional isolation modules.

.10 VFD shall minimize the audible motor noise through the used of an adjustable carrier frequency. The carrier frequency shall be automatically adjusted to optimize motor and VFD operation while reducing motor noise. VFDs with fixed carrier frequency are not acceptable.

.11 All VFDs shall contain integral emi filters to attenuate radio frequency interference conducted to the ac power line.

.12 The drive enclosure shall be standard as NEMA 12 (ip 55) and optional shall be NEMA 4X (ip 66). See schedules for project requirements.

.13 Protective Features:

.1 A minimum of class 20 i2t electronic motor overload protection for single motor applications shall be provided. Overload protection shall automatically compensate for changes in motor speed.

.2 Protection against input transients, loss of AC line phase, output short circuit, output ground fault, over voltage, under voltage, VFD over temperature and motor over temperature. The VFD shall display all faults in plain language. Codes are not acceptable.

.3 Protect VFD from input phase loss. The VFD should be able to protect itself from damage and indicate the phase loss condition. During an input phase loss condition, the VFD shall be able to be programmed to either trip off while displaying an alarm, issue a warning while running at reduced output capacity, or issue a warning while running at full commanded speed. This function is independent of which input power phase is lost.

.4 Protect from under voltage. The VFD shall provide full rated output with an input voltage as low as 90% of the nominal. The VFD will continue to operate with reduced output, without faulting, with an input voltage as low as 70% of the nominal voltage.

.5 Protect from over voltage. The VFD shall continue to operate without faulting with a momentary input voltage as high as 130% of the nominal voltage.

.6 The VFD shall incorporate a programmable motor preheat feature to keep the motor warm and prevent condensation build up in the motor when it is stopped in a damp environment by providing the motor stator with a controlled level of current.

.7 VFD shall include a “signal loss detection” algorithm with adjustable time delay to sense the loss of an analog input signal. It shall also include a programmable time delay to eliminate nuisance signal loss indications. The functions after detection shall be programmable.

.8 VFD shall function normally when the keypad is removed while the VFD is running. No warnings or alarms shall be issued as a result of removing the keypad.

.9 VFD shall catch a rotating motor operating forward or reverse up to full speed without VFD fault or component damage.

.10 Selectable over-voltage control shall be provided to protect the drive from power regenerated by the motor while maintaining control of the driven load.

.11 VFD shall include current sensors on all three output phases to accurately measure motor current, protect the VFD from output short circuits, output ground faults, and act as a motor overload. If an output phase loss is detected, the VFD will trip off and identify which of the output phases is low or lost.

.12 If the temperature of the VFD’s heat sink rises to 80?c, the VFD shall automatically reduce its carrier frequency to reduce the heat sink temperature. It shall also be possible to program the VFD so that it reduces its output current limit value if the VFD’s temperature becomes too high.

.13 In order to ensure operation during periods of overload, it must be possible to program the VFD to automatically reduce its output current to a programmed value during periods of excessive load. This allows the VFD to continue to run the load without tripping.

.14 The VFD shall have temperature controlled cooling fan(s) for quiet operation, minimized losses, and increased fan life. At low loads or low ambient temperatures, the fan(s) may be off even when the VFD is running.

.15 The VFD shall store in memory the last 10 alarms. A description of the alarm, and the date and time of the alarm shall be recorded.

.16 When used with a pumping system, the VFD shall be able to detect no-flow situations, dry pump conditions, and operation off the end of the pump curve. It shall be programmable to take appropriate protective action when one of the above situations is detected.

.2 Internal Control Algorithm

.1 This is a standard HVAC drive that has been upgraded and modified by pump experts for hydronic applications. It is set up with a closed loop internal control sequence that will optimize life cycle, system comfort, and minimize energy consumption.

.3 Interface Features

.1 Hand, off and auto keys shall be provided to start and stop the VFD and determine the source of the speed reference. It shall be possible to either disable these keys or password protect them from undesired operation.

.2 There shall be an “info” key on the keypad. The info key shall include “on-line” context sensitive assistance for programming and troubleshooting.

.3 The VFD shall be programmable to provide a digital output signal to indicate whether the VFD is in hand or auto mode. This is to alert the building automation system whether the VFD is being controlled locally or by the building automation system.

.4 Password protected keypad with alphanumeric, graphical, backlit display can be remotely mounted. Two levels of password protection shall be provided to guard against unauthorized parameter changes.

.5 All VFDs shall have the same customer interface. The keypad and display shall be identical and interchangeable for all sizes of VFDs.

.6 To set up multiple VFDs, it shall be possible to upload all setup parameters to the VFD’s keypad, place that keypad on all other VFDs in turn and download the setup parameters to each VFD. To facilitate setting up VFDs of various sizes, it shall be possible to download from the keypad only size independent parameters. Keypad shall provide visual indication of copy status.

.7 Display shall be programmable to communicate in multiple languages including english, spanish and french.

.8 A red fault light, a yellow warning light and a green power-on light shall be provided. These indications shall be visible both on the keypad and on the VFD when the keypad is removed.

.9 A quick setup menu with factory preset typical HVAC parameters shall be provided on the VFD. The VFD shall also have individual fan, pump, and compressor menus specifically designed to facilitate start-up of these applications.

.10 A four-feedback PID controller to control the speed of the VFD shall be standard. This controller shall accept up to four feedback signals. It shall be programmable to compare the feedback signals to a common setpoint or to individual setpoints and to automatically select either the maximum or the feedback signal as the controlling signal. It shall also be possible to calculate the controlling feedback signal as the average of all feedback signals or the difference between a pair of feedback signals.

.1 The VFD shall be able to apply individual scaling to each feedback signal.

.2 The VFD's PID controller shall be able to actively adjust its setpoint based on flow. This allows the VFD to compensate for a pressure feedback sensor which is located near the output of the pump rather than out in the controlled system.

.11 The VFD shall have three additional PID controllers which can be used to control damper and valve positioners in the system and to provide setpoint reset.

.12 Floating point control interface shall be provided to increase/decrease speed in response to contact closures.

.13 Five simultaneous meter displays shall be available. They shall include at a minimum, frequency, motor current, motor voltage, VFD output power, VFD output energy, VFD temperature in degrees, among others.

.14 Programmable sleep mode shall be able to stop the VFD. When its output frequency drops below set "sleep" level for a specified time, when an external contact commands that the VFD go into sleep mode, or when the VFD detects a no-flow situation, the VFD may be programmed to stop. When the VFD's speed is being controlled by its PID controller, it shall be possible to program a "wake-up" feedback value that will cause the VFD to start. To avoid excessive starting and stopping of the driven equipment, it shall be possible to program a minimum run time before sleep mode can be initiated and a minimum sleep time for the VFD.

.15 A run permissive circuit shall be provided to accept a "system ready" signal to ensure that the VFD does not start until dampers or other auxiliary equipment are in the proper state for VFD operation. The run permissive circuit shall also be capable of initiating an output "run request" signal to indicate to the external equipment that the VFD has received a request to run.

.16 VFD shall be programmable to display feedback signals in appropriate units, such as inches of water column (in-wg), pressure per square inch (psi) or temperature (deg.F).

.17 VFD shall be programmable to sense the loss of load and signal this condition via a keypad warning, relay output and/or over the serial communications bus. To ensure against nuisance indications, this feature

must be based on motor torque, not current, and must include a proof timer to keep brief periods of no load from falsely triggering this indication.

.4 Standard Control And Monitoring Inputs And Outputs

.1 Six dedicated, programmable digital inputs shall be provided for interfacing with the systems control and safety interlock circuitry.

.1 Two terminals shall be programmable to act as either as digital outputs or additional digital inputs.

.2 Two programmable relay outputs, Form C 240 V AC, 2 A, shall be provided for remote indication of VFD status.

.1 Each relay shall have an adjustable on delay / off delay time.

.3 Two programmable analog inputs shall be provided that can be either direct-or-reverse acting. Each shall be independently selectable to be used with either an analog voltage or current signal.

.1 The maximum and minimum range of each shall be able to be independently scalable from 0 to 10 V dc and 0 to 20 mA.

.2 A programmable low-pass filter for either or both of the analog inputs must be included to compensate for noise.

.3 The VFD shall provide front panel meter displays programmable to show the value of each analog input signal for system set-up and troubleshooting,

.4 One programmable analog current output (0/4 to 20 mA) shall be provided for indication of VFD status. This output shall be programmable to show the reference or feedback signal supplied to the VFD and for VFD output frequency, current and power. It shall be possible to scale the minimum and maximum values of this output.

.5 It shall be possible through serial bus communications to read the status of all analog and digital inputs of the VFD.

.6 It shall be possible to command all digital and analog output through the serial communication bus.

.5 Optional Control And Monitoring Inputs And Outputs

.1 It shall be possible to add optional modules to the VFD in the field to expand its analog and digital inputs and outputs.

.1 These modules shall use rigid connectors to plug into the VFD's control card.

.2 The VFD shall automatically recognize the option module after it is powered up. There shall be no need to manually configure the module.

.3 Modules may include such items as:

a) Additional digital outputs, including relay outputs
b) Additional digital inputs
c) Additional analog outputs

d) Additional analog inputs, including Ni or Pt temperature sensor inputs

.4 It shall be possible through serial bus communications to control the status of all optional analog and digital outputs of the VFD.

.6 Standard programmable firefighter's override mode allows a digital input to control the VFD and override all other local or remote commands. It shall be possible to program the VFD so that it will ignore most normal VFD safety circuits including motor overload. The VFD shall display firemode whenever in firefighter's override mode. Firemode shall allow selection of forward or reverse operation and the selection of a speed source or preset speed, as required to accommodate local fire codes, standards and conditions.

.7 A real-time clock shall be an integral part of the VFD.

.1 It shall be possible to use this to display the current date and time on the VFD's display.

.1 Ten programmable time periods, with individually selectable ON and OFF functions shall be available. The clock shall also be programmable to control start/stop functions, constant speeds, PID parameter setpoints and output relays. Is shall be possible to program unique events that occur only during normal work days, others that occur only on non-work days, and others that occur on specific days or dates. The manufacturer shall provide free PC-based software to set up the calendar for this schedule.

.2 All VFD faults shall be time stamped to aid troubleshooting.

.3 It shall be possible to program maintenance reminders based on date and time, VFD running hours, or VFD operating hours.

.4 The real-time clock shall be able to time and date stamp all faults recorded in the VFD fault log.

.8 The VFD shall be able to store load profile data to assist in analyzing the system demand and energy consumption over time.

.9 The VFD shall include a sequential logic controller to provide advanced control interface capabilities. This shall include:

.1 Comparators for comparing VFD analog values to programmed trigger values

.1 Logic operators to combine up to three logic expressions using Boolean algebra

.2 Delay timers

.3 A 20-step programmable structure

10. The VFD shall include a cascade controller which allows the VFD to operate in closed loop set point (PID) control mode one motor at a controlled speed and control the operation of 3 additional constant speed motor starters.

.11 Serial communications

.1 The VFD shall include a standard eia-485 communications port and capabilities to be connected to the following serial communication protocols at no additional cost and without a need to install any additional hardware or software in the VFD:

.1 Modbus RTU

.2 BACnet MS/TP

.3 LonWorks Free Topology (FTP)

.4 VFD shall have standard rs-485 port for direct connection of personal computer (pc) to the VFD. The manufacturer shall provide no-charge pc software to allow complete setup and access of the VFD and logs of VFD operation through the rs-485 port. It shall be possible to communicate to the VFD through this usb port without interrupting VFD communications to the building management system.

.5 The VFD shall have provisions for an optional 24 v DC back-up power interface to power the VFD's control card. This is to allow the VFD to continue to communicate to the building automation system even if power to the VFD is lost.

12. Adjustments

.1 The VFD shall have a manually adjustable carrier frequency that can be adjusted in 0.5 khz increments to allow the user to select the desired operating characteristics. The VFD shall also be programmable to automatically reduce its carrier frequency to avoid tripping due to thermal loading.

.1 Four independent setups shall be provided.

.2 Four preset speeds per setup shall be provided for a total of 16.

.3 Each setup shall have two programmable ramp up and ramp down times. Acceleration and deceleration ramp times shall be adjustable over the range from 1 to 3,600 seconds.

.4 Each setup shall be programmable for a unique current limit value. If the output current from the VFD reaches this value, any further attempt to increase the current produced by the VFD will cause the VFD to reduce its output frequency to reduce the load on the VFD. If desired, it shall be possible to program a timer which will cause the VFD to trip off after a programmed time period.

.5 If the VFD trips on one of the following conditions, the VFD shall be programmable for automatic or manual reset: external interlock, under-voltage, over-voltage, current limit, over temperature, and VFD overload.

.6 The number of restart attempts shall be selectable from 0 through 20 or infinitely and the time between attempts shall be adjustable from 0 through 600 seconds.

.7 An automatic "start delay" may be selected from 0 to 120 seconds. During this delay time, the VFD shall be programmable to either apply no voltage to the motor or apply a DC braking current if desired.

.8 Four programmable critical frequency lockout ranges to prevent the VFD from operating the load at a speed that causes vibration in the driven equipment shall be provided. Semi-automatic setting of lockout ranges shall simplify the set-up.

.13 Optional features

.1 All optional features shall be built and mounted by VFD manufacturer. All optional features shall be UL listed by the VFD manufacturer as a complete assembly and carry a UL label.

.1 All panels shall be marked for their short circuit current rating in compliance with UL.

.14 Service conditions

.1 Ambient temperature, continuous, full speed, full load operation:

.1 -10 to 45°C (14 to 113°F) through 125 hp @ 460 and 600 volt, through 60 hp @ 208 volt

.2 -10 to 40°C (14 to 104°F) 150 hp and larger

.1 0 to 95% relative humidity, non-condensing.

.2 Elevation to 3,300 feet without derating.

.3 AC line voltage variation, -10 to +10% of nominal with full output.

.4 No side clearance shall be required for cooling.

.5 All power and control wiring shall be done from the bottom.

.6 All VFDs shall be plenum rated.

.7 Pumps

.1 Inline pump matched to VFD and factory tested.

3 Execution

3.1 PREPARATION

.1 Verify that electric power is available and of the correct characteristics (voltage and phase) prior to ordering pump.

3.2 INSTALLATION

.1 Install to manufacturer's written instructions.

.2 Provide access space around pumps for service. Provide no less than minimum as recommended by manufacturer.

.3 Decrease from line size with long radius reducing elbows or reducers. Support piping adjacent to pump such that no weight is carried on pump casings. For close coupled or base mounted pumps, provide supports under elbows on pump suction and discharge line sizes 102 mm and over. Refer to Section 23 05 48.

.4 Provide line sized shut-off isolation valve and strainer on pump suction, and line sized soft seated check valve, balancing device, and shut-off isolation valve on pump discharge.

.5 Provide air cock and drain connection on horizontal pump casings.

.6 Provide drains for bases and stuffing boxes piped to and discharging into floor drains.

.7 Provide common pressure gauge, piped complete with isolation valves to suction and discharge side of pump.

.8 Check, align, and certify alignment of base mounted pumps prior to start-up.

.9 Install close coupled and base mounted pumps on concrete housekeeping base, with anchor bolts, set and level, and grout in place. Refer to Section 03 30 00.

.10 Lubricate pumps before start-up.

3.3 INTEGRAL VARIABLE SPEED PUMPS

.1 Install equipment in accordance with manufacturer's instructions and all applicable codes.

.2 Ensure that pump is pipe-mounted and free to float with any movement, expansion and contraction of piping system.

- .1 Support pump using floor mounted saddle or wall bracket as required.
- .2 For vertical in-line pumps supported from structure, ensure no pipe strain is imposed on pump flanges.

.3 Power wiring, as required, shall be the responsibility of the electrical contractor. All wiring shall be performed per manufacturer's instructions and all applicable codes.

.4 Control wiring for remote mounted switches and sensor/transmitters shall be the responsibility of the controls contractor. All wiring shall be performed per manufacturer's instructions and all applicable codes.

.5 Demonstration:

- .1 The control package manufacturer's factory trained representative shall provide start-up of the packaged pumping system. This start-up shall include verification of proper installation, system initiation, adjustment and fine tuning. Start-up shall not be considered complete until the sequence of operation, including all alarms, has been sufficiently demonstrated to the Owner or Owner's designated representative. This jobsite visit shall occur only after all hook-ups, tie-ins, and terminations have been completed and signed-off on the manufacturer's start-up request form.
- .2 The pump control package manufacturer's factory trained representative shall provide on-site training for owner's personnel. This training shall fully cover maintenance and operation of all system components.

3.4 PERFORMANCE VERIFICATION

.1 General
- .1 In accordance with manufacturer's recommendations and as specified herein.

.2 Exclusions:
- .1 This paragraph does not apply to small fractional horse-power (lower than 1/2 hp) 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 and await instructions.

.5 Multiple Pump Installations - Series and Parallel:
- .1 Repeat PV procedures specified above for pump performance and pump BHP for combinations of pump operations.

.6 Mark points of design and actual performance at design conditions as finally set upon completion of TAB.

.7 Include reports in Operation and Maintenance Manuals:
- .1 Record of point(s) of actual performance at maximum and minimum conditions and for single and parallel operation as finally set at completion of commissioning on pump curves.
- .2 Pump performance curves (family of curves) to be provided with report.

END OF SECTION

1 General

1.1 SUMMARY

.1 Section Includes:
- .1 Materials and installation for copper tubing and fittings for refrigerant.

1.2 REFERENCES

.1 American Society of Mechanical Engineers (ASME)
- .1 ASME B16.22-01, Wrought Copper and Copper Alloy Solder - Joint Pressure Fittings.
- .2 ASME B16.24-02, Cast Copper Pipe Flanges and Flanged Fittings: Class 150, 300, 400, 600, 900, 1500 and 2500.
- .3 ASME B16.26-88, Cast Copper Alloy Fittings for Flared Copper Tubes.
- .4 ASME B31.5-01, Refrigeration Piping and Heat Transfer Components.

.2 American Society for Testing and Materials International (ASTM)
- .1 ASTM A307-04, Standard Specification for Carbon Steel Bolts and Studs, 60,000 PSI Tensile Strength.
- .2 ASTM B280-03, Standard Specification for Seamless Copper Tube for Air Conditioning and Refrigeration Field Service.

.3 Canadian Standards Association (CSA International)
- .1 CSA B52-99, Mechanical Refrigeration Code.

.4 Environment Canada (EC)
- .1 EPS 1/RA/1-96, Environmental Code of Practice for the Elimination of Fluorocarbon Emissions from Refrigeration and Air Conditioning Systems.

.5 Health Canada / Workplace Hazardous Materials Information System (WHMIS)
- .1 Material Safety Data Sheets (MSDS).

1.3 SUBMITTALS

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

.2 Product Data:
- .1 Submit manufacturer's printed product literature, specifications and datasheet for piping, fittings and equipment.
- .2 Submit WHMIS MSDS in accordance with Section 02 81 01 - Hazardous Materials. Indicate VOC's for adhesive and solvents during application and curing.

.3 Test Reports: submit certified test reports from approved independent testing laboratories indicating compliance with specifications for specified performance characteristics and physical properties.

.4 Certificates: submit certificates signed by manufacturer certifying that materials comply with specified performance characteristics and physical properties.

.5 Instructions: submit manufacturer's installation instructions.

.6 Closeout submittals: submit maintenance and engineering data for incorporation into manual specified in Section 01 78 00 - Closeout Submittals.

1.4 QUALITY ASSURANCE

.1 Comply with Provincial Regulations and Mechanical Refrigeration Codes.

.2 Pre-Installation Meeting:
- .1 Convene pre-installation meeting one week prior to beginning work of this Section and on-site installations in accordance with Section 01 32 16 - Construction Progress Schedules - Bar (GANTT) Charts.
  - .1 Verify project requirements.
  - .2 Review installation and substrate conditions.
  - .3 Co-ordination with other building subtrades.
  - .4 Review manufacturer's installation instructions and warranty requirements.

.3 Health and Safety:
- .1 Do construction occupational health and safety in accordance with Section 01 35 29.06 - Health and Safety Requirements.

1.5 START-UP AND TESTING

.1 Supply initial charge of refrigerant and oil for each refrigeration system. Losses of oil or refrigerant prior to acceptance of equipment or due to defects covered under guarantee shall be replaced. Supply to the Owner, one complete charge of lubricating oil in addition to that placed in the system.

.2 Charge the system with refrigerant and test entire system for leaks after completion of installation. Repair leaks, put system into operation, and test equipment performance.

.3 Shut-down system if initial start-up testing takes place in winter and machines are to remain inoperative. Repeat start-up and testing operation at beginning of first cooling season.

.4 Provide cooling season start-up, winter season shut-down for first year of operation.

2 Products

2.1 TUBING

.1 Processed for refrigeration installations, deoxidized, dehydrated and sealed.
- .1 Hard copper: to ASTM B280, type ACR.
- .2 Annealed copper: to ASTM B280, with minimum wall thickness as per CSA B52 and ASME B31.5.

2.2 FITTINGS

.1 Service: design pressure 2070 kPa and temperature 121 degrees C.

.2 Brazed:
- .1 Fittings: wrought copper to ASME B16.22.
- .2 Joints: silver solder or copper-phosphorous, 95% Cu-5%P and non-corrosive flux.

.3 Flanged:
- .1 Bronze or brass, to ASME B16.24, Class 150 and Class 300.
- .2 Gaskets: suitable for service.
- .3 Bolts, nuts and washers: to ASTM A307, heavy series.

.4 Flared:
- .1 Bronze or brass, for refrigeration, to ASME B16.26.

2.3 PIPE SLEEVES

.1 Hard copper or steel, sized to provide 6 mm clearance around between sleeve and uninsulated pipe or between sleeve and insulation.

2.4 VALVES

.1 22 mm and under: Class 500, 3.5 Mpa, globe or angle non-directional type, diaphragm, packless type, with forged brass body and bonnet, moisture proof seal for below freezing applications, brazed connections.

.2 Over 22 mm: Class 375, 2.5 Mpa, globe or angle type, diaphragm, packless type, back-seating, cap seal, with cast bronze body and bonnet, moisture proof seal for below freezing applications, brazed connections.

2.5 LIQUID INDICATORS

.1 Liquid indicators shall be double port type with copper or brass body, and flared or solder ends.

.2 Provide removable seal caps on each port to inspect refrigerant condition.

2.6 STRAINERS

.1 Refrigerant strainers shall be angle replaceable cartridge type with brass shell.

.2 Cartridge material and screen size shall be suitable for refrigerant and pipe material utilized in the system.

2.7 FILTER DRIERS

.1 Combination filter driers shall be angle type, with brass shell and incorporate a combined straining and drying material.

.2 Desiccant material shall be replaceable.

2.8 SOLENOID VALVES

.1 Solenoid valves shall have copper or brass body with flared or screwed ends.

.2 Coil assembly shall be replaceable.

.3 Valves shall incorporate a manually operated stem to serve as a bypass in case of coil failure.

2.9 EXPANSION VALVES

.1 Provide angle type or straight through expansion valves suitable for the refrigerant utilized in the system.

.2 Valves shall have brass body, internal or external equalizer, adjustable super-heat setting and be complete with capillary tube and remote sensing bulb.

2.10 CHARGING VALVES

.1 Provide general purpose type refrigerant charging valves with brass body, flared or solder ends and with removable valve core.

.2 Provide valve inlet with quick coupling connection for ease of charging.

2.11 FLEXIBLE CONNECTORS

.1 Flexible connectors shall consist of close pitch corrugated bronze hose with single layer of exterior braiding to provide additional strength and prevent elongation of corrugated section.

.2 Connectors shall be minimum 9" long and provided with bronze fittings to facilitate connection to equipment.

3 Execution

3.1 MANUFACTURER'S INSTRUCTIONS

.1 Compliance: comply with manufacturer's written recommendations or specifications, including product technical bulletins, handling, storage and installation instructions, and datasheet.

3.2 GENERAL

.1 Install in accordance with CSA B52, EPS1/RA/1 and ASME B31.5, Section 23 05 01 - Installation of Pipework.

3.3 BRAZING PROCEDURES

.1 Bleed inert gas into pipe during brazing.

.2 Remove valve internal parts, solenoid valve coils, sight glass.

.3 Do not apply heat near expansion valve and bulb.

3.4 PIPING INSTALLATION

.1 General:
- .1 Soft annealed copper tubing: bend without crimping or constriction. Hard drawn copper tubing: do not bend. Minimize use of fittings.

.2 Hot gas lines:
- .1 Pitch at least 1:240 down in direction of flow to prevent oil return to compressor during operation.
- .2 Provide trap at base of risers greater than 2400 mm high and at each 7600 mm thereafter.
- .3 Provide inverted deep trap at top of risers.
- .4 Provide double risers for compressors having capacity modulation.
  - .1 Large riser: install traps as specified.
  - .2 Small riser: size for 5.1 m/s at minimum load. Connect upstream of traps on large riser.

3.5 PRESSURE AND LEAK TESTING

.1 Close valves on factory charged equipment and other equipment not designed for test pressures.

.2 Leak test to CSA B52 before evacuation to 2MPa and 1MPa on high and low sides respectively.

.3 Test Procedure: build pressure up to 35 kPa with refrigerant gas on high and low sides. Supplement with nitrogen to required test pressure. Test for leaks with electronic or halide detector. Repair leaks and repeat tests.

3.6 DX EQUIPMENT START-UP AND TESTING

.1 Refrigeration equipment: Prepare system for start-up by having manufacturer's factory trained representative supervise testing, dehydration and charging of machine. Do start-up including co-ordination on start-up of condensers.

.2 Testing:
- .1 Provide sufficient refrigerant, dry nitrogen and refrigeration oil for pressure and operational testing under manufacturer's supervision.
- .2 Prior to testing ensure that system is complete. Protect relief valves during test procedure. After completion of test, reconnect and make good piping connections and leak test entire system.

3.7 AIR COOLED CONDENSING UNIT

.1 Check unit for damage before and after placement:
- .1 Protect and cover exposed units to the elements during construction.
- .2 Conform to installation drawings. Mount units on roof mounting frame.

3.8 LIQUID INDICATORS

.1 Provide full size liquid indicators in main liquid line leaving condenser. If receiver is used install in liquid line leaving receiver.

3.9 STRAINERS

.1 Provide full size strainer ahead of each automatic valve. Where multiple expansion valves with integral strainers are used, install single main liquid line strainer.

.2 On steel piping systems provide adequate strainer in suction line to remove scale and rust inherent in steel pipe.

.3 Provide shut-off valve on each side of strainer to facilitate maintenance.

3.10 FILTER-DRIERS

.1 Filter-driers may be used in systems instead of separate strainers and driers.

.2 Install with three valve bypass assembly to permit isolation for servicing.

3.11 SOLENOID VALVES

.1 Provide solenoid valves in liquid line of systems operating with single pump-out or pump-down compressor control, in liquid line of single or multiple evaporator systems and in oil bleeder lines from flooded evaporators to stop flow of oil and refrigerant into the suction line when system shuts down.

.2 Provide solenoid valves with manually operated stems.

3.12 EXPANSION VALVES

.1 Size expansion valves properly to avoid penalty of being undersized at full load and of being excessively oversized at partial load.

.2 Properly evaluate refrigerant pressure drop through system to determine the available pressure drop across the valve.

.3 Select valves for maximum load at design operating pressure and minimum 7.2 deg.C of superheat.

.4 Locate remote expansion valve sensing bulb immediately after evaporator outlet on suction line.

3.13 CHARGING VALVES

.1 Provide refrigerant charging connections in liquid line between receiver shut-off valve and expansion valve.

3.14 FLEXIBLE CONNECTORS

.1 In general install suction and hot gas piping connections to compressors with three directional changes for distance of minimum six pipe diameters before reaching point of support.

.2 Flexible connectors shall only be utilized at or near compressors where it is not physically possible to absorb vibration within piping configuration.

3.15 FIELD QUALITY CONTROL

.1 Site Tests/Inspection:
- .1 Close service valves on factory charged equipment.

.2 Ambient temperatures to be at least 13 degrees C for at least 12 hours before and during dehydration.

.3 Use copper lines of largest practical size to reduce evacuation time.

.4 Use two-stage vacuum pump with gas ballast on 2nd stage capable of pulling 5Pa absolute and filled with dehydrated oil.

.5 Measure system pressure with vacuum gauge. Take readings with valve between vacuum pump and system closed.

.6 Triple evacuate system components containing gases other than correct refrigerant or having lost holding charge as follows:
- .1 Twice to 14 Pa absolute and hold for 4 h.
- .2 Break vacuum with refrigerant to 14 kPa.
- .3 Final to 5 Pa absolute and hold for at least 12 h.
- .4 Isolate pump from system, record vacuum and time readings until stabilization of vacuum.
- .5 Submit test results to Departmental Representative.

.7 Charging:
- .1 Charge system through filter-drier and charging valve on high side. Low side charging not permitted.
- .2 With compressors off, charge only amount necessary for proper operation of system. If system pressures equalize before system is fully charged, close charging valve and start up. With unit operating, add remainder of charge to system.
- .3 Re-purge charging line if refrigerant container is changed during charging process.

.8 Checks:
- .1 Make checks and measurements as per manufacturer's operation and maintenance instructions.
- .2 Record and report measurements Departmental Representative.

.9 Manufacturer's Field Services:
- .1 Have manufacturer of products, supplied under this Section, review Work involved in the handling, installation/application, protection and cleaning, of its products and submit written reports, in acceptable format, to verify compliance of Work with Contract.
- .2 Provide manufacturer's field services consisting of product use recommendations and periodic site visits for inspection of product installation in accordance with manufacturer's instructions.
- .3 Schedule site visits, to review Work, at stages listed:
  - .1 After delivery and storage of products, and when preparatory Work, or other Work, on which the Work of this Section depends, is complete but before installation begins.

.2 Twice during progress of Work at 25% and 60% complete.

.3 Upon completion of the Work, after cleaning is carried out.

.4 Obtain reports, within 3 days of review, and submit, immediately to Departmental Representative.

END OF SECTION

1 General

1.1 SECTION INCLUDES

.1 Metal duct work.
.2 Nonmetal duct work.
.3 Casing and plenums.
.4 Buried duct work.
.5 Kitchen hood duct work.
.6 Duct cleaning.

1.2 REFERENCES

.1 ASTM A36/A36M - Carbon Structural Steel.
.2 ASTM A90/A90M - Weight (Mass) of Coating on Iron and Steel Articles with Zinc or Zinc-Alloy Coatings.
.3 ASTM A167 - Stainless and Heat-Resisting Chromium-Nickel Steel Plate, Sheet, and Strip.
.4 ASTM A480/A480M - General Requirements for Flat-Rolled Stainless and Heat-Resisting Steel Plate, Sheet, and Strip.
.5 ASTM A568/A568M - General Requirements for Steel Sheet, Carbon, and High-Strength, Low-Alloy, Hot-Rolled and Cold-Rolled.
.6 ASTM A653/A653M - Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.
.7 ASTM A1008/A1008M - Steel, Sheet, Cold-Rolled Carbon, Structural, High-Strength Low-Alloy and High Strength Low-Alloy with Improved Formability.
.8 ASTM A1011/A1011M - Standard Specification for Steel, Sheet, and Strip Hot-Rolled, Carbon, Structural, High-Strength, Low-Alloy with Improved Formability.
.9 ASTM B209 - Aluminum and Aluminum-Alloy Sheet and Plate.
.10 ASTM C14/C14M - Concrete Sewer, Storm Drain, and Culvert Pipe.
.11 ASTM C443 - Joints for Concrete Pipe and Manholes, Using Rubber Gaskets.
.12 AWS D9.1 - Sheet Metal Welding Code.
.13 NBS PS 15 - Voluntary Product Standard for Custom Contact-Moulded Reinforced-Polyestor Chemical Resistant Process Equipment.
.14 NFPA 90A - Installation of Air Conditioning and Ventilating Systems.
.15 NFPA 90B - Installation of Warm Air Heating and Air-Conditioning Systems.
.16 NFPA 91 - Exhaust Systems for Air Conveying of Vapours, Gases, Mists, and Noncombustible Particulate Solids.
.17 NFPA 96 - Ventilation Control and Fire Protection of Commercial Cooking Operations.
.18 SMACNA - HVAC Air Duct Leakage Test Manual.
.19 SMACNA - HVAC Duct Construction Standards - Metal and Flexible.
.20 SMACNA - Fibrous Glass Duct Construction Standards.
.21 UL 181 - Factory-Made Air Ducts and Connectors.

1.3 DEFINITIONS

.1 Low pressure/low velocity: Static pressure in duct less than 498 Pa (2" w.g.) and velocities less than 10 meters/second (2000 fpm).

.2 Medium pressure/high velocity: Static pressure in duct less than 996 Pa (4" w.g.) and velocities between 10 meters/second (2000 fpm) and 20 meters/second (4000 fpm).

.3 High pressure/high velocity: Static pressure in ducts more than 996 Pa (4" w.g.) And velocities greater than 4000 fpm.

.4 Duct sizes: as shown on drawings are outside dimensions. For acoustically lined or internally insulated ducts, sizes shown are actual duct sizes and the insulation thickness has been accounted for.

1.4 PERFORMANCE REQUIREMENTS

.1 No variation of duct configuration or sizes permitted except by written permission. Size round ducts installed in place of rectangular ducts to ASHRAE table of equivalent rectangular and round ducts.

1.5 SUBMITTALS

.1 Section 01 33 00: Procedures for submittals.

.2 Shop Drawings: Indicate duct fittings, particulars such as gauges, sizes, welds, and configuration prior to start of work for 1000 kPa pressure class and higher systems.

.3 Product Data: Provide data for duct materials.

.4 Test Reports: Indicate pressure tests performed. Include date, section tested, test pressure, and leakage rate, following SMACNA HVAC Air Duct Leakage Test Manual.

1.6 QUALITY ASSURANCE

.1 Perform Work to SMACNA - HVAC Duct Construction Standards - Metal and Flexible.

.2 Ductwork shall meet the requirements of NFPA 90A, Air Conditioning and Ventilating Systems, and NFPA No. 96, Standard for the Installation of Equipment for the Removal of Smoke and Grease-Laden Vapours from Commercial Cooking Equipment

1.7 QUALIFICATIONS

.1 Manufacturer: Company specializing in manufacturing the Products specified in this section with minimum three years documented experience.

.2 Installer: Company specializing in performing the work of this section with minimum 3 years documented experience.

1.8 ENVIRONMENTAL REQUIREMENTS

.1 Do not install duct sealants when temperatures are less than those recommended by sealant manufacturers.

.2 Maintain temperatures during and after installation of duct sealants.

2 Products

2.1 DUCT MATERIALS

.1 Galvanized Steel Ducts: ASTM A653 galvanized steel sheet, lock-forming quality, having G60 zinc coating to ASTM A90 on both sides.

.2 Steel Ducts: ASTM A1008.

.3 Aluminum Ducts: ASTM B209; aluminum sheet, alloy 3003-H14. Aluminum Connectors and Bar Stock: Alloy 6061- T6 or of equivalent strength.

.4 Stainless Steel Ducts: ASTM A167, Type 304.

.5 Concrete Ducts: ASTM C14; hub and spigot concrete sewer pipe with ASTM C443 joints, rubber gaskets.

.6 Fasteners: use rivets and bolts throughout; sheet metal screws accepted on low pressure ducts.

2.2 SEALANT

.1 Oil resistant, water based or solvent based, anti-microbial, anti-bacterial, ultra violet resistant, polymer type, flame resistant duct sealant.

.2 VOC content to be less than VOC limits of the State of California's South Coast Air Quality District Rule #1168. VOC content less than 30 g/L (less water and less exempt compounds) for sealing metal to metal contact.

.3 Sealant shall be cured for a minimum of 48 hours.

.4 Flame Spread Rating: 0 (zero).

.5 Smoke Spread Raring: 0 (zero).

2.3 TAPE

.1 Polyvinyl treated, open weave fibre glass, 50 mm wide.

2.4 SEAL CLASSIFICATION

.1 Classification as follows:

Maximum Pressure Pa	SMACNA Seal Class
up to 500	B
Over 500	A

.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.

.3 Class C: transverse joints and connections made air tight with gaskets. Longitudinal seams unsealed.

.4 Unsealed seams and joints.

2.5 DUCT WORK FABRICATION

.1 Fabricate and support to SMACNA HVAC Duct Construction Standards - Metal and Flexible, and as indicated. Provide duct material, gauges, reinforcing, and sealing for operating pressures indicated.

.2 Construct T's, bends, and elbows with radius of not less than 1-1/2 times width of duct on centreline. Where not possible and where rectangular elbows are used, provide air foil turning vanes.

.3 Complete metal ducts within themselves with no single partition between ducts. Where width of duct exceeds 450 mm, cross break for rigidity. Open corners are not acceptable.

.4 Lap metal ducts in direction of air flow. Hammer down edges and slips to leave smooth duct interior.

.5 Increase duct sizes gradually, not exceeding 15 degrees divergence wherever possible; maximum 30 degrees divergence upstream of equipment and 45 degrees convergence downstream.

.6 Fabricate continuously welded round and oval duct fittings two gauges heavier than duct gauges indicated in SMACNA Standard. Joints: minimum 100 mm cemented slip joint, brazed or electric welded. Prime coat welded joints.

.7 Provide standard 45 degree lateral wye takeoffs unless duct manufacturer can show 90 degree and tap has less static pressure loss.

.8 Rigidly construct metal ducts with joints mechanically tight, substantially airtight, braced and stiffened so as not to breath, rattle, vibrate or sag. Caulk duct joints and connections with sealant as ducts are being assembled.

.9 Provide easements where low pressure ductwork conflicts with piping and structure where easements exceed 10% duct area, split into two ducts maintaining original duct area.

.10 Exposed ductwork to be fabricated from Aluminum for aesthetics.

2.6 FITTINGS

.1 Fabrication: to SMACNA.

.2 Radiused elbows.
- .1 Rectangular: standard radius with single thickness turning vanes. Centreline radius: 1.5 times width of duct.
- .2 Round: smooth radius. Centreline radius: 1.5 times diameter.
- .3 Oval: 7 gore 90’s, 5 gore 45’s.

.3 Mitred elbows, rectangular:
- .1 To 400 mm: with single thickness Airfoil turning vanes.
- .2 Over 400 mm: with double thickness Airfoil turning vanes.

.4 Branches:
- .1 Rectangular main and branch: with radius on branch 1.5 times width of duct.
- .2 Round main and branch: enter main duct at 45 degrees with conical connection.
- .3 Provide volume control damper in branch duct near connection to main duct.
- .4 Main duct branches: with splitter damper.

.5 Transitions:
- .1 Diverging: 15 degrees maximum included angle when increasing duct sizes.
- .2 Converging: 45 degrees maximum included angle downstream of equipment.
- .3 Diverging: 30 degrees maximum included angle upstream of equipment.

.6 Offsets:
.1 Full radiused elbows, as indicated.

.7 Obstruction deflectors: maintain full cross-sectional area.
.1 Maximum included angles: as for transitions.

2.7 MANUFACTURED DUCT WORK AND FITTINGS

.1 Manufacture to SMACNA HVAC Duct Construction Standards - Metal and Flexible, and as indicated. Provide duct material, gauges, reinforcing, and sealing for operating pressures indicated.

.2 Flat Oval Ducts:
.1 Machine made from round spiral lockseam duct with light reinforcing corrugations; fittings manufactured of at least two gauges heavier metal than duct.

.3 Double Wall Insulated Flat Oval Ducts:
.1 Machine made from round spiral lockseam duct with light reinforcing corrugations, galvanized steel outer wall, 25 mm thick fibreglass insulation, perforated galvanized steel inner wall; fittings manufactured with solid inner wall.

.4 PVC Coated Steel Ducts:
.1 UL 181, Class 1, galvanized steel duct coated with polyvinyl chloride plastic, 0.1 mm thick on outside and 0.05 mm thick on inside.

.5 Transverse Duct Connection System:
.1 SMACNA "E" rated rigidly class connection, interlocking angle and duct edge connection system with sealant, gasket, cleats, and corner clips.

2.8 CASINGS

.1 Fabricate casings to SMACNA HVAC Duct Construction Standards - Metal and Flexible and construct for operating pressures indicated.

.2 Mount floor mounted casings on 100 mm high concrete curbs. At floor, rivet panels on 200 mm centres to angles. Where floors are acoustically insulated, provide liner of 1.20 mm galvanized expanded metal mesh supported at 300 mm centres, turned up 300 mm at sides with sheet metal shields.

.3 Reinforce door frames with steel angles tied to horizontal and vertical plenum supporting angles. Install hinged access doors where indicated or required for access to equipment for cleaning and inspection. Provide clear wire glass observation ports, minimum 150 X 150 mm size.

.4 Fabricate acoustic casings with reinforcing turned inward. Provide 1.50 mm back facing and 0.80 mm perforated front facing with 2.4 mm diameter holes on 4 mm centres. Construct panels 75 mm thick packed with 72 kg/cu m minimum glass fibre media, on inverted channels of 1.50 mm.

2.9 FIRESTOPPING

.1 Retaining angles around duct, on both sides of fire separation

.2 Fire stopping material and installation must not distort duct.

2.10 HANGERS AND SUPPORTS

.1 Hangers and Supports: in accordance with Section 23 05 29 - Hangers and Supports for HVAC Piping Equipment.

.1 Band hangers: use on round and oval ducts up to 500 mm diameter, of same material as duct but next sheet metal thickness heavier than duct.

.2 Trapeze hangers: ducts over 500 mm diameter or longest side, to SMACNA.

.3 Hangers: steel angle with black steel rods to following table.

Duct Size (mm)	Angle Size (mm)	Rod Size (mm)
up to 750	25 x 25 x 3	6
751 to 1050	40 x 40 x 3	6
1051 to 1500	40 x 40 x 3	10
1501 to 2100	50 x 50 x 3	10
2101 to 2400	50 x 50 x 5	10
2401 and over	50 x 50 x 6	10

.4 Upper hanger attachments:

.1 For concrete: manufactured concrete inserts.

.2 For steel joist: manufactured joist clamp or steel plate washer.

.1 Mount to top cord.

.3 For steel beams: manufactured beam clamps:

2.11 WIRE ROPE SUSPENSION SYSTEMS

.1 Wire rope suspension systems shall be ULC, CSA and SMACNA approved and tested.

.2 Wire suspensions systems consist of a pre-formed wire rope sling with either a ferruled loop, permanently fixed threaded 1/4ins (or 3/8ins) stud, or permanently fixed nipple end with toggle, at one end or hook or eyelet. The end fixings and the wire must be of the same manufacturer. The system is secured and tensioned with a hanger self-locking grip at the other end.

.3 Only wire and or supports supplied and or approved, shall be used with the system.

.4 The contractor shall select the correct specification of wire hanger to use for supporting each particular service from table 1 below. Each size is designated with a maximum Safe Working Load Limit (which incorporates a 5:1 safety factor). The correct specification of wire hanger required is determined using the following formula:

Weight per metre of object suspended (kg) x Distance between suspension points (m) = Weight loading per hanger suspension point (kg).

Table 1 Wire Hanger Safe Working Loads

Size	**Working Load Limit (kg)** **Working Load Limit (lbs)**
No. 1	0 - 10 kg 0 - 22 lbs
No. 2	10.5 - 45.5 kg 23 - 100 lbs
No. 3	46 - 91 kg 101 - 200 lbs
No. 4	95.5 - 225 kg 210 - 495 lbs
No. 5	225.5 - 325 kg 496 - 715 lbs

(i) Where the installed wire rope is not vertical then the working load limit shall be reduced in accordance with the recommendations given in the manufacturer's handbook.

.5 The contractor shall select and use the correct length of wire rope required to support the service.

.6 No in-line joins shall be permitted in the rope.

3 Execution

3.1 GENERAL REQUIREMENTS

.1 Do work in accordance with SMACNA.

.2 Do not break continuity of insulation vapour barrier with hangers or rods.
.1 Ensure diffuser is fully seated.

.3 Support risers in accordance with SMACNA.

.4 Install breakaway joints in ductwork on sides of fire separation.

.5 Install proprietary manufactured flanged duct joints and manufactured equipment in accordance with manufacturer's instructions.

.6 Manufacture duct in lengths and diameter to accommodate installation of acoustic duct lining.

.7 At each point where ducts pass through partitions, the joints around the duct shall be sealed with non-combustible material.

3.2 INSTALLATION

.1 Install and seal ducts to SMACNA HVAC Duct Construction Standards - Metal and Flexible according to seal classification specified.

.2 Provide openings in duct work where required to accommodate thermometers and controllers. Provide pilot tube openings where required for testing of systems, complete with metal can with spring device or screw to ensure against air leakage. Where openings are provided in insulated duct work, install insulation material inside a metal ring.

.3 Locate ducts with sufficient space around equipment to allow normal operating and maintenance activities.

.4 Use double nuts and lock washers on threaded rod supports.

.5 Provide access doors for inspection.

.6 Tape joints of PVC coated metal duct work with PVC tape.

.7 Connect terminal units to supply ducts directly or with 300 mm maximum length of flexible duct. Do not use flexible duct to change direction.

.8 Connect diffusers to low pressure ducts directly. To decouple diffuser from duct system, use 1.5 m maximum length of flexible duct held in place with caulking compound and strap or clamp. Do not use flexible duct to change direction.

.9 Connect flexible ducts to metal ducts with adhesive and strap or clamp.

.10 Set plenum doors 150 to 300 mm above floor. Arrange door swings so that fan static pressure holds door in closed position.

.11 During construction provide temporary closures of metal or taped polyethylene on open duct work to prevent construction dust from entering duct work system.

.12 Provide floor drains in fresh air coil, and humidifier sections with deep seal traps.

3.3 CLEANING

.1 Clean work to requirements of Division 1 and as detailed herein.

.2 Clean duct system and force air at high velocity through duct to remove accumulated dust. To obtain sufficient air, clean half the system at a time. Protect equipment which may be harmed by excessive dirt with temporary filters, or bypass during cleaning.

.3 Provide adequate access into duct work for cleaning purposes.

.4 Prior to occupancy and during initial occupancy, building shall be flushed at maximum outdoor air volume. Supply a total of 4,300 cu.m of outdoor air per sq.m of floor area or approximately 30,564,400cu.m of outdoor air or approximately 54 days of flushing. Note that a minimum of 3 weeks of flushing will be required prior to occupancy.

3.4 WATER TIGHT DUCTS

.1 Provide watertight duct for:
- .1 Fresh air intake.
- .2 As indicated.

.2 Form bottom of horizontal duct without longitudinal seams.
- .1 Solder or weld joints of bottom and side sheets.

.2 Seal other joints with duct sealer.

.3 Slope horizontal branch ductwork down towards hoods served.
.1 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 discharging to open funnel drain.

3.5 WIRE ROPE SUSPENSION SYSTEMS

.1 The wire hangers shall be fixed to the building structure in accordance with the standard practice and structural limitations.

.2 Loop end can be wrapped around purlins, beams, roof trusses and other accessible building features.

.3 Stud end can be fixed with suitable anchors into concrete ceilings and structures, metal decking and pressed metal brackets (using nuts).

.4 Toggle end can be fixed into profile roof cladding, light fittings and luminaries.

.5 Other wire rope systems can be fixed to an approved structure, as determined by the Departmental Representative.

.6 The wire hangers shall not be fixed to any other services, without the approval of the Departmental Representative.

.7 The free end of the wire rope should be threaded through one channel of the self-locking grip before being either passed around the object being suspended or connected to it, using a suitable fixing. The wire rope is then threaded back through the second channel in the grip until the required level is achieved.

.8 Adjust duct elevations as required to remain level and plumb, the weight of the suspended object must be independently supported while making adjustments.

.9 The wire rope must not be damaged, twisted or deformed in any way prior to, or during, installation. Any such ropes must be discarded and replaced.

.10 When installing wire hangers the angle between the ropes when exiting the grip must never exceed the manufacturer’s recommendations and/or 60 degrees.

.11 Lubricants, paint or any other coating shall not be applied to the wire hanger as it may impair its performance.

.12 Wire hangers must be installed in accordance with the manufacturer’s loading and installation instructions and all the manufacturer’s recommendations.

3.6 LEAKAGE TESTS

.1 Refer to Section 23 05 94.

.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 Do not install 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 degrees elbows.

.7 Complete tests before performance insulation or concealment Work.

3.7 SEALANT APPLICATION

.1 Contractor shall apply sealant on exposed ductwork in a 50mm band centered on joint.

.2 Sealant shall be applied evenly with a clean edge finish perpendicular to duct and plumb.

.3 Tape shall be utilized to provide clean edge finish to sealant application.

3.8 SOUND ATTENUATING TRANSFER DUCTS

.1 Sound attenuating transfer air ducts shall be installed where indicated on drawings complete with internal acoustic insulation in accordance with Section 23 07 13.

.2 Elbows on sound attenuating transfer air ducts shall not utilize turning vanes.

.3 Geometry of all sound attenuating transfer air ducts shall ensure that sound contacts a minimum of two duct surfaces.

.4 Provide single elbow configurations or double elbow configurations as indicated on drawings. It is permissible to utilize double elbow configurations in lieu of single elbow but not vice versa.

END OF SECTION

1 General

1.1 SUMMARY

.1 Section Includes:
  .1 Materials and installation of high-pressure metallic ductwork, joints and accessories.
.2 Sustainable requirements for construction and verification.

1.2 REFERENCES

.1 American Society of Heating, Refrigerating and Air-Conditioning Engineers, Inc. (ASHRAE).
.2 American Society for Testing and Materials (ASTM).
  .1 ASTM A653/A653M-04a, Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy Coated (Galvannealed) by the Hot-Dip Process. (Metric).
.3 Department of Justice Canada (Jus).
  .1 Canadian Environmental Protection Act (CEPA), 1999, c. 33.
  .2 Transportation of Dangerous Goods Act (TDGA), 1992, c. 34.
.4 Health Canada/Workplace Hazardous Materials Information System (WHMIS).
  .1 Material Safety Data Sheets (MSDS).
.5 Sheet Metal Air Conditioning Contractors' National Association (SMACNA).
  .1 SMACNA HVAC Duct Construction Standards, Metal and Flexible, 95 (Addendum No. 1, (1997).
  .2 SMACNA HVAC Air Duct Leakage Test Manual, 1st Edition 1985.
  .3 SMACNA IAQ Guideline for Occupied Buildings under Construction, 1st Edition 1995.

1.3 SUBMITTALS

.1 Submit shop drawings and product data in accordance with Section 01 33 00 - Submittal Procedures.

.2 Product Data: submit WHMIS MSDS - Section 02 61 33 - Hazardous Materials for the following:
  .1 Sealants.
  .2 Tape.
  .3 Proprietary joints.
  .4 Fittings.

1.4 QUALITY ASSURANCE

.1 Certification of Ratings:
  .1 Catalogue or published ratings to be those obtained from tests carried out by manufacturer or independent testing agency signifying adherence to Codes and Standards.

.2 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 HANDLING

.1 Packing, shipping, handling and unloading:
- .1 Deliver, store and handle in accordance with Section 01 61 00 - Common Product Requirements.
- .2 Deliver, store and handle materials in accordance with manufacturer's written instructions.
- .3 Store and manage hazardous materials in accordance with cepa, tdga AND Regional and Municipal Regulations.

.2 Waste Management and Disposal: Remove from site and dispose of packaging materials at appropriate recycling facilities.
- .2 Collect and separate for disposal paper, plastic, polystyrene, corrugated cardboard packaging material in appropriate on-site bins for recycling in accordance with Waste Management Plan.
- .3 Divert unused metal materials from landfill to metal recycling facility as approved by Departmental Representative.
- .4 Unused sealant materials must not be disposed of into sewer system, into streams, lakes, onto ground or in other location where it will pose health or environmental hazard.
- .5 Fold up metal and plastic banding, flatten and place in designated area for recycling.
- .6 Handle and dispose of hazardous materials in accordance with CEPA, TDGA, Regional and Municipal regulations.
- .7 Disposal of asbestos waste generated by removal activities must comply with Federal, Provincial, Territorial and Municipal regulations. Dispose of asbestos waste in sealed double thickness 6 ml bags or leak proof drums. Label containers with appropriate warning labels.
- .8 Provide manifests describing and listing waste created. Transport containers by approved means to licenced landfill for burial.

1.6 DEFINITIONS

.1 Low pressure/low velocity: static pressure in duct less than 498 Pa and velocities less than 10 meters/second.

.2 Medium pressure/high velocity: Static pressure in duct less than 996 Pa and velocities between 10 meters/second and 20 meters/second.

.3 High pressure/high velocity: Static pressure in ducts more than 996 Pa and velocities greater than 4000 fpm.

.4 Duct sizes: as shown on drawings are outside dimensions. For acoustically lined or internally insulated ducts, sizes shown are actual duct sizes and the insulation thickness has been accounted for

1.7 QUALITY ASSURANCE

.1 Ductwork shall meet the requirements of NFPA 90A, Air Conditioning and Ventilating Systems, and NFPA No. 96, Standard for the Installation of Equipment for the Removal of Smoke and Grease-Laden Vapours from Commercial Cooking Equipment.

.2 Fabricate in accordance with SMACNA duct manuals and ASHRAE handbooks.

1.8 INDOOR AIR QUALITY (IAQ) MANAGEMENT PLAN

.1 During construction meet or exceed the requirements of SMACNA IAQ Guideline for Occupied Buildings under Construction.

2 Products

2.1 GENERAL

.1 Fasteners: Use rivets and bolts throughout; sheet metal screws accepted on low pressure ducts.

.2 Complete metal ducts within themselves with no single partition between ducts. Where width of duct exceeds 450 mm, cross break for rigidity. Open corners are not acceptable.

.3 Lop metal ducts in direction of air flow. Hammer down edges and slips to leave smooth duct interior.

.4 Where 1.5 time radius elbows are not possible and where rectangular elbows possible, use rectangular elbows and provide approved type air foil turning vanes. Where acoustical lining is provided, provide turning vanes of perforated metal type with fibre glass inside.

.5 Rigidly constructed metal ducts with joints mechanically tight, substantially airtight, braced and stiffened so as not to breath, rattle, vibrate or sag. Caulk duct joints and connections with sealant as ducts are being assembled.

2.2 DUCTWORK

.1 Material:
- .1 Galvanized steel with Z90 designation zinc coating lock forming quality: to ASTM A653/A653M.
- .2 Thickness: to SMACNA.

.2 Construction - round and oval.
- .1 Ducts: factory fabricated, spiral wound, with matching fittings and specials to SMACNA.
- .2 Transverse joints up to 900 mm: slip type with tape and sealants.
- .3 Transverse joints over 900 mm: Vanstone.
- .4 Fittings:
  - .1 Elbows: smooth radius or seven-piece (for 90 degrees), five-piece (for 45 degrees). Centreline radius: 1.5 x diameter.
  - .2 Branches: conical transition with conical branch at 45 degrees and 45 degrees elbow.

.3 Construction - rectangular:
- .1 Ducts: to SMACNA.
- .2 Transverse joints: welded or proprietary duct joints to SMACNA seal Class A.
- .3 Fittings:
  - .1 Elbows: smooth radius; centreline radius 1.5 x width of duct. No vanes.

.2 Branches: with conical branch at 45 degrees and 45 degrees elbow except where duct manufacturer can show 90 degree and tap has less static pressure loss.

.4 Firestopping:
- .1 50 x 50 x 3 mm retaining angles around duct, on both sides of fire separation.
- .2 Firestopping material must not distort duct.

2.3 SEAL CLASSIFICATION

.1 Classification as follows:

Maximum Pressure Pa	SMACNA Seal Class
2500	A
1500	A
1000	A
750	A

.2 Seal classification:
- .1 Class A: longitudinal seams, transverse joints, duct wall penetrations and connections made airtight with sealant, gaskets, tape or combination thereof.
- .2 Class B: longitudinal seams, transverse joints and connections made airtight with gaskets, sealant, tape or combination thereof.

2.4 SEALANT

.1 Oil resistant, water based, anti-microbial, anti-bacterial, ultra violet resistant, polymer type, flame resistant duct sealant.

.2 VOC content to be less than VOC limits of the State of California's South Coast Air Quality District Rule #1168. VOC content less than 30 g/L (less water and less exempt compounds) for sealing metal to metal contact.

.3 Sealant shall be cured for at minimum of 48 hours.

.4 Flame spread Rating: 0 (zero).

.5 Smoke Spread Rating: 0 (zero).

2.5 TAPE

.1 Polyvinyl treated, open weave fibre glass, 50 mm wide.

2.6 DUCT LEAKAGE

.1 In accordance with SMACNA HVAC air duct leakage test manual.

2.7 HANGERS AND SUPPORTS

.1 Hangers and Supports: in accordance with Section 23 05 29 - Hangers and Supports for HVAC Piping Equipment.

- .1 Band hangers: use on round and oval ducts up to 500 mm diameter, of same material as duct but next sheet metal thickness heavier than duct.
- .2 Trapeze hangers: ducts over 500 mm diameter or longest side, to SMACNA.
- .3 Hangers: steel angle with black steel rods to following table.

Duct Size (mm)	Angle Size (mm)	Rod Size (mm)
up to 750	25 x 25 x 3	6
751 to 1050	40 x 40 x 3	6
1051 to 1500	40 x 40 x 3	10
1501 to 2100	50 x 50 x 3	10
2101 to 2400	50 x 50 x 5	10
2401 and over	50 x 50 x 6	10

- .4 Upper hanger attachments:
  - .1 For concrete: manufactured concrete inserts.
  - .2 For steel joist: manufactured joist clamp or steel plate washer.
    - .1 Mount to top cord.
  - .3 For steel beams: manufactured beam clamps:

2.8 WIRE ROPE SUSPENSION SYSTEMS

.1 Wire rope suspension systems shall be ULC, CSA and SMACNA approved and tested.

.2 Wire suspensions systems consist of a pre-formed wire rope sling with either a ferruled loop, permanently fixed threaded 1/4ins (or 3/8ins) stud, or permanently fixed nipple end with toggle, at one end or hook or eyelet. The end fixings and the wire must be of the same manufacturer. The system is secured and tensioned with a hanger self-locking grip at the other end.

.3 Only wire and or supports supplied and or approved, shall be used with the system.

.4 The contractor shall select the correct specification of wire hanger to use for supporting each particular service from table 1 below. Each size is designated with a maximum Safe Working Load Limit (which incorporates a 5:1 safety factor). The correct specification of wire hanger required is determined using the following formula:

Weight per metre of object suspended (kg) x Distance between suspension points (m) = Weight loading per hanger suspension point (kg).

Table 1 Wire Hanger Safe Working Loads

Size	**Working Load Limit (kg)** **Working Load Limit (lbs)**
No. 1	0 - 10 kg 0 - 22 lbs
No. 2	10.5 - 45.5 kg 23 - 100 lbs
No. 3	46 - 91 kg 101 - 200 lbs
No. 4	95.5 - 225 kg 210 - 495 lbs
No. 5	225.5 - 325 kg 496 - 715 lbs

(i) Where the installed wire rope is not vertical then the working load limit shall be reduced in accordance with the recommendations given in the manufacturer's handbook.

.5 The contractor shall select and use the correct length of wire rope required to support the service.

.6 No in-line joins shall be permitted in the rope.

3 Execution

3.1 GENERAL

.1 Do work in accordance with SMACNA.

.2 Do not break continuity of insulation vapour barrier with hangers or rods.
- .1 Insulate band hangers 100 mm beyond insulated duct.
- .2 Ensure diffuser is fully seated.

.3 Support risers in accordance with SMACNA.

.4 Install breakaway joints in ductwork on sides of fire separation.

.5 Ensure installation of firestopping does not distort duct.

.6 Provide openings in ductwork where required to accommodate thermometers and controllers. Provide pitot tube openings where required for testing of systems, complete with metal cam with spring device or screw to ensure against air leakage. Where openings are provided in insulated ductwork, install insulation material inside a metal ring.

.7 Clean duct systems and force air at high velocity through duct to remove accumulated dust. To obtain sufficient air, clean half the system at a time. Protect equipment which may be harmed by excessive dirt with filters, or bypass during cleaning.

.8 Locate ducts with sufficient space around equipment to allow normal operating and maintenance activities.

.9 Connect terminal units to medium pressure ducts with 300 mm maximum length of flexible duct. Do not use flexible duct to change directions.

.10 At each point where ducts pass through partitions, the joints around the duct shall be sealed with non-combustible material.

3.2 HANGERS

.1 Band hangers: install in accordance with SMACNA.

.2 Angle hangers: complete with locking nuts and washers.

.3 Hanger spacing: as follows:

Duct Size (mm)	Spacing (mm)
to 1500	3000
1501 and over	2500

3.3 SEALING AND TAPING

.1 Apply sealant in accordance with SMACNA and to manufacturer's recommendations.

.2 Bed tape in sealant and recoat with minimum of one coat of sealant to manufacturer's recommendations.

3.4 WIRE ROPE SUSPENSION SYSTEMS

.1 The wire hangers shall be fixed to the building structure in accordance with the standard practice and structural limitations.

.2 Loop end can be wrapped around purlins, beams, roof trusses and other accessible building features.

.3 Stud end can be fixed with suitable anchors into concrete ceilings and structures, metal decking and pressed metal brackets (using nuts).

.4 Toggle end can be fixed into profile roof cladding, light fittings and luminaries.

.5 Other wire rope systems can be fixed to an approved structure, as determined by the Departmental Representative.

.6 The wire hangers shall not be fixed to any other services, without the approval of the Departmental Representative.

.7 The free end of the wire rope should be threaded through one channel of the self-locking grip before being either passed around the object being suspended or connected to it, using a suitable fixing. The wire rope is then threaded back through the second channel in the grip until the required level is achieved.

.8 Adjust duct elevations as required to remain level and plumb, the weight of the suspended object must be independently supported while making adjustments.

.9 The wire rope must not be damaged, twisted or deformed in any way prior to, or during, installation. Any such ropes must be discarded and replaced.

.10 When installing wire hangers the angle between the ropes when exiting the grip must never exceed the manufacturer's recommendations and/or 60 degrees.

.11 Lubricants, paint or any other coating shall not be applied to the wire hanger as it may impair its performance.

.12 Wire hangers must be installed in accordance with the manufacturer's loading and installation instructions and all the manufacturer's recommendations.

3.5 LEAKAGE TESTS

.1 Refer to Section 23 05 94 - Pressure Testing of Ducted Air Systems.

.2 In accordance with SMACNA HVAC Duct Leakage Test Manual.

.3 Perform leakage tests in sections.

.4 Perform trial leakage tests, as instructed to demonstrate workmanship.

.5 Do not install additional ductwork until trial tests have been achieved.

.6 Test section minimum of 30 m long with not less than three branch takeoffs and two 90 degrees elbows.

.7 Complete tests before performing insulation or concealment Work.

END OF SECTION

1 General

1.1 SECTION INCLUDES

.1 Silencers.

1.2 REFERENCES

.1 AABC - National Standards for Total System Balance.
.2 AMCA 300 - Reverberant Room Method for Sound Testing of Fans.
.3 AMCA 301 - Methods for Calculating Fan Sound Ratings from Laboratory Test Data.
.4 AMCA 302 - Application of Sone Ratings for Non-Ducted Air Moving Devices.
.5 AMCA 303 - Application of Sound Power Level Ratings for Fans.
.6 ANSI S1.1 - Acoustical Terminology.
.7 ANSI S1.8 - Preferred Reference Quantities for Acoustical Levels.
.8 ANSI S1.13 - Measurement of Sound Pressure Levels in Air.
.9 ARI 270 - Sound Rating of Outdoor Unitary Equipment.
.10 ARI 575 - Measuring Machinery Sound Within an Equipment Space.
.11 ASA 16 (ANSI S1.36) - Survey Methods for Determination of Sound Power Levels of Noise Sources.
.12 ASA 47 (ANSI S1.4) - Specification for Sound Level Meters.
.13 ASA 49 (ANSI S12.1) - Preparation of Standard Procedures to Determine the Noise Emission from Sources.
.14 ASHRAE 68 - Laboratory Method of Testing to Determine the Sound Power in a Duct.
.15 ASHRAE Handbook - Systems Volume, Chapter "Sound and Vibration Control".
.16 ASTM E90 - Method for Laboratory Measurement of Airborne Sound Transmission loss of Building Partitions and Elements.
.17 ASTM E477 - Method of Measuring Acoustical and Airflow Performance of Duct Liner Materials and Prefabricated Silencers.
.18 ASTM E596 - Method for Laboratory Measurement of Noise Reduction of Sound-Isolating Enclosures.
.19 NEBB - Procedural Standards for Measuring Sound and Vibration.
.20 SMACNA - HVAC Duct Construction Standards - Metal and Flexible.

1.3 SUBMITTALS

.1 Section 01 33 00: Procedures for submittals.

.2 Shop Drawings: Indicate assembly, materials, thicknesses, dimensional data, pressure losses, acoustical performance, layout, and connection details.

.3 Product Data: Provide catalogue information indicating, materials, dimensional data, pressure losses, and acoustical performance.

.4 Design Data: Provide engineering calculations, referenced to specifications and AMCA 301 standards indicating that maximum room sound levels are not exceeded.

.5 Test Reports: Indicate dynamic insertion loss and noise generation values of silencers.

.6 Manufacturer's Installation Instructions: Indicate installation requirements which maintain integrity of sound isolation.

1.4 PROJECT RECORD DOCUMENTS

.1 Section 01 78 00: Submittals for project closeout.

.2 Record actual locations of silencers and sound attenuating devices.

1.5 QUALITY ASSURANCE

.1 Perform Work to AMCA 300 standards and recommendations of ASHRAE 68.

1.6 QUALIFICATIONS

.1 Manufacturer: Company specializing in manufacturing the Products specified in this section with minimum three years documented experience.

.2 Design application of duct silencers under direct supervision of a Professional Engineer experienced in design of this work and licensed at the place where the Project is located.

2 Products

2.1 DUCT SILENCERS

.1 Description: Duct section with sheet metal outer casing, sound absorbing fill material, and inner casing of perforated sheet metal; incorporating interior baffles of similar construction. Fabricate to SMACNA HVAC Duct Construction Standards - Metal and Flexible.

.2 Configuration and performance: as noted on equipment schedule, insertion loss to ASTM E477

.3 Materials:

- .1 Outer Casing: Minimum 0.8 mm (22 gauge) thick galvanized steel stiffened as required, with mastic filled lock formed seams, 50 mm long, 2.9 mm slip joints on both ends.
- .2 Inner Casing and Splitters: Minimum 0.6 mm (26 gauge) thick perforated galvanized steel.
- .3 Fill: Formaldehyde free Glass fibre or mineral wool of minimum 64 kg/cu m density.
- .4 Fill Liner: 0.0254 mm Mylar or Tedlar film.

2.2 CROSS TALK SILENCERS

.1 Description: manufactured dual elbow silencer with sheet metal outer casing, sound absorbing fill material, and inner casing of perforated sheet metal; incorporating interior baffles of similar construction. Fabricate to SMACNA HVAC Duct Construction Standards - Metal and Flexible.

.2 Configuration and performance: as noted on equipment schedule, insertion loss to ASTM E477

.3 Materials:

.1 Outer Casing: Minimum 0.8 mm (22 gauge) thick galvanized steel stiffened as required, with mastic filled lock formed seams, 75 mm long, 2.9 mm slip joints on both ends.

.2 Inner Casing and Splitters: Minimum 0.8 mm (22 gauge) thick perforated galvanized steel.

.3 Fill: Formaldehyde free Glass fibre or mineral wool of minimum 64 kg/cu m density.

.4 Specification Based on VAW Model XTS

3 Execution

3.1 INSTALLATION

.1 Install to manufacturer's written instructions.

.2 Support duct silencers independent of duct work with flexible duct connections, lagged with leaded vinyl sheet on inlet and outlet. Refer to Section 23 33 00.

1 General

1.1 SECTION INCLUDES

.1 Air turning devices/extractors.
.2 Backdraft dampers.
.3 Combination fire and smoke dampers.
.4 Duct access doors.
.5 Duct test holes.
.6 Fire dampers.
.7 Flexible duct connections.
.8 Volume control dampers.

1.2 REFERENCES

.1 NFPA 90A - Installation of Air Conditioning and Ventilating Systems.
.2 NFPA 92A - Smoke-Control Systems.
.3 SMACNA - HVAC Duct Construction Standards - Metal and Flexible.
.4 UL 33 - Heat Responsive Links for Fire-Protection Service.
.5 UL 555 - Fire Dampers.
.6 UL 555S - Smoke Dampers.

1.3 SUBMITTALS

.1 Section 01 33 00: Procedures for submittals.

.2 Shop Drawings: Provide for shop fabricated assemblies including volume control dampers.

.3 Product Data: Provide for shop fabricated assemblies including volume control dampers. Include electrical characteristics and connection requirements.

.4 Manufacturer's Installation Instructions: Indicate for dampers including fire and fire/ smoke dampers.

1.4 PROJECT RECORD DOCUMENTS

.1 Section 01 78 00: Submittals for project closeout.

.2 Record actual locations of access doors.

1.5 QUALITY ASSURANCE

.1 Manufacturer: Company specializing in manufacturing the Products specified in this section with minimum three years documented experience.

.2 Accessories shall meet the requirements of NFPA 90A, Air Conditioning and Ventilating Systems.

.3 Fabricate in accordance with ASHRAE handbooks and SMACNA duct manuals.

1.6 REGULATORY REQUIREMENTS

.1 Products Requiring Electrical Connection: Listed and classified by Underwriters' Laboratories Inc., as suitable for the purpose specified and indicated.

1.7 DELIVERY, STORAGE, AND HANDLING

.1 Section 01 61 00: Transport, handle, store, and protect products.

.2 Protect dampers from damage to operating linkages and blades.

1.8 EXTRA MATERIALS

.1 Section 01 78 00: Submittals for project closeout.

.2 Provide two of each size and type of fusible link.

2 Products

2.1 TURNING VANES

.1 Factory or shop fabricated single thickness or double thickness, to recommendations of SMACNA and as indicated.

.2 Shall be airfoil type.

.3 Where acoustical lining is provided, provide turning vanes of perforated metal type with fibre glass inside.

2.2 BACKDRAFT DAMPERS.

.1 Gravity Backdraft Dampers, Size 450 x 450 mm or Smaller Provided with Air Moving Equipment: Air moving equipment manufacturers standard construction.

.2 Extruded aluminum 6063T5 backdraft damper frame shall not be less than 1.52 mm in thickness. Frame shall be 63.5 mm deep.

.3 Blades shall be extruded aluminum (6063T5) profiles and shall be less than 1.52 mm in thickness.

.4 Blade and side seals shall be extruded silicone. Seals are to be secured in integral slots within the aluminum extrusions.

.5 Bearing system shall be composed of Celcon bearings rotating on zinc-plated 12.7 mm steel pivot points.

.6 Linkage system shall consist of hard alloy aluminum (6005T6) crank arms fastened to zinc-plated steel pivot rods and shall be doubly secured within channel running along top of blade. Large diameter 8.73 mm hard alloy aluminum (6065-T6C) linkage rod shall connect the crank arms by means of a zinc-plated steel trunnion.

.7 Cup point trunnion set screw shall create a compression hard spot where it secures to the linkage rod for a slip-proof grip.

.8 Trunnions shall be zinc-plated to provide a hard, smooth and long-lasting rotating surface.
- .1 Performance:
- .2 Temperature range: -40 deg.C to 100 deg.C.
- .3 Leakage: 101.2 l/s per square meter at 0.25 kPa.
- .4 Pressure Drop: less than 24.9 Pa.

.9 Backdraft dampers shall be made to size required. Minimum section size shall be 152 mm wide x 152 mm high. Maximum section size shall be 914 mm wide by 3658 mm high. Mullion breaks shall be used when damper height exceeds 1220 mm.

.10 Backdraft dampers with dimensions greater than maximum section size shall be manufactured in multiple sections. Multiple sections are not interlinked or connected. To install, each section must be individually fastened to a structural frame prepared on site.

.11 Fully adjustable device to permit setting for varying differential static pressures less than 2.49 Pa.

2.3 DUCT ACCESS DOORS

.1 Fabricate to SMACNA HVAC Duct Construction Standards - Metal and Flexible, and as indicated.

.2 Access doors to be ULC labelled.

.3 Fabrication for un-insulated ducts: Rigid and close-fitting of galvanized steel with sealing gaskets and quick fastening locking devices.

.4 Fabrication for 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 with sealing gaskets and quick fastening locking devices.

.5 Gaskets: neoprene.

.6 Hardware:
- .1 Less Than 300 mm Square: Secure with sash locks complete with safety chain.
- .2 Up to 450 mm Square: Provide two hinges and two sash locks.
- .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.
- .5 300 x 300 mm glass viewing panels where indicated.
- .6 Hold open devices.

.7 Access doors with sheet metal screw fasteners are not acceptable.

2.4 DUCT TEST HOLES

.1 Temporary Test Holes: Cut or drill in ducts as required. Cap with neat patches, neoprene plugs, threaded plugs, or threaded or twist-on metal caps.

.2 Permanent Test Holes: Factory fabricated, air tight flanged fittings with screw cap. Provide extended neck fittings to clear insulation.

2.5 FLEXIBLE DUCT CONNECTIONS

.1 Fabricate to SMACNA HVAC Duct Construction Standards - Metal and Flexible, and as indicated.

.2 Connector:
- .1 Fabric: cUL listed fire-retardant self extinguishing neoprene coated woven glass fibre fabric to NFPA 90A, minimum density 1.0 kg/sq m. Approximately 50mm of fabric clenched by means of double locked seams.

.2 Frame: 75 mm wide, 0.6 mm thick galvanized sheet metal.
.3 Attach edging strip to ducting and equipment by screws or bolts at 150 mm (6") intervals

.3 Leaded Vinyl Sheet: Minimum 14 mm0.55 inch thick, 4.2 kg/sq m0.87 lbs per sq ft, 10 dB attenuation in 10 to 10,000 Hz range.

2.6 DRYER VENT

.1 Provide stainless steel side wall commercial dryer vent complete with backdraft damper, wind guard, and rain cap. Vent to be minimum 26 gauge metal.

3 Execution

3.1 INSTALLATION

.1 Install accessories to manufacturer's written instructions, NFPA 90A, and follow SMACNA HVAC Duct Construction Standards - Metal and Flexible. Refer to Section 23 31 00 for duct construction and pressure class.

.2 Provide backdraft dampers on exhaust fans or exhaust ducts nearest to outside and where indicated.

3.2 ACCESS DOORS

.1 Provide adequately sized duct access doors for inspection and cleaning.

.2 Sizes:
.1 600 x 600 mm for person size entry.
.2 900 x 900 mm for servicing entry.
.3 300 x 300 mm for viewing.
.4 As indicated.

.3 Locations (before and after):
.1 Fire and smoke dampers (install at fire dampers).
.2 Control dampers.
.3 Devices requiring maintenance.
.4 Required by code.
.5 Reheat coils.
.6 Filters.
.7 To facilitate cleaning of ductwork (minimum
.8 Elsewhere as indicated.

.4 Provide 100 mm x 100 mm (4" x 4") quick opening access doors for inspection at balancing dampers, before and after filters, coils, fans, automatic dampers, at fire dampers, combination fire and smoke dampers, and elsewhere as indicated. Provide for cleaning kitchen exhaust duct work to NFPA 96. Provide minimum 200 x 200 mm size for hand access, 450 x 450 mm size for shoulder access, and as indicated. Provide 100 x 100 mm for balancing dampers only. Review locations prior to fabrication.

3.3 TEST PORTS

.1 Install in accordance with recommendations of SMACNA and in accordance with manufacturer's instructions.

.2 Provide duct test ports where indicated and required for testing and balancing purposes.

.3 Install insulation port extensions as required.

.4 Locations:
- .1 For traverse readings:
  - .1 Ducted inlets to roof and wall exhausters.
  - .2 Inlets and outlets of other fan systems.
  - .3 Main and sub-main ducts.
  - .4 And as indicated.
- .2 For temperature readings:
  - .1 At outside air intakes.
  - .2 In mixed air applications in locations as approved by Departmental Representative.
  - .3 At inlet and outlet of coils.
  - .4 Downstream of junctions of two converging air streams of different temperatures.
  - .5 And as indicated.

3.4 FLEXIBLE CONNECTORS

.1 Provide flexible connections immediately adjacent to equipment in ducts associated with fans and motorized equipment, and supported by vibration isolators, including but not limited to the following:
- .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.

.6 For fans developing static pressures of 1250 Pa and over, cover connections with leaded vinyl sheet, held in place with metal straps.

END OF SECTION

1 General

1.1 SUMMARY

.1 Section Includes:
- .1 Balancing dampers for mechanical forced air ventilation and air conditioning systems.
- .2 Sustainable requirements for construction and verification.

1.2 REFERENCES

.1 Sheet Metal and Air Conditioning National Association (SMACNA).
- .1 SMACNA HVAC Duct Construction Standards, Metal and Flexible-1985.

.2 Health Canada/Workplace Hazardous Materials Information System (WHMIS)
- .1 Material Safety Data Sheets (MSDS).

1.3 SUBMITTALS

.1 Product Data:
- .1 Submit manufacturer's printed product literature, specifications and datasheet in accordance with Section 01 33 00 - Submittal Procedures. Include product characteristics, performance criteria, and limitations.
  - .1 Submit two copies of Workplace Hazardous Materials Information System (WHMIS) Material Safety Data Sheets (MSDS) in accordance with Section 01 33 00 - Submittal Procedures.

.2 Quality assurance submittals: submit following in accordance with Section 01 33 00 - Submittal Procedures..
- .1 Certificates: submit certificates signed by manufacturer certifying that materials comply with specified performance characteristics and physical properties.
- .2 Instructions: submit manufacturer's installation instructions.

1.4 QUALITY ASSURANCE

.1 Health and Safety Requirements:
- .1 Do construction occupational health and safety in accordance with Section 01 35 29.06 - Health and Safety Requirements.

2 Products

2.1 GENERAL

.1 Manufacture to SMACNA standards.

2.2 MANUAL VOLUME CONTROL DAMPERS.

.1 Fabricate to SMACNA HVAC Duct Construction Standards - Metal and Flexible, and as indicated.

.2 Splitter Dampers:
- .1 Fabricate from same material as duct but one sheet metal thickness heavier (minimum 16 gauge), with appropriate stiffening to avoid vibration.
- .2 Blade: Fabricate of double thickness sheet metal to streamline shape, secured with continuous piano hinge.
- .3 Operator: Minimum 6 mm diameter rod in self aligning, universal joint action, flanged bushing with set screw and position indicator.
- .4 Rod configuration to prevent end from entering duct.
- .5 Folded leading edge.
- .6 Size on basis of straight air volume proportioning.

.3 Single Blade Dampers:
- .1 Fabricate for duct sizes up to 150 (in depth) x 760 mm.
- .2 Fabricate from same material as duct, but one sheet metal thickness heavier (minimum 16 gauge). V-groove stiffened.
- .3 Size and configuration to recommendations of SMACNA
- .4 Locking quadrant with shaft extension to accommodate insulation thickness.
- .5 Inside and outside nylon end bearings.
- .6 Channel frame of same material as adjacent duct, complete with angle stop.

.4 Multi-Blade Damper:
- .1 Factory manufactured of material compatible with duct.
- .2 Opposed blade: configuration, metal thickness and construction to recommendations of SMACNA.
- .3 Maximum blade height: 100 mm
- .4 Bearings: self-lubricating oil impregnated nylon.
- .5 Linkage: shaft extension with locking quadrant.
- .6 Channel frame of same material as adjacent duct, complete with angle stop.

.5 End Bearings: Except in round duct work 300 mm and smaller, provide end bearings.

.6 Quadrants:
- .1 Provide locking, indicating quadrant regulators on single and multi-blade dampers.
- .2 On insulated ducts mount quadrant regulators on stand-off mounting brackets, bases, or adapters.
- .3 Where rod lengths exceed 750 mm provide regulator at both ends.

3 Execution

3.1 MANUFACTURER'S INSTRUCTIONS

.1 Compliance: comply with manufacturer's written recommendations or specifications, including product technical bulletins, handling, storage and installation instructions, and datasheet.

3.2 INSTALLATION

.1 Install where specified, where required for balancing and where indicated on drawings.

.2 Install in accordance with recommendations of SMACNA and in accordance with manufacturer's instructions.

.3 Use splitter dampers only where indicated.

.4 Provide commercial balancing dampers on all low velocity duct take-offs to diffusers, grilles, and registers, regardless of whether dampers are specified as part of the diffuser, grille, or register assembly unless specifically noted otherwise.

.5 Runouts to registers and diffusers: install single blade damper located as close as possible to main ducts. Where indicated on the drawings, a balancing damper is not required for runouts in non-accessible ceiling spaces provided a damper is specified on the register and diffuser.

.6 Dampers: shall be installed vibration free.

.7 Ensure damper operators are observable and accessible. Provide access doors in ceilings/ walls where required.

END OF SECTION

1 General

1.1 SUMMARY

.1 Section Includes:
- .1 Operating dampers for mechanical forced air ventilation and air conditioning systems.
- .2 Sustainable requirements for construction and verification.

1.2 REFERENCES

.1 American Society for Testing and Materials International (ASTM)
- .1 ASTM A653/A653M-04a, Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by Hot-Dip Process.

.2 Health Canada/Workplace Hazardous Materials Information System (WHMIS)
- .1 Material Safety Data Sheets (MSDS).

1.3 SUBMITTALS

.1 Product Data:
- .1 Submit manufacturer's printed product literature, specifications and datasheet in accordance with Section 01 33 00 - Submittal Procedures. Include product characteristics, performance criteria, and limitations.
  - .1 Submit two copies of Workplace Hazardous Materials Information System (WHMIS) Material Safety Data Sheets (MSDS) in accordance with Section 01 33 00 - Submittal Procedures.

.2 Quality assurance submittals: submit following in accordance with Section 01 33 00 - Submittal Procedures.
- .1 Certificates: submit certificates signed by manufacturer certifying that materials comply with specified performance characteristics and physical properties.
- .2 Instructions: submit manufacturer's installation instructions.

.3 Closeout Submittals
- .1 Provide maintenance data for incorporation into manual specified in Section 01 78 00 - Closeout Submittals.

1.4 QUALITY ASSURANCE

.1 Health and Safety Requirements: do construction occupational health and safety in accordance with Section 01 35 29.06 - Health and Safety Requirements.

.2 Certificates:
- .1 Catalogue or published ratings those obtained from tests carried out by manufacturer or those ordered by manufacturer from independent testing agency.

2 Products

2.1 MULTI-LEAF DAMPERS

.1 Opposed airfoil blade type as indicated.

.2 Extruded aluminum (6063T5) damper frame shall not be less than 2.03 mm thickness. Damper frame to be 100 mm deep.

.3 Blades to be extruded aluminum (6063T5) profiles. Aluminum end caps are to be press fitted to blade ends, in order to seal hollow interior and reduce air leakage rate.

.4 Blade and frame seals shall be of extruded silicone. Seals are to be secured in an integral slot within the aluminum extrusions.

.5 Bearings are to be composed of a Celcon inner bearing fixed to a 11.11 mm aluminum hexagon blade pin, rotating within a polycarbonate outer bearing inserted in the frame, resulting in no metal-to-metal or metal-to-plastic contact.

.6 Linkage hardware shall be installed in the frame side and constructed of aluminum and corrosion-resistant, zinc-plated steel, complete with cup-point trunnion screws for a slip-proof grip.

.7 Standard air leakage data to be certified under the AMCA Certified Ratings Program.

.8 Dampers shall be made to size required without blanking off free area.

.9 Intermediate or tubular steel structural support is required to resist applied pressure loads for dampers that consist of two or more sections in both height and width.

.10 Operator: to Division 25.

.11 Insulated aluminum dampers:
- .1 Frames: insulated with extruded polystyrene foam with RSI 0.88.
- .2 Blades: constructed from aluminum extrusions with internal hollows insulated with polyurethane or polystyrene foam, RSI 0.88.

.12 Performance:
- .1 Temperature Range: -40 deg.C to 100 deg.C.
- .2 Leakage: 15.2 l/s per sq.meter at 0.25 kPa, 40.5 l/s per sq.meter at 1.0 kPa. Shall meet Class 1A at 0.25 kPa.
- .3 Pressure Drop: less than 4 Pa at 5.08 m/s.

2.2 DISC TYPE DAMPERS

.1 Frame: insulated brake formed, welded, 1.6 mm thick, galvanized steel to ASTM A653/A653M.

.2 Disc: insulated spin formed, 1.6 mm thick, galvanized steel to ASTM A653/A653M.

.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 less than 0.001 % of rated air flow at .25 kPa pressure differential across damper.
- .2 Pressure drop: at full open position less than 5 Pa differential across damper at 5.08 m/s.

2.3 BACKDRAFT DAMPERS

.1 Extruded aluminum 6063T5 backdraft damper frame shall not be less than 1.52 mm in thickness. Frame shall be 63.5 mm deep.

.2 Blades shall be extruded aluminum (6063T5) profiles and shall be less than 1.52 mm in thickness.

.3 Blade and side seals shall be extruded silicone. Seals are to be secured in integral slots within the aluminum extrusions.

.4 Bearing system shall be composed of Celcon bearings rotating on zinc-plated 12.7 mm steel pivot points.

.5 Linkage system shall consist of hard alloy aluminum (6005T6) crank arms fastened to zinc-plated steel pivot rods and shall be doubly secured within channel running along top of blade. Large diameter 8.73 mm hard alloy aluminum (6065-T6C) linkage rod shall connect the crank arms by means of a zinc-plated steel trunnion.

.6 Cup point trunnion set screw shall create a compression hard spot where it secures to the linkage rod for a slip–proof grip.

.7 Trunnions shall be zinc-plated to provide a hard, smooth and long-lasting rotating surface.

.8 Performance:
- .1 Temperature range: -40 deg.C to 100 deg.C.
- .2 Leakage: 101.2 l/s per square meter at 0.25 kPa.
- .3 Pressure Drop: less than 24.9 Pa.

.9 Backdraft dampers shall be made to size required. Minimum section size shall be 152 mm wide x 152 mm high. Maximum section size shall be 914 mm wide by 3658 mm high. Mullion breaks shall be used when damper height exceeds 1220 mm.

.10 Backdraft dampers with dimensions greater than maximum section size shall be manufactured in multiple sections. Multiple sections are not interlinked or connected. To install, each section must be individually fastened to a structural frame prepared on site.

.11 Fully adjustable device to permit setting for varying differential static pressures less than 2.49 Pa.

3 Execution

3.1 MANUFACTURER'S INSTRUCTIONS

.1 Compliance: comply with manufacturer's written recommendations or specifications, including product technical bulletins, handling, storage and installation instructions, and datasheet.

3.2 INSTALLATION

.1 Install where indicated.

.2 Install in accordance with recommendations of SMACNA and 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.

.6 Install insulated dampers at interface with outdoors including outdoor air intakes, exhaust ducts, and relief ducts.

END OF SECTION

1 General

1.1 SUMMARY

.1 Section Includes:
- .1 Fire and smoke dampers, and fire stop flaps.
- .2 Sustainable requirements for construction and verification.

1.2 REFERENCES

.1 American National Standards Institute/National Fire Protection Association (ANSI/NFPA)
- .1 ANSI/NFPA 90A-2002, Standard for the Installation of Air Conditioning and Ventilating Systems.

.2 Health Canada/Workplace Hazardous Materials Information System (WHMIS)
- .1 Material Safety Data Sheets (MSDS).

.3 Underwriters Laboratories of Canada (ULC)
- .1 CAN4-S112-M1990, Fire Test of Fire Damper Assemblies.
- .2 CAN4-S112.2-M84, Standard Method of Fire Test of Ceiling Firestop Flap Assemblies.
- .3 ULC-S505-1974, Fusible Links for Fire Protection Service.

1.3 SUBMITTALS

.1 Product Data:
- .1 Submit manufacturer's printed product literature, specifications and datasheet in accordance with Section 01 33 00 - Submittal Procedures. Include product characteristics, performance criteria, and limitations.
  - .1 Submit two copies of Workplace Hazardous Materials Information System (WHMIS) Material Safety Data Sheets (MSDS) in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Indicate the following:
  - .1 Fire dampers.
  - .2 Smoke dampers.
  - .3 Fire stop flaps.
  - .4 Operators.
  - .5 Fusible links.
  - .6 Design details of break-away joints.

.2 Quality assurance submittals: submit following in accordance with Section 01 33 00 - Submittal Procedures.
- .1 Certificates: submit certificates signed by manufacturer certifying that materials comply with specified performance characteristics and physical properties.
- .2 Instructions: submit manufacturer's installation instructions.

.3 Closeout Submittals:
- .1 Provide maintenance data for incorporation into manual specified in Section 01 78 00 - Closeout Submittals.

.2 Provide a Fire Damper Schedule identifying the following: damper tag, duct size, location, access door size, location.

1.4 QUALITY ASSURANCE

.1 Health and Safety Requirements: do construction occupational health and safety in accordance with Section 01 35 29.06 - Health and Safety Requirements.

.2 Certificates:
- .1 Catalogue or published ratings those obtained from tests carried out by manufacturer or those ordered by manufacturer from independent testing agency signifying adherence to codes and standards.

1.5 MAINTENANCE

.1 Extra Materials:
- .1 Provide maintenance materials in accordance with Section 01 78 00 - Closeout Submittals.
- .2 Provide following:
  - .1 Six (6) fusible links of each type.

2 Products

2.1 FIRE DAMPERS

.1 Fabricate to NFPA 90A and as indicated.

.2 Fire dampers: arrangement Type A, B and C, listed and bear label of ULC, UL, Warnock Hersey, meet requirements of authorities having jurisdiction. Fire damper assemblies fire tested in accordance with CAN4-S112. Fusible links on fire dampers shall be constructed to ULC Standard S505.

.3 Mild steel, factory fabricated for fire rating requirement to maintain integrity of fire wall and/or fire separation
- .1 Fire dampers: 1-1/2 hour fire rated unless otherwise indicated or required.
- .2 Fire dampers: automatic operating type and have dynamic rating suitable for maximum air velocity and pressure differential to which it will be subjected.

.4 Design and construct dampers to not reduce duct or air transfer opening cross-sectional area.

.5 Ceiling Dampers: Galvanized steel, 0.76 mm frame and 1.5 mm flap, two layers 3.2 mm ceramic fibre on top side, and one layer on bottom side for round flaps, with locking clip

.6 Horizontal Dampers: Galvanized steel, 0.76 mm frame, stainless steel closure spring, and lightweight, heat retardant non-asbestos fabric blanket.

.7 Curtain Type Dampers: Galvanized steel with interlocking blades. Provide stainless steel closure springs and latches for horizontal installations. Configure with blades out of air stream except for 250 Pa pressure class ducts up to 300 mm in height.

.8 Multiple Blade Dampers: 1.5 mm galvanized steel frame and blades, oil-impregnated bronze or stainless steel sleeve bearings and plated steel axles, 3.2 x 12.7 mm plated steel concealed linkage, stainless steel closure spring, blade stops, and lock.

.9 Fusible link actuated, weighted to close and lock in closed position when released or having negator-spring-closing operator for multi-leaf type or roll door type in horizontal position with vertical air flow.

.10 Fusible Links: separate at 71 degrees C (161 Deg.F.) with adjustable link straps for combination fire/balancing dampers.

.11 Fire dampers in low pressure ductwork may be multi-blade, offset butterfly of curtain type.

.12 Fabricate combination fire and balancing dampers with linkage readily adjustable in open position.

.13 50 x 50 x 3 mm retaining angle iron frame, on full perimeter of fire damper, on both sides of fire separation being pierced.

.14 Equip fire dampers with steel sleeve and frame installed disruption ductwork (breakaway ductwork) to ensure damper operation is not impaired. Equip sleeves or frames with perimeter mounting angles attached on both sides of wall or floor opening, except where noted otherwise. Construct ductwork in fire-rated floor-ceiling or roof-ceiling assembly systems with air ducts that pierce ceiling to conform with ULC.

.15 Fire dampers mounted on through the ceiling/floor security grilles shall utilize the security grille frame as the sleeve through the rated structure. Fire damper to be mounted on the service side to the security grille frame.

2.4 COMBINATION FIRE AND SMOKE DAMPERS

.1 Fabricate to NFPA 90A, UL 555, UL 555S, and as indicated.

.2 Provide factory sleeve and collar for each damper.

.3 Multiple Blade Dampers: Fabricate with 1.5 mm galvanized steel frame and blades, oil-impregnated bronze or stainless steel sleeve bearings and plated steel axles, stainless steel jamb seals, 3.2 x 12.7 mm plated steel concealed linkage, stainless steel closure spring, blade stops, and lock, and 12.7 mm actuator shaft.

.4 Smoke Rating: Leakage Class III Smoke Damper in accordance with UL555S. A Class lll smoke damper leaks no more than 80 cubic feet per minute (2.27 m^3/min) at 4 in. wg. (1 kPa.) differential pressure

.5 Operators: UL listed and labelled Electric 24V, 60 Hz, two-position, fail close, externally mounted.

.6 Duct Smoke Detector: Factory mounted duct smoke detector with no minimum velocity requirement and complete with single point low voltage electrical connection. Sensor to be photoelectronic type.

.5 Normally Open Smoke Responsive Fire Dampers: opposed blades complete with factory mounted actuator, flexible stainless steel blade edge seals to provide constant sealing pressure.

3 Execution

3.1 MANUFACTURER'S INSTRUCTIONS

.1 Compliance: comply with manufacturer's written recommendations or specifications, including product technical bulletins, handling, storage and installation instructions, and datasheet.

3.2 INSTALLATION

.1 Provide fire dampers at locations indicated, where ducts and outlets pass through fire rated components, and where required by authorities having jurisdiction. Install with required perimeter mounting angles, sleeves, breakaway duct connections, corrosion resistant springs, bearings, bushings and hinges.

.2 Install fire dampers and combination smoke and fire dampers to ANSI/NFPA 90A and in accordance with conditions of ULC listing.

.3 Maintain integrity of fire separation.

.4 After completion and prior to concealment obtain approvals of complete installation from authority having jurisdiction.

.5 Install access door adjacent to each damper.

.6 Co-ordinate with installer of firestopping.

.7 Ensure access doors/panels, fusible links, damper operators are easily observed and accessible.

.8 Install break-away joints of approved design on each side of fire separation.

.9 Contractor to individually tag each and every fire damper and provide a fire damper schedule in the Operation and Maintenance manual showing tag, size, type and location.

.10 Contractor shall tag fire damper and access door with fire damper tag.

.11 Demonstrate re-setting of fire dampers to Owner's representative.

.12 Where required by authority, seal dampers against smoke with non-intumescent (non-expanding) fire rated sealant.

END OF SECTION

1 General

1.1 SUMMARY

.1 Section Includes:
  .1 Materials and installation of flexible ductwork, joints and accessories.
.2 Sustainable requirements for construction and verification.

1.2 REFERENCES

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

.2 Department of Justice Canada (Jus).
  .1 Canadian Environmental Protection Act (CEPA), 1999, c. 33.
  .2 Transportation of Dangerous Goods Act, 1992 (TDGA), c. 34.

.3 Health Canada/Workplace Hazardous Materials Information System (WHMIS).
  .1 Material Safety Data Sheets (MSDS).

.4 National Fire Protection Association (NFPA).
  .1 NFPA 90A-02, Standard for the Installation of Air-Conditioning and Ventilating Systems.
  .2 NFPA 90B-02, Standard for Installation of Warm Air Heating and Air-Conditioning Systems.

.5 Sheet Metal and Air-Conditioning Contractors' National Association (SMACNA).
  .1 SMACNA HVAC Duct Construction Standards - Metal and Flexible, 95 (Addendum No.1, November 1997).
  .2 SMACNA IAQ Guideline for Occupied Buildings under Construction, 1st Edition 1995.

.6 Underwriters' Laboratories Inc. (UL).
  .1 UL 181-96, Standard for Factory-Made Air Ducts and Air Connectors.

.7 Underwriters' Laboratories of Canada (ULC).
  .1 CAN/ULC-S110-1986 (R2001), Fire Tests for Air Ducts.

1.3 SUBMITTALS

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

.2 Product Data: submit WHMIS MSDS in accordance with Section 02 81 01 - Hazardous Materials for the following:
  .1 Thermal properties.
  .2 Friction loss.
  .3 Acoustical loss.
  .4 Leakage.
  .5 Fire rating.

.3 Samples: submit samples with product data of different types of flexible duct being used in accordance with Section 01 33 00 - Submittal Procedures.

1.4 QUALITY ASSURANCE

.1 Certification of Ratings:
- .1 Catalogue or published ratings to be those obtained from tests carried out by manufacturer or independent testing agency signifying adherence to Codes and Standards.

.2 Health and Safety:
- .1 Do construction occupational health and safety in accordance with Section 01 35 29.06 - Health and Safety Requirements.

2 Products

2.1 GENERAL

.1 Factory fabricated to CAN/ULC-S110.

.2 Pressure drop coefficients listed below are based on relative sheet metal duct pressure drop coefficient of 1.00.

.3 Flame spread rating not to exceed 25. Smoke developed rating not to exceed 50.

2.2 FLEXIBLE DUCT MATERIALS

.1 Two ply vinyl film supported by helically wound spring steel wire.
- .1 Pressure Rating: 2.50 kPa positive and 250 Pa negative.
- .2 Maximum Velocity: 20.3 m/sec.
- .3 Temperature Range: -23 to 71 degrees C.

.2 ULC Labeled, black polymer film supported by helically wound spring steel wire.
- .1 Pressure Rating: 1000 Pa positive and 175 Pa negative.
- .2 Maximum Velocity: 20.3 m/sec.
- .3 Temperature Range: -28 to 79 degrees C.

.3 ULC labeled, multiple layers of aluminum laminate supported by helically wound spring steel wire.
- .1 Pressure Rating: 2.50 kPa positive and 250 Pa negative.
- .2 Maximum Velocity: 20.3 m/sec.
- .3 Temperature Range: -28 to 99 degrees C.

2.3 INSULATED FLEXIBLE DUCT MATERIALS

.1 Two ply vinyl film supported by helically wound spring steel wire; fibreglass insulation; polyethylene vapour barrier film.
- .1 Pressure Rating: 2.50 kPa positive and 250 Pa negative.
- .2 Maximum Velocity: 20.3 m/sec.
- .3 Temperature Range: -23 to 71 degrees C.

.2 Black polymer film supported by helically wound spring steel wire; fibreglass insulation; polyethylene vapour barrier film.
- .1 Pressure Rating: 1000 Pa positive and 175 Pa negative.

.2 Maximum Velocity: 20.3 m/sec.
.3 Temperature Range: -28 to 79 degrees C.

.3 Multiple layers of aluminum laminate supported by helically wound spring steel wire; fibreglass insulation; polyethylene vapour barrier film.
.1 Pressure Rating: 2.50 kPa positive and 250 Pa negative.
.2 Maximum Velocity: 20.3 m/sec.
.3 Temperature Range: -28 to 99 degrees C.

Part 3 Execution

3.1 DUCT INSTALLATION

.1 Install in accordance with: SMACNA.

END OF SECTION

1 General

1.1 SECTION INCLUDES

.1 Centrifugal fans.
.2 Roof and Wall Exhausters.
.3 Axial fans.
.4 Propeller fans.
.5 Fan accessories.
.6 Roof curbs.
.7 Motors and Drives.
.8 Cabinet Exhaust Fans

1.2 SUBMITTALS

.1 Section 01 33 00: Procedures for submittals.

.2 Shop Drawings: Indicate assembly, unit dimensions, weight loading, required clearances, construction details, field connection details, and electrical characteristics and connection requirements.

.3 Product Data:
- .1 Provide literature which indicates dimensions, weights, capacities, ratings, fan performance, gauges and finishes of materials, and electrical characteristics and connection requirements.
- .2 Provide data of filter media, filter performance data, filter assembly, and filter frames.
- .3 Provide fan curves with specified operating point clearly plotted.
- .4 Submit sound power level data for both fan outlet and casing radiation at rated capacity.
- .5 Submit electrical requirements for power supply wiring including wiring diagrams for interlock and control wiring, clearly indicating factory-installed and field-installed wiring.

1.3 SOURCE QUALITY CONTROL

.1 Fans used shall not decrease motor size, increase noise level, increase tip speed by more than 10 percent or increase inlet air velocity by more than 20 percent, from specified criteria; and capable of accommodating static pressure variations of plus or minus 10 percent.

1.4 OPERATION AND MAINTENANCE

.1 Submit operation and maintenance data to requirements of Section 01 78 00.

.2 Include instructions for lubrication, filter replacement, motor and drive replacement, spare parts lists, and wiring diagrams.

2 Products

2.1 CENTRIFUGAL FANS

.1 Wheel and Inlet
- .1 Backward Inclined: Steel construction with smooth curved inlet flange, heavy back plate, backwardly curved blades welded or riveted to flange and back plate, cast hub riveted to back plate and keyed to shaft with set screws.
- .2 Forward Curved: Steel construction with inlet flange, back plate, shallow blades with inlet and tip curved forward in direction of air flow, mechanically secured to flange and back plate, steel hub swaged to back plate and keyed to shaft with set screw.
- .3 Airfoil Wheel: Steel construction with smooth curved inlet flange, heavy back plate, die formed hollow airfoil shaped blades continuously welded at tip, flanged and back plate, cast hub riveted to back plate and keyed to shaft with set screws.

.2 Housing
- .1 Heavy gage steel, spot welded, designed to minimize turbulence with spun inlet bell and shaped cut-off.
- .2 Factory finish before assembly in prime coated. For fans handling air downstream of humidifiers, provide two additional coats of paint. Prime coating on aluminum parts is not required.
- .3 Provide bolted construction with horizontal flanged split housing.
- .4 Fabricate plug fans without volute housing, with steel cabinet, lined.
- .5 Shafts: Hot rolled steel, ground and polished, with key-away and protectively coated with lubricating oil.
- .6 V-Belt Drive: Cast iron or steel sheaves, dynamically balanced, keyed, variable and adjustable pitch sheaves for motors 11.2 kW and under, fixed sheaves for 15 kW and over, matched belts, drive rated minimum 1.5 times nameplate rating of the motor.
- .7 Belt Guards: Fabricate to SMACNA Low Pressure Duct Construction Standards.

.3 Accessories
- .1 Adjustable Inlet Vanes: Steel construction with blades supported at both ends with two permanently lubricated bearings, variable mechanism terminating in single control lever with control shaft for double width fans.
- .2 Discharge Dampers: Opposed blade heavy duty steel dampers assembly with blades constructed of two plates formed around and welded to shaft, channel frame, sealed ball bearings, with blades linked out of air stream to single control lever.
- .3 Inlet/Outlet Screens: Galvanized steel welded grid.
- .4 Access Doors: Shaped to conform to scroll with quick opening latches and gaskets.
- .5 Scroll Drain: 15 mm steel pipe coupling welded to low point of fan scroll.

2.2 AXIAL FANS

.1 Hub and Impeller
- .1 Airfoil Impeller Blades: Adjustable die cast aluminum alloy or welded steel die formed blades with belt drive.
- .2 Hub: Die cast aluminum alloy or cast iron hub or with belt drive of spun, welded steel, bored and keyed to shaft.

.3 Controllable Pitch Assemblies: Incorporate ball bearing, counterbalanced blade and variable pitch assembly into hub with mechanical link to casing exterior mounted actuator, or pneumatic or electric actuator incorporated within hub.

.2 Casing
- .1 Casing: 6 mm steel for fans 1000 mm in diameter and smaller and 0.9 mm steel for larger fans.
- .2 Fabrication: Continuously weld with inlet and outlet flanges connections, motor or shaft supports. Incorporate flow straightening guide vanes for fans specified for static pressures greater than 250 Pa.
- .3 Finish: One coat enamel.
- .4 Shafts: Hot rolled steel, ground and polished, with key-away and protectively coated with lubricating oil.
- .5 V-Belt Drive: Cast iron or steel sheaves, dynamically balanced, keyed, variable and adjustable pitch sheaves for motors 1.12 kW and under, fixed sheaves for 15 kW and over, matched belts, drive rated minimum 1.5 times nameplate rating of the motor.
- .6 Belt Guards: Fabricate to SMACNA Low Pressure Duct Construction Standards.
- .7 Lubrication: Extend lubrication fittings to outside of casing.

.3 Accessories
- .1 Adjustable Inlet Vanes: Steel construction with blades supported at both ends with two permanently lubricated bearings, variable mechanism terminating in single control lever with control shaft for double width fans.
- .2 Inlet Bell: Bell mouth inlet fabricated of steel with flange.
- .3 Outlet Cones: Fabricated of steel with flanges, outlet area/inlet area ratio of 1.5/1.0.
- .4 Inlet Screens: Galvanized steel welded grid to fit inlet bell.
- .5 Dampers: Welded steel construction, consisting of two semi-circular pivoted vanes in short casing section, finished with one coat enamel. Provide airstream operation closing blades by reversing air flow and gravity.
- .6 Access Doors: Shaped to conform to casing with quick opening latches and gaskets.
- .7 Blade Pitch Actuator: Factory mounted and calibrated, electric actuator requiring single phase power and accepting electric input.

2.3 ROOF AND WALL EXHAUSTERS

.1 Roof Mounted Fans
- .1 Centrifugal or Axial Fan: V-belt or direct driven, with spun aluminum housing, resilient mounted motor, 12 mm mesh bird screen, square base to suit roof curb, continuous curb gaskets, plate bolts and screws.
- .2 Roof Curb: 200 mm high self-flashing curb with continuously welded seams, built in cant strip, factory installed door nailer strip.
- .3 Disconnect Switch: Factory wired non-fusible in housing for thermal overload protected motor and wall mounted.
- .4 Back Draft Damper: Gravity activated, aluminum multiple blade construction, felt edged with nylon bearings.
- .5 V-belt Drive: Cast iron or steel sheaves, dynamically balanced, bored to fit shafts and keyed, variable and adjustable pitch motor sheave selected so requiring rpm is obtained with sheaves set at mid-position, fan shaft with self aligning pre-lubricated ball bearings.

.2 Wall Exhausters
- .1 Centrifugal or Axial Fan: V-belt or direct driven, with spun aluminum housing, motor, 12 mm mesh bird screen, cadmium plated bolts and screws.
- .2 Disconnect Switch: Factory wired non-fusible in housing for thermal overload protected motor and wall mounted.
- .3 Back Draft Damper: Gravity activated, aluminum multiple blade construction, felt edge with nylon bearings.
- .4 V-belt Drive: Cast iron or steel sheaves, dynamically balanced, bored to fit shafts and keyed, variable and adjustable pitch motor sheave selected so required rpm is obtained with sheaves set at mid-position, fan shaft with self aligning pre-lubricated ball bearings.

2.4 CABINET EXHAUST FANS

.1 Cabinet and Ceiling Exhaust Fans
- .1 Centrifugal Fan: V-belt or direct driven, with galvanized steel housing lined with 15 mm acoustic insulation, resilient mounted motor, gravity back draft damper in discharge.
- .2 Disconnect Switch: Factory wired non-fusible in housing for thermal overload protected motor and wall mounted.
- .3 Grille for Ceiling Fan: Moulded white plastic grille or aluminum grille with baked white enamel finish.
- .4 V-belt Drive: Cast iron or steel sheaves, dynamically balanced, bored to fit shafts and keyed, variable and adjustable pitch motor sheave selected so required rpm is obtained with sheaves set at mid-position, fan shaft with self aligning pre-lubricated ball bearings.
- .5 To be complete with factory mounted solid state speed control for air balancing only. The speed control shall not be utilized as the disconnect switch.

3 Execution

3.1 PREPARATION

.1 Verify that electric power is available and of the correct characteristics (voltage and phase) prior to ordering pump.

3.2 INSTALLATION

.1 Install in accordance with manufacturer's instructions.

.2 Assemble high pressure packaged air units by bolting sections together. Isolate fan section with flexible duct connections.

.3 Install flexible connections between fan inlet and discharge ductwork. Ensure metal bands of connectors are parallel with minimum 25 mm flex between ductwork and fan while running.

.4 Install fan restraining snubbers as indicated. Flexible connectors shall not be in tension while running.

.5 Pipe scroll drains to nearest floor drain.

.6 Provide access to adjustable blade axial fan wheels for varying blade angle setting. Adjust blades for varying range of volume and pressure.

.7 Provide floor mounted axial fans with reinforced legs and ceiling suspended units with support brackets bolted to casing flange.

.8 When fan inlet or outlet is exposed, provide safety screen.

.9 Install unit on vibration isolators with static deflection of 50 mm. For smaller fans, vibration isolators to be as recommended by manufacturer.

.10 Set roof mounted fans on metal, self flashing curbs 200 mm minimum above roof. Provide acoustic insulation on duct to below roof line and one fan inlet plenum and drip pan for collecting condensation.

.11 Provide exhaust fans with multi-blade, rattle free, back draft damper with felt lines blades edges, bird screen, disconnect switch and curb caps.

.12 Supply and install sheaves as necessary for final air balancing.

.13 Do not operate fans for any purpose until ductwork is clean, filters in place, bearings lubricated, and fan has been test run under observation.

END OF SECTION

1 General

1.1 SECTION INCLUDES

.1 Variable volume terminal units.
.2 Integral heating coils.
.3 Integral damper motor operators.
.4 Controls.

1.2 REFERENCES

.1 ARI Standard 880-98, Air Terminals.
.2 ASHRAE Standard 130-1996, Method or Testing for Rating Ducted Air Terminal Units.
.3 ADC 1062 - Air Distribution and Control Device Test Code.
.4 NFPA 90A - Installation of Air Conditioning and Ventilation Systems.
.5 UL 181 - Factory-Made Air Ducts and Connectors.

1.3 SUBMITTALS

.1 Shop Drawings: Indicate configuration, general assembly, and materials used in fabrication, and electrical characteristics and connection requirements.

.2 Product Data: Provide data indicating configuration, general assembly, and materials used in fabrication. Include catalogue performance ratings which indicate air flow, static pressure, and NC designation. Include electrical characteristics and connection requirements.

.3 Include schedules listing discharge and radiated sound power level for each of second through sixth octave bands at inlet static pressures of 250 to 1000 Pa.

.4 Manufacturer's Installation Instructions: Indicate support and hanging details, and service clearances required.

1.4 OPERATION AND MAINTENANCE DATA

.1 Operation and Maintenance Data: Include manufacturer's descriptive literature, operating instructions, maintenance and repair data, and parts lists. Include directions for resetting constant volume regulators.

1.5 WARRANTY

.1 Section 01 78 00: Submittals for project closeout.

.2 Provide one year warranty.

.3 Warranty: Include coverage of system powered control systems.

2 Products

2.2 SINGLE DUCT VARIABLE VOLUME UNITS

.1 Basic Assembly:
  .1 Casings: Minimum 0.8 mm galvanized steel.

.2 Lining: Minimum 13 mm thick neoprene or vinyl coated fibrous glass insulation, 24 g/L density, meeting NFPA 90A requirements and UL 181 erosion requirements. Face lining with mylar film.
.3 Plenum Air Inlets: Round stub connections for duct attachment.
.4 Plenum Air Outlets: S slip and drive connections.

.2 Basic Unit:
.1 Configuration: Air volume damper assembly inside unit casing. Locate control component inside protective metal shroud.
.2 Volume Damper: Construct of galvanized steel with peripheral gasket and self lubricating bearings; maximum damper leakage: 2 percent of design air flow at 0.25 kPa inlet static pressure.
.3 Mount damper operator to position damper normally open.

.3 Attenuator Section: Acoustically lined duct, as indicated on drawings. Minimum duct length before first connection to be 1500mm.

.4 Hot Water Heating Coil:
.1 Construction: 13 mm copper tube mechanically expanded into aluminum plate fins, leak tested under water to 10380 kPa pressure, factory installed.
.2 Capacity: Refer to schedule.

.7 Automatic Damper Operator:
.1 Electric Actuator: 24 volt with high limit.

.8 Controls:
.1 Suitable for operation with duct pressures between 60 and 750 Pa static pressure.
.2 Mount controls in sheet metal enclosure on unit.
.3 EMCS controls to be supplied by controls contractor (Division 25) and factory mounted.
.4 Controls to be low voltage.

3 Execution

3.1 INSTALLATION

.1 Install to manufacturer's written instructions.

.2 Provide ceiling access doors or locate units above easily removable ceiling components.

.3 Support units individually from structure. Do not support from adjacent ductwork.

.4 Connect to ductwork to Section 23 31 13.

.5 Provide minimum of 1.5 m of 25 mm thick lined ductwork downstream of units.

.6 Verify that electric power is available and of the correct characteristics.

3.2 ADJUSTING

.1 Reset volume with damper operator attached to assembly allowing flow range modulation from 100 percent of design flow to 0 percent full flow. Set units with heating coils for minimum airflow as indicated in schedule.

3.3 SCHEDULES

.1 Refer to Mechanical Equipment Schedules.

1 General

1.1 SUMMARY

.1 Section Includes:
- .1 Supply, return and exhaust grilles and registers, diffusers and linear grilles, for commercial and residential use.
- .2 Sustainable requirements for construction and verification.

1.2 SYSTEM DESCRIPTION

.1 Performance Requirements:
- .1 Catalogued or published ratings for manufactured items: obtained from tests carried out by manufacturer or those ordered by manufacturer from independent testing agency signifying adherence to Codes and Standards.

1.3 SUBMITTALS

.1 Product Data:
- .1 Submit manufacturer's printed product literature, specifications and datasheet in accordance with Section 01 33 00 - Submittal Procedures. Include product characteristics, performance criteria, and limitations.
  - .1 Submit two copies of Workplace Hazardous Materials Information System (WHMIS) Material Safety Data Sheets (MSDS) in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Indicate following:
  - .1 Capacity.
  - .2 Throw and terminal velocity.
  - .3 Noise criteria.
  - .4 Pressure drop.
  - .5 Neck velocity.

.2 Quality assurance submittals: submit following in accordance with Section 01 33 00 - Submittal Procedures.
- .1 Certificates: submit certificates signed by manufacturer certifying that materials comply with specified performance characteristics and physical properties.
- .2 Instructions: submit manufacturer's installation instructions.

1.4 QUALITY ASSURANCE

.1 Air flow tests and sound level measurement shall be made in accordance with ANSI/ ASHRAE Standard 70.

.2 Manufacturer shall have published performance data.

.3 Manufacturer shall certify catalogued performance and ensure correct application of air outlet types.

1.5 JOB CONDITIONS

.1 Review requirements of outlets as to size, finish and type of mounting prior to submitting shop drawings and schedules of outlet.

.2 Positions indicated are approximate only. Check location of outlets and make necessary adjustment in position to conform with Architectural features, symmetry, performance, and lighting arrangement.

2 Products

2.1 GENERAL

.1 To meet capacity, pressure drop, terminal velocity, throw, noise level, neck velocity as indicated.

.2 Base air outlet application on space noise level, either by Noise Criteria (NC) curves or Room Criteria (RC) curves, as listed below:

.1	Classroom	NC 30
.2	Offices	NC 30
.3	Scenario Spaces	NC 30

.3 Frames:

.1 Full perimeter gaskets.

.2 Plaster frames for diffusers, located in plaster surface.

.3 Concealed fasteners.

.4 Concealed manual volume control damper operators.

.5 Provide baffles to direct air away from walls, columns or other obstructions within the radius of diffuser operation.

.6 Provide anti-smudge frames or plaques on diffusers located in rough textured surfaces such as acoustical plaster.

.7 Refer to equipment schedule for specification of air outlets.

.8 Colour: as directed by Departmental Representative.

2.2 MANUFACTURED UNITS

.1 Grilles, registers and diffusers of same generic type, products of one manufacturer.

2.3 RETURN AND EXHAUST GRILLES AND REGISTERS

.1 Sidewall and ceiling exhaust grilles shall have streamlined blades, depth of which exceeds 20 mm spacing. Provide spring tension or other device to set blades. Provide units with horizontal face.

.2 Provide 25 mm narrow margin frame with countersunk screw holes.

.3 Fabricate of steel with 20 gauge minimum frames and 22 gauge minimum blades, steel and aluminum with 20 gauge minimum frame, or heavy aluminum extrusions.

.4 Provide exhaust grilles, with integral, gang-operated opposed blade dampers with removable key operator, operable from face, where indicated.

.5 Finish in factory baked enamel finish, colour by Departmental Representative.

2.4 GRID CORE RETURN AND EXHAUST GRILLES

.1 Fabricate fixed grilles of 13 mm x 13 mm x 13 mm louvres.

.2 Provide 32 mm margin frame with lay-in frame for suspended grid ceilings.

.3 Fabricate of aluminum.

.4 Provide exhaust grilles, where not individually connected to exhaust fans, with integral, gang-operated opposed blade dampers with removable key operator, operable from face, where indicated.

2.5 LOUVRED SUPPLY GRILLES

.1 Ceiling supply grilles shall have streamlined and individually adjustable curved blades to discharge air along face of grille. Units shall have two-way deflection.

.2 Provide 25 mm narrow margin frame with countersunk screw holes.

.3 Fabricate of heavy aluminum extrusions.

.4 Provide grilles with integral, gang-operated opposed blade dampers with removable key operator, operable from face, and equalizing grid, where indicated.

.5 Finish in factory enamel finish, colour as selected by Departmental Representative.

2.6 SQUARE PLAQUE DIFFUSER

.1 Diffuser shall consist of a precision formed back cone of one piece seamless construction which incorporates a round inlet collar of sufficient length for connecting rigid ductwork.

.2 Removable inner plaque assembly shall be incorporated that drops no more than 1/4" below the ceiling plane to assure proper air distribution performance.

.3 Sizes and mounting as detailed on drawings.

2.7 DUCT MOUNTED SPIRAL DUCT GRILLE

.1 Double deflection type with two sets of fully adjustable deflection blades spaced 19 mm (3/4").

.2 Front blades to run parallel to long dimension.

.3 Provide adjustable air scoop with operator on side of frame.

.4 Sizes and mounting as detailed on drawings.

.5 Contractor shall ensure grille does not rattle during operation.

2.8 SECURITY GRILLE

.1 Perorated faced steel maximum security grilles of size and mountings as indicated on drawings.

.2 Grilles shall be from approved list of security grilles as follows:

.1 Chubb OP-20V from www.gunnebo.com
.2 Simpson V-2 from www.simpsoninstall@email.com and (902) 664-6266.
.3 Eneround security-type ventilating grille from www.dthompson@heatingproducts.nf.net and (709) 754-9100
.4 Virtucom SCO Security from www.virtucom-inc.com

.3 Grille to be stamped with manufacturer and model number on faceplate of grille.

.4 Grilles to be secured using Chubb or S&C flathead or equivalent flathead steel spanners from grille manufacturer.

.5 Grilles to be complete with a minimum of 2 spanner tools for the installation/removal of flathead steel spanner screws. Spanner tools to be turned over to owner at completion of project.

.6 Finish: as noted on drawings.

2.9 OUTSIDE LOUVRES

.1 Refer to Section 23 37 20 - Louvres, Intakes and Vents.

3 Execution

3.1 MANUFACTURER'S INSTRUCTIONS

.1 Compliance: comply with manufacturer's written recommendations or specifications, including product technical bulletins, handling, storage and installation instructions, and datasheet.

3.2 INSTALLATION

.1 Install in accordance with manufacturer’s instructions.

.2 Install with oval head, stainless steel screws in countersunk holes where fastenings are visible.

.3 Bolt grilles, registers and diffusers, in place, where indicated.

.4 With security grilles, contractor shall use high yield grout to fill any space between back of the face plate and the mounting surface.

3.3 CLEANING

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

.2 Upon completion and verification of performance of installation, remove surplus materials, excess materials, rubbish, tools and equipment.

END OF SECTION

1 General

1.1 SUMMARY

.1 Section Includes:
- .1 Mechanical louvers; intakes; vents; and reinforcement and bracing for air vents, intakes and gooseneck hoods.
- .2 Sustainable requirements for construction and verification.

1.2 REFERENCES

.1 American National Standards Institute (ANSI)/ National Fire Protection Association (NFPA)
- .1 ANSI/NFPA 96-04, Standard for Ventilation Control and Fire Protection of Commercial Cooking Operations.

.2 American Society for Testing and Materials International (ASTM)
- .1 ASTM E90-04, Standard Test Method for Laboratory Measurement of Airborne Sound Transmission Loss of Building Partitions and Elements.

.3 Health Canada/Workplace Hazardous Materials Information System (WHMIS)
- .1 Material Safety Data Sheets (MSDS).

.4 Sheet Metal and Air Conditioning Contractors' National Association (SMACNA)

.5 Society of Automotive Engineers (SAE)

1.3 SYSTEM DESCRIPTION

.1 Performance Requirements:
- .1 Catalogued or published ratings for manufactured items: obtained from tests carried out by manufacturer or those ordered by manufacturer from independent testing agency signifying adherence to codes and standards.

1.4 SUBMITTALS

.1 Product Data:
- .1 Submit manufacturer's printed product literature, specifications and datasheet in accordance with Section 01 33 00 - Submittal Procedures. Include product characteristics, performance criteria, and limitations.
  - .1 Submit two copies of Workplace Hazardous Materials Information System (WHMIS) Material Safety Data Sheets (MSDS) in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Indicate following:
  - .1 Pressure drop.
  - .2 Face area.
  - .3 Free area.

.2 Quality assurance submittals: submit following in accordance with Section 01 33 00 - Submittal Procedures.
- .1 Certificates: submit certificates signed by manufacturer certifying that materials comply with specified performance characteristics and physical properties.

.2 Instructions: submit manufacturer's installation instructions.

.3 Test Reports:

.1 Submit certified data from independent laboratory substantiating acoustic and aerodynamic performance to ASTM E90.

1.5 QUALITY ASSURANCE

.1 Health and Safety Requirements: do construction occupational health and safety in accordance with Section 01 35 30 - Health and Safety Requirements.

2 Products

2.1 FIXED LOUVRES - ALUMINUM

.1 Construction: welded with exposed joints ground flush and smooth. Blade and frame fillet welds concealed from view.

.2 Material: extruded aluminum alloy 6063-T5; blades and frames minimum 2.7 mm thick.

.3 Blade: stationary with drainable gutters, reinforcing bosses and maximum blade length of 1500 mm or manufacturer’s recommendations.

.4 Frame, head, sill and jamb: 100 or 150 mm deep one piece extruded aluminum, minimum 2 mm thick with approved caulking slot, integral to unit. Depth as indicated. Frames shall be jointed at each corner with full length weld.

.5 Mullions: at 1500 mm maximum centres, visible vertical mullions.

.6 Fastenings: stainless steel 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: as selected by Departmental Representative.

3 Execution

3.1 MANUFACTURER'S INSTRUCTIONS

.1 Compliance: comply with manufacturer's written recommendations or specifications, including product technical bulletins, handling, storage and installation instructions, and datasheet.

3.2 INSTALLATION

.1 In accordance with manufacturer's and SMACNA recommendations.

.2 Reinforce and brace as indicated.

.3 Anchor securely into opening. Seal with caulking to ensure weather tightness.

3.3 CLEANING

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

.2 Upon completion and verification of performance of installation, remove surplus materials, excess materials, rubbish, tools and equipment.

END OF SECTION

1 General

1.1 REFERENCES

.1 American National Standards Institute/National Fire Prevention Association (ANSI/NFPA)
- .1 ANSI/NFPA 96- 1994, Ventilation Control and Fire Protection of Commercial Cooking Operations.

.2 American Society of Heating, Refrigeration and Air-Conditioning Engineers (ASHRAE)
- .1 ASHRAE 52.1- 1992, Gravimetric And Dust Spot for Testing Air-cleaning Devices Used in General Ventilation for Removing Particulate Matter.

.3 Canadian General Standards Board (CGSB)
- .1 CAN/CGSB-115.10- M90, Disposable Air Filters for the Removal of Particulate Matter from Ventilating Systems.
- .2 CAN/CGSB-115.11- M85, Filters, Air, High Efficiency, Disposable, Bag Type (Reaffirmed April 1985).
- .3 CAN/CGSB-115.12- M85, Filters, Air, Medium Efficiency, Disposable, Bag Type (Reaffirmed April 1985).
- .4 CAN/CGSB-115.13- 85, Filter Media, Automatic Roll (Reaffirmed April 1985).
- .5 CAN/CGSB-115.14- M91, High Efficiency Cartridge Type Supported Air Filters for the Removal of Particulate Matter from Ventilating Systems.
- .6 CAN/CGSB-115.15- M91, High Efficiency Rigid Type Air Filters for Removal of Particulate Matter from Ventilating Systems.
- .7 CAN/CGSB-115.16- M82, Activated Carbon for Odor Removal from Ventilating Systems.
- .8 CAN/CGSB-115.18- M85, Filter, Air, Extended Area Panel Type, Medium Efficiency.
- .9 CAN/CGSB-115.20- 95, Polarized Media Air Filter.

.4 Underwriters' Laboratories of Canada
- .1 ULC -S111- M80, "Fire Tests for Air Filter Units".
- .2 ULC-S649-1993, Grease Filters for Commercial and Institutional Kitchen Exhaust Systems.

1.2 SHOP DRAWINGS AND PRODUCT DATA

.1 Submit shop drawing 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 QUALITY ASSURANCE

.1 Filters shall be product of and supplied by one manufacturer. Filter components assembled to form filter banks shall be products of same manufacturer.

.2 Filter media shall be UL listed, Class I or Class II, as approved by local authority.

1.5 MAINTENANCE 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 frames and filters, addresses of suppliers, list of specialized tools necessary for adjusting, repairing or replacing for inclusion in operating manual.

1.6 ALTERNATIVES

.1 Size, media face area, Merv rating, initial and final resistance of alternative manufacturer’s shall be same as type specified.

1.7 EXTRA MATERIALS

.1 Spare filters: in addition to filters to be installed immediately prior to acceptance by Departmental Representative , supply one complete set of filters for each filter unit or filter bank in accordance with section 01 78 00 - Closeout Submittals. Total number of filters for each and every filter bank as follows:
- .1 One set for testing, balancing and commissioning.
- .2 One set to be installed at acceptance.
- .3 One spare set to be used by Owner during first year of operation.

2 Products

2.1 GENERAL

.1 Media: suitable for air at 100% RH and air temperatures between minus 40 and 50 °C.

.2 Number of units, size and thickness of panels, overall dimensions of filter bank, configuration and capacities: as indicated.

.3 Pressure drop when clean and dirty, sizes and thickness: as indicated on schedule.

.4 Fire rated to: ULC S111

.5 Final filters for all supply air systems shall be MERV 14 to meet LEED requirements.

2.2 ACCESSORIES

.1 Seals: to ensure leakproof operation.

.2 Blank-off plates: as required, to fit all openings and of same material as holding frames.

.3 Access and servicing: through doors/panels on each side and/or from upstream or downstream face of filter bank.

2.3 FIBROUS GLASS PANEL FILTERS

.1 Disposable fibrous glass media: to CAN/CGSB-115.10 with adhesive.

.2 Holding frame: 1.2 mm minimum thick galvanized steel with 3 mm diam hinged wire mesh screen.

.3 Performance: as indicated, to ASHRAE 52.2.

.4 Fire rated: to ULC -S111.

.5 Nominal thickness: as indicated.

2.4 COTTON PANEL FILTERS

.1 Disposable pleated reinforced cotton dry media: to CAN/CGSB 115.18.

.2 Holding frame: galvanized steel, or slide in channel for side access.

.3 Performance: as indicated, to ASHRAE 52.2.

.4 Fire Rated: to ULC -S111.

.5 Nominal thickness: as indicated.

2.5 FILTER GAUGES - MANOMETER TYPE

.1 Direct Reading Dial: 90 mm diameter diaphragm actuated dial in metal case, vent valves, black figures on white background, front recalibration adjustment, range 0 Pa to two times initial pressure, 2 percent of full scale accuracy.

.2 Inclined Manometer: One piece moulded plastic with epoxy coated aluminum scale, inclined-vertical indicating tube and built-in spirit level, range 0 Pa to two times initial pressure, 3 percent of full scale accuracy.

.3 Accessories: Static pressure tips with integral compression fittings, 6 mm aluminum tubing, 2-way or 3-way vent valves.

2.6 RIGID, SUPPORTED BAG TYPE FILTERS

.1 Media: disposable preformed fibrous glass, cartridge with approximately 4.6 sq.m. (50 sq.ft.) of media per 472 l/s capacity (1000 CFM).

.2 Holding frame: galvanized steel with bracing. Provision for front mounted panel pre-filter and front or rear removal of filter media.

.3 Media support: welded wire grid.

.4 High efficiency: to CAN/CGSB-115.11.

.5 Medium efficiency: to CAN/CGSB-115.12

.6 Nominal thickness: as indicated.

2.7 CARTRIDGE FILTERS

.1 Media: deep pleated, disposable, high efficiency, to CAN/CGSB-115.14.

.2 Holding frame: galvanized steel with bracing.

.3 Media support: welded wire grid.

2.8 FILTER FRAMES AND HOUSINGS

.1 General: Fabricate filter frames and supporting structures of 1.50 mm (16 gauge) galvanized steel or extruded aluminum T-section construction with necessary gasketing between frames and walls.

.2 Standard Sizes: Provide for interchangeability of filter media of other manufacturers; for panel filters; for extended surface and high efficiency particulate air filters, provide for upstream mounting of panel filters.

.3 Side Servicing Housings: Flanged for insertion into ductwork, of reinforced 1.5 mm galvanized steel; access doors with continuous gasketing and positive locking devices on both sides; extruded aluminum tracks or channels for primary and secondary filters with positive sealing gaskets.

3 Execution

3.1 INSTALLATION GENERAL

.1 Install in accordance with manufacturer’s recommendations and with adequate space for access, maintenance and replacement.

.2 Filter banks shall have removal and access indicated.

.3 Do not operate fan systems without filtration in place.

3.2 REPLACEMENT MEDIA

.1 Replace all media with new upon acceptance.

.2 Filter media to be new and clean, as indicated by pressure gauge, at time of acceptance.

3.3 FILTER GAUGES

.1 Install type as indicated across each filter bank (pre-filter and final filter) in approved and easy readable location.

.2 Mark each filter gauge with value of pressure drop for clean condition and manufacturer's recommended replacement (dirty) value.

END OF SECTION

1 General

1.1 SECTION INCLUDES

.1 Fabricated breechings.
.2 Manufactured chimneys for gas fired equipment.
.3 Vent dampers.
.4 Manufactured double wall chimneys for fuel fired equipment.

1.2 REFERENCES

.1 ANSI Z21.66 - Automatic Vent Damper Devices for Use with Gas-Fired Appliances.
.2 ANSI Z21.67 - Mechanically Actuated Automatic Vent Damper Devices for Use with Gas-Fired Appliances.
.3 ANSI Z21.68 - Thermally Operated Automatic Vent Damper Devices for Use with Gas-Fired Appliances.
.4 ASTM A167 - Stainless and Heat-Resisting Chromium-Nickel Steel Plate, Sheet, and Strip.
.5 ASTM A653/A653M - Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.
.6 ASTM A1011/A1011M - Standard Specification for Steel, Sheet, and Strip, Hot-Rolled, Carbon, Structural, High-Strength Low-Alloy and High-Strength Low-Alloy with Improved Formability.
.7 ASTM C401 - Classification of Alumina and Alumina-Silicate Castable Refractories.
.8 NEMA MG1 - Motors and Generators.
.9 NFPA 31 (ANSI Z95.1) - Standard for the Installation.
.10 NFPA 54 (ANSI Z223.1) - The National Fuel Gas Code.
.11 NFPA 82 - Standard on Incinerators and Waste and Linen Handling Systems and Equipment.
.12 NFPA 211 - Standard for Chimneys, Fireplaces, Vents, and Solid Fuel-Burning Appliances.
.13 SMACNA - HVAC Duct Construction Standards - Metal and Flexible.
.14 UL 103 - Standard for Factory Built Chimneys for Residential Type and Building Heating Appliances.
.15 UL 127 - Standard for Factory-Built Fireplaces.
.16 UL 378 - Standard for Safety for Draft Equipment.
.17 UL 441 - Standard for Safety for Gas Vents.
.18 UL 641 - Type L Low-Temperature Venting Systems.
.19 UL 959 (ANSI Z181.1) - Medium Heat Appliance Factory Built Chimneys.

1.3 DEFINITIONS

.1 Breeching: Vent Connector.

.2 Chimney: Primarily vertical shaft enclosing at least one vent for conducting flue gases outdoors.

.3 Smoke Pipe: Round, single wall vent connector.

.4 Vent: That portion of a venting system designed to convey flue gases directly outdoors from a vent connector or from an appliance when a vent connector is not used.

.5 Vent Connector: That part of a venting system that conducts the flue gases from the flue collar of an appliance to a chimney or vent, and may include a draft control device.

1.4 DESIGN REQUIREMENTS

.1 Factory built vents and chimneys used for venting natural draft appliances to NFPA 211, UL listed and labeled.

1.5 SUBMITTALS FOR REVIEW

.1 Section 01 33 00: Procedures for submittals.

.2 Shop Drawings: Indicate general construction, dimensions, weights, support and layout of breechings. Submit layout drawings indicating plan view and elevations where factory built units are used.

.3 Product Data: Provide data indicating factory built chimneys, including dimensional details of components and flue caps, dimensions and weights, electrical characteristics and connection requirements.

.4 Submit manufacturer's installation instructions: Indicate assembly, support details, and connection requirements.

1.6 QUALITY ASSURANCE

.1 Manufacturer Qualifications: Company specializing in manufacturing the Products specified in this section with minimum three years documented experience.

.2 Installer Qualifications: Company specializing in performing the work of this section with minimum 3 years documented experience.

1.7 REGULATORY REQUIREMENTS

.1 Conform to applicable code for installation of natural gas burning appliances and equipment.

.2 Conform to applicable code for installation of oil burning appliances and equipment.

.3 Products Requiring Electrical Connection: Listed and classified by Underwriters' Laboratories, Inc., as suitable for the purpose specified and indicated.

2 Products

2.1 BREECHING

.1 Fabricate of ASTM A1011 carbon steel. Fabricate breechings less than 24 inch (600 mm) diameter of galvanized sheet steel, lock forming quality with ASTM A653 G90 zinc coating.

.2 Fabricate unlined breechings from following minimum gauges. Refer to SMACNA HVAC Duct Construction Standards - Metal and Flexible.

.1 Sizes up to 300 mm: 1.2 mm (18 gauge)

.2 Sizes 325 to 600 mm: 1.6 mm (16 gauge)
.3 Sizes 625 to 900 mm: 2.0 mm (14 gauge)
.4 Sizes 925 to 1500 mm: 2.6 mm. (12 gauge)
.5 Sizes over 1500 mm: 3.3 mm. (10 gauge)

.3 Fabricate lined breechings from 2.6mm (12 gauge) sheet, all sizes. Refer to SMACNA HVAC Duct Construction Standards - Metal and Flexible.

.4 Weld longitudinal seams. Fabricate joints by welding, lapping and bolting, or with companion flanges. For breechings less than 600 mm diameter provide groove seam (pipe lock or flat lock) with end joints beaded and crimped.

.5 Reinforce rectangular breeching with angle frames and round breeching with flanged girth joints or angle frames. Refer to SMACNA HVAC Duct Construction Standards - Metal and Flexible.
.1 Sizes up to 750 mm: No reinforcing required.
.2 Sizes 780 to 900 mm: 40 x 40 x 5 mm, at 1500 mm centres.
.3 Sizes 925 to 1500 mm: 50 x 50 x 6 mm, at 1500 mm centres.
.4 Sizes over 1500 mm: 75 x 75 x 12 mm, at 1500 mm centres.

.6 Fabricate breeching fittings to match adjoining breechings. Fabricate elbows with centre-line radius equal to breeching width. Limit angular tapers to 20 degrees maximum.

2.2 TYPE B DOUBLE WALL GAS VENTS

.1 Fabrication: Inner pipe of sheet aluminum, and outer pipe of galvanized sheet steel, tested in compliance with UL 441.

2.3 DOUBLE WALL METAL STACKS (TYPE A)

.1 Provide double wall metal stacks, tested to UL 103 and cUL listed, for use with building heating equipment, in compliance with NFPA 211.

.2 Fabricate with 25 mm minimum air space between walls. Construct inner jacket of 0.9 mm ASTM A167 Type 304 stainless steel. Construct outer jacket of aluminum coated steel 0.6 mm for sizes 250 mm to 600 mm and 0.9 mm for sizes 700 mm to 1200 mm.

2.4 ACCESSORIES

.1 Accessories shall be cUL labeled:

.2 Ventilated Roof Thimble: Consists of roof penetration, vent flashing with spacers and storm collar.

.3 Exit Cone: Consists of inner cone, and outer jacket, to increase stack exit velocity 1.5 times.

.4 Stack Cap (Rain Cap): Consists of conical rainshield with inverted cone for partial rain protection with low flow resistance.

.5 Cleanouts: bolted, gasketted type, full size of breeching. Provide cleanout doors of same gauge as breeching, where required by code, specified or indicated on Drawings.

.6 Barometric dampers: Provide adjustable self-actuating barometric draft dampers, where indicated or required by equipment manufacturer, full size of breeching.

.7 Expansion sleeves with heat resistant caulking, held in place as indicated.

.8 Breeching Gaskets: High temperature fibre glass.

2.5 VENTS FOR CONDENSING OR NEAR CONDENSING APPLIANCES

.1 Material: AL-29-4C or Polypropylene

.2 Class: to suit appliance.

.3 Venting must be rated for use with maximum flue gas temperature of appliance at appliances minimum efficiency.

2.6 POLYPROYLENE VENTING

.1 Polypropylene venting to be rated for use with Category II and Category IV appliances and Type BH gas venting systems.

.2 System to be certified for operating flue gas temperature of 110 Deg.C (230 Deg.F) per ULC-S636 and CE certified for sustained flue gases up to 120 Deg.C (248 Deg.F).

.3 Vent system shall be suitable for service pressure up to 5000 Pa (20" w.c.).

.4 Vent System shall have zero clearance to combustibles.

.5 Manufacturer to provide a 10 year limited warranty on vent system.

.6 Vent System shall be rated for use with appliance being vented.

3 Execution

3.1 FABRICATION

.1 Fabricate chimneys with baseplate, anchors, cleanout, provision for support, expansion and contraction, tee-sections, flashing and counterflashing and raincap

3.2 APPLICATION

.1 Provide type B for atmospheric natural gas-fired equipment.

.2 Provide Type A for forced draft natural gas-fired equipment.

.3 Vent material for vents serving condensing or near condensing appliances shall be as specified for entire length.

3.3 INSTALLATION

.1 Install to manufacturer's written instructions.

.2 Install to NFPA 54 (ANSI Z223.1).

.3 Install breechings with minimum of joints. Align accurately at connections, with internal surfaces smooth.

.4 Support breechings from building structure, rigidly with suitable ties, braces, hangers and anchors to hold to shape and prevent buckling; minimum 1.5m (5') centres. Support vertical breechings, chimneys, and stacks at 4 m spacing, to adjacent structural surfaces, or at floor penetrations. Refer to SMACNA HVAC Duct Construction Standards - Metal and Flexible for equivalent duct support configuration and size.

.5 Install concrete inserts for support of breechings, chimneys, and stacks in coordination with formwork.

.6 Pitch breechings with positive slope up from fuel-fired equipment to chimney or stack. With the exception of required slope, chimney and stacks shall be level and plumb.

.7 Install vent dampers, locating close to draft hood collar, and secured to breeching.

.8 Coordinate installation of dampers, where required

.9 Insulate breechings to Section 23 05 50.

.10 At appliances, provide slip joints permitting removal of appliances without removal or dismantling of breechings, breeching insulation, chimneys, or stacks.

.11 Provide minimum length of breeching to connect appliance to chimney. Provide Type B chimney continuously from appliances.

.12 For Type B double wall gas vents, maintain cUL listed minimum clearances from combustibles. Assemble pipe and accessories as required for complete installation.

.13 Install thimbles where penetrating roof, floor, ceiling and where breeching enters masonry chimney. Pack annular space with heat resistant caulking.

.14 Install flashing and counter flashing on chimneys penetrating roofs and exterior walls, ensure penetration is sealed and moisture drains away from penetration.

.15 Install rain caps on outdoor terminations.

.16 Clean breechings, chimneys, and stacks after installation, removing dust and debris.

END OF SECTION

1 General

1.1 SECTION INCLUDES

.1 Boilers.
.2 Controls and boiler trim.
.3 Hot water connections.
.4 Fuel connection.
.5 Collector, draft hood, and chimney connection.
.6 Collector, induced draft fan, and chimney connection.

1.2 REFERENCES

.1 AGA - Directory of Certified Appliances and Accessories.
.2 ANSI Z21.13/CSA 4.9
.3 ANSI/ASHRAE 15-1994, Section 8.13.6
.4 ASME SEC 4 - Boiler and Pressure Vessel Codes - Rules for Construction of Heating Boilers.
.5 ASME SEC 8D - Boilers and Pressure Vessel Codes - Rules for Construction of Pressure Vessels.
.6 HI (Hydronics Institute) - Testing and Rating Standard for Cast Iron and Steel Heating Boilers.
.7 NEMA 250 - Enclosures for Electrical Equipment (1000 Volts Maximum).
.8 NFPA 54 (AGA Z223.1) - National Fuel Gas Code.
.9 NFPA 58 - Liquified Petroleum Gas Code.
.10 UL - Gas and Oil Equipment Directory.

1.3 SUBMITTALS FOR REVIEW

.1 Product Data: Provide data indicating general assembly, components, controls, safety controls, and wiring diagrams with electrical characteristics and connection requirements.

.2 Submit manufacturer's installation instructions. Indicate assembly, support details, connection requirements, and include start-up instructions.

.3 Manufacturer's Field Reports: Indicate condition of equipment after start-up including control settings and performance chart of control system.

1.4 REGULATORY REQUIREMENTS

.1 Conform to applicable code for internal wiring of factory wired equipment.

.2 Conform to ASME SEC 4 and SEC 8D for boiler construction.

.3 Units: CSA Certified

.4 Products Requiring Electrical Connection: Listed and classified by Underwriters' Laboratories, Inc., as suitable for the purpose specified and indicated.

.5 Comply with provincial regulations.

1.5 DELIVERY, STORAGE, AND PROTECTION

.1 Protect units before, during, and after installation from damage to casing by leaving factory shipping packaging in place until immediately prior to final acceptance.

1.6 WARRANTY

.1 The pressure vessel/heat exchanger of the boiler shall carry a 10 year prorated, limited warranty against failure due to condensate corrosion, thermal stress, mechanical defects or workmanship. A Warranty Certificate must be issued to the Owner from the manufacturer and a copy of warranty to be submitted for Departmental Representative's approval.

1.7 START-UP

.1 Provide start-up service, make adjustments and efficiency tests, and instruct operators. This is to include integration of boiler controls with Building Management System.

.2 Start-up to be performed by factory trained personnel who are approved by the manufacturer.

.3 Complete and submit copies of manufacturers start-up report for inclusion in Operating and Maintenance manual.

2 Products

2.1 MANUFACTURED UNITS

.1 Boiler modules shall be natural gas fired, condensing fire tube design with a modulating forced draft power burner and positive pressure vent discharge approved for use with a 30% propylene glycol / 70% water mixture circulating fluid.

.2 Each boiler shall be; UL Listed, CSD-1 approved, ASME coded and stamped, and incorporate a gas train designed in accordance with FM.

2.2 HEAT EXCHANGER

.1 The boiler shall be capable of handling return water temperatures down to 40 F without any failure due to thermal shock or fireside condensation.

.2 The heat exchangers shall be ASME stamped for a working pressure not less than 160 psig.

.3 The boiler water pressure drop shall *not exceed* 4.9 psig at 130 gpm.

.4 The boiler water connections shall be flanged 150 lb. ANSI rated.

.5 The pressure vessels are constructed of SA53 carbon steel, with a 0.25" thick wall and 0.50 in. thick upper head. Inspection openings in the pressure vessels shall be in accordance with ASME Section IV pressure vessel code.

.6 The boiler shall be designed so that the thermal efficiency increases as the boiler firing rate decreases.

.7 The heat exchangers shall be constructed of 316L stainless steel fire tubes and tube sheets with a one-pass combustion gas flow design. The fire tubes shall be 5/8" OD with no less than 0.065" wall thickness.

.8 The upper and lower stainless steel tubesheets shall be no less than 0.313" thick.

.9 The pressure vessel/heat exchangers shall be welded construction. The heat exchangers shall be ASME stamped for a working pressure not less than 160 psig.

.10 Access to the tubesheets and heat exchangers shall be provided. Minimum access opening shall be no less than 8 in. diameter.

2.3 FUEL BURNING SYSTEM

.1 The boiler burner shall be capable of a 10 to 1 turndown ratio of the firing rate without loss of combustion efficiency or staging of gas valves.

.2 The burner shall be metal fiber mesh covering a stainless steel body, with spark ignition and flame rectification.

.3 All burner material exposed to the combustion zone shall be of stainless steel construction.

.4 There shall be no moving parts within the burner itself.

.5 A modulating air/fuel valve shall meter the air and natural gas input. The modulating motor must be linked to both the gas valve body and air valve body with a single linkage. The linkage shall not require any field adjustment.

.6 A variable frequency drive (VFD) controlled cast aluminum pre-mix blower shall be utilized to ensure the optimum mixing of air & fuel between the air/fuel valve and the burner.

.7 The boiler(s) shall have a firing/leak test valve as required by CSD-1.

.8 The boiler(s) shall have dual-seated main gas valve.

.9 Gas control trains shall have a redundant safety shut-off feature, main gas regulation, shut-off cock and plugged pressure tapping to meet the requirements of ANSI Z21.13/CSA 4.9.

.10 The boiler(s) shall be equipped with a 100 percent safety shutdown.

.11 The ignition shall be Fully Interrupted Spark or Hot Surface Ignition type with full flame rectification by remote sensing separate from the ignition source, with a three-try-for-ignition sequence, to ensure consistent operation.

.12 The igniter will be located to the side of the heat exchanger to protect the device from condensation during start-up.

.13 The ignition control module shall include an LED that indicates six (6) individual diagnostic flash codes.

.14 An external viewing port shall be provided, permitting visual observation of burner operation.

2.4 EXHAUST MANIFOLD

.1 The exhaust manifold shall be of corrosion resistant cast aluminum with a 6"diameter flue connection.

.2 The exhaust manifold shall have a gravity drain for the elimination of the condensation with collecting reservoir.

2.5 TRIM

.1 The following safety controls shall be provided:
- .1 Limit temperature controller with automatic reset shall control burner to prevent boiler water temperature from exceeding safe system temperature.
- .2 35 PSIG ASME pressure relief valve, piped by the installer to an approved drain
- .3 Temperature and pressure gauge (shipped loose)
- .4 Low water cut-off with automatic reset and inlet flow switch to automatically prevent burner operation when water falls below safe level or there is no flow through boiler

.2 Provide boiler air vent tapping.

.3 Provide approved breeching and venting system to suit installation. Exact arrangement and lengths to be determined in conjunction with Mechanical Contractor and are to suit site conditions. Vent and combustion air pipe material to be as specified for condensing equipment.

2.6 CONTROLS

.1 Temperature Setpoint (4ma-20ma). Boiler shall include integral factory wired operating controls to control all operation and energy input of the boiler. The controller shall have the ability to vary boiler input throughout its full range to maximize the condensing capability of the boiler without header temperature swings.

.2 The boiler will operate to vary header temperature setpoint linearly as an externally applied 4 ma to 20 ma signal is supplied. Main header outlet temperature shall not be more than +/- 2 degrees C from setpoint at any pint of operation. The boiler shall have LCD display for monitoring of all sensors and interlocks. Refer to Controls Division 25 for operating parameters.

.3 Interlock boiler control and operation with isolation valve.

3 Execution

3.1 INSTALLATION

.1 Install to manufacturer's written instructions and in compliance with all Local and Provincial Codes

.2 Install to NFPA 54 and CSA B139.1.

.3 Install boiler on concrete housekeeping base, sized minimum 100 mm larger than boiler base. Refer to Section 03 30 00.

.4 Provide connection of natural gas service to NFPA 54 (AGA Z223.1) and CSA B139.1.

.5 Provide piping connections and accessories as indicated; refer to Section 23 05 20.

.6 Pipe relief valves to nearest floor drain.

.7 Provide for connection to electrical service. Refer to Electrical.

.8 Boiler capacity, size and performance shall be as per Equipment Schedule

3.2 MANUFACTURER'S FIELD SERVICES

.1 Prepare and start systems with factory trained personnel.

.2 Test during operation and adjust if necessary:
1. Safeties (2.2 - F)
2. Operating Controls (2.3)
3. Static and full load gas supply pressure
4. Gas manifold and blower air pressure
5. Amp draw of blower

.3 Submit copy of start-up report to Departmental Representative.

.4 Provide factory authorized service representative to train maintenance personnel on procedures and schedules related to start-up, shut-down, troubleshooting, servicing, and preventive maintenance.

END OF SECTION

1 General

1.1 SECTION INCLUDES

.1 Refrigerant piping and connections.
.2 Refrigerant specialties: moisture and liquid indicators, valves, strainers, check valves, pressure relief valves, filter-driers, solenoid valves, expansion valves, receivers, flexible connections.
.3 Reciprocating compressors.
.4 Air cooled condensing units.
.5 Air cooled refrigerant condensers.
.6 Controls and control connections.

1.2 QUALITY ASSURANCE

.1 Manufacturer: Company specializing in manufacture of refrigeration system components with three years documented experience.
.2 Equipment shall be certified in accordance with UL Standard 1995/CSA C22.2 No. 236, Safety Standard for Heating and Cooling Equipment
.3 Equipment and refrigeration system shall comply with ASHRAE 15, Safety Standard for Mechanical Refrigeration.
.4 System Seasonal Energy Efficiency Ratio/Energy Efficiency Ratio (SEER/EER) shall be equal to or greater than prescribed by ASHRAE 90.1, Energy Efficient Design of New Buildings except Low-Rise Residential Buildings.
.5 Units shall be safety certified by ETL and be ETL US and ETL Canada listed. Unit nameplate shall include the ETL/ETL Canada label.

1.3 SUBMITTALS

.1 Submit shop drawings to requirements of Section 01 30 00.

.2 Indicate general assembly of specialties, rated capacities, weights, accessories, electrical requirements, wiring diagrams (clearly indicate any and all field wiring requirements), dimensions, operating and shipping weights and loading, required clearances, and location and size of field connections. Include schematic layouts showing condenser, refrigeration compressors, cooling coils, refrigerant piping and accessories required for complete system.
.3 Submit design data indicating pipe sizing.

.4 Submit manufacturer's installation instructions under provisions of Section 01 30 00.

1.4 SUBMITTALS FOR INFORMATION

.1 Sections 01 33 10 and 01 78 05: Submission procedures.

.2 Manufacturer's Certificate: Certify that specified products meet or exceed specified requirements.

1.5 CLOSEOUT SUBMITTALS

.1 Section 01 33 10: Submission procedures.

1.6 PROJECT RECORD DOCUMENTS

.1 Submit documents to requirements of Section 01 70 00.

.2 Accurately record actual locations of equipment and refrigeration accessories on drawings.

1.7 OPERATION AND MAINTENANCE DATA

.1 Submit operation and maintenance data to requirements of Section 01 70 00.

.2 Include start-up instructions, maintenance data, parts lists, controls, and accessories.

1.8 WARRANTY

.1 Provide a 5 year warranty to Division 1 and CCDC 2 General Conditions.

.2 Warranty: Include coverage for refrigerant compressors and motors.

1.9 START-UP AND TESTING

.1 Supply initial charge of refrigerant and oil for each refrigeration system. Losses of oil or refrigerant prior to acceptance of equipment or due to defects covered under guarantee shall be replaced. Supply to the Owner, one complete charge of lubricating oil in addition to that placed in the system.

.2 Charge the system with refrigerant and test entire system for leaks after completion of installation. Repair leaks, put system into operation, and test equipment performance.

.3 Shut-down system if initial start-up testing takes place in winter and machines are to remain inoperative. Repeat start-up and testing operation at beginning of first cooling season.

.4 Provide cooling season start-up, winter season shut-down for first year of operation.

2 Products

2.1 PIPING

.1 Refer to 23 23 00.
.2 Flexible Connectors: Corrugated stainless steel or bronze hose with single layer of exterior braiding, minimum 230 mm long with copper tube ends.

2.2 REFRIGERANT

.1 Refrigerant shall be an HFC (hydroflourocarbon) matched to system, refer to equipment schedule for basis of design.

2.3 REFRIGERANT SPECIALTIES

.1 Moisture and Liquid Indicators: Single port type: UL listed with copper or brass body, flared or solder ends, sight glass, colour coded paper moisture indicator with removable element cartridge and plastic cap.

.2 Valves:
- .1 Diaphragm Packless Valves: UL listed, globe or angle pattern, forged brass body and bonnet, phosphor bronze and stainless steel diaphragms, rising stem and handwheel, stainless steel spring, nylon seat disc, solder or flared ends.
- .2 Packed Angle Valves: Forged brass with seal cap and copper gasket, rising stem and seat, moulded stem packing, solder or flared ends.
- .3 Packed Ball Valves: Two piece forged brass body with teflon ball seals and copper tube extensions, brass seal cap, chrome plated ball, stem with neoprene ring stem seals.

.3 Strainers:
- .1 Straight Line or Angle Line Type: Brass or steel shell, steel cap and flange, and replaceable cartridge, with screen of stainless steel wire or monel reinforced with brass.
- .2 Straight line Non-Cleanable Type: Steel shell, copper plated fittings, stainless steel wire screen.

.4 Check Valves:
- .1 Globe Type: Cast bronze or forged brass body, forged brass cap with neoprene seal, brass guide and disc holder, phosphor-bronze or stainless steel spring, teflon seat disc.
- .2 Straight Thru Type: Brass body and disc, phosphor-bronze or stainless steel spring, neoprene seat.

.5 Pressure Relief Valves: (Straight Thru or Angle Type: Brass body and disc, neoprene seat, factory sealed and ASME stamped.

.6 Filter-Driers:
- .1 Replaceable Cartridge Angle Type: UL listed, brass shell and bronze cap, perforated brass shell and moulded desiccant filter core.
- .2 Permanent Straight Thru Type: UL listed, steel shell with moulded desiccant filter core.

.7 Solenoid Valves:
- .1 Valve: Pilot operated, copper or brass body with flared, solder, or threaded ends; stainless steel stem and plunger assembly permitting manual operation.
- .2 Coil assembly: UL listed, replaceable with moulded electromagnetic coil, with surge protector and colour coded lead wires, integral junction box with pilot light.

.8 Expansion Valves
- .1 Angle or Straight Through Type: Brass body, adjustable super heat setting, replaceable inlet strainer, with non-replaceable capillary tube and remote sensing bulb and remote bulb well.
- .2 Selection: Select for maximum load at design operating pressure and 6 degrees C super heat.

.9 Receivers
  .1 Internal Diameter 150 mm and Smaller: UL listed, steel, brazed with tappings for inlet, outlet, and pressure relief valve.
  .2 Internal Diameter Over 150 mm: Welded steel, to ANSI ASME SEC 8D.
.10 Refer to 23 23 00.

2.4 HERMETIC COMPRESSORS

.1 Construct hermetic reciprocating compressors with positive oil lubrication system, internal pressure relief valve, suction service valve, discharge muffler, installed in welded steel shell.

.2 Provide automatic capacity reduction equipment consisting of electrically actuated suction valve unloaders with replaceable solenoid valves.

.3 Provide compressor motor, suction gas cooled with two winding thermostats providing overheating protection, with starter.

.4 Provide crankcase heater, energized continuously.

.5 Unit to have external hot gas bypass.

2.5 SEMI-HERMETIC COMPRESSORS

.1 Construct semi-hermetic (serviceable hermetic) reciprocating compressors with reversible, positive displacement, oil pump lubrication system spring loaded heads and replaceable cylinder liners, mesh suction inlet screen, and discharge service valves.

.2 Provide automatic capacity reduction equipment consisting of suction valve unloaders operated by oil pressure.

.3 Provide compressor motor, suction gas cooled with solid state sensor and electronic winding overheating protection, with starter.

.4 Provide crankcase heater energized continuously.

.5 Unit to have external hot gas bypass.

2.6 COMPRESSOR CONTROLS

.1 On compressor, mount steel control panel, containing power and control wiring, moulded case disconnect switch, factory wired with single point power connection.

.2 Provide across-the-line starter, non-recycling compressor overload, starter relay, control power transformer or terminal for controls power, terminal strip for connection to interface equipment. Provide manual reset current overload protection.

.3 Provide the following devices on control panel face:
  .1 Compressor run light.
  .2 Start-stop switch.
  .3 Control power fuse or circuit breaker.

.4 Demand limit switch.
.5 Elapsed time meter.
.6 Crankcase heater start-up switch and light.

.4 Provide high discharge pressure switch, low suction pressure switch, and oil pressure switch safety controls arranged so that operating any one will shut down machine and require manual reset.

.5 Provide the following operating controls:
.1 Multi-step suction pressure controller which activates cylinder unloaders.
.2 Five minute off timer prevents compressor from short cycling.
.3 Part winding start timer.
.4 Periodic pump-out timer to pump down on high suction refrigerant pressure.

.6 Provide pre-piped gage board with pressure gages for suction and discharge refrigerant pressures, and oil pressure.

2.7 AIR COOLED CONDENSING UNITS

.1 General Description:
.1 Condensing unit shall include compressors, air-cooled condenser coils, condenser fans, suction and liquid connection valves, and unit controls.
.2 Condenser shall include air-cooled condenser coils, condenser fans, discharge and liquid connection valves, and unit controls.
.3 Unit shall be factory assembled and tested including leak testing of the coil and run testing of the completed unit. Run test report shall be supplied with the unit in the controls compartment's literature pocket.
.4 Unit shall have decals and tags to indicate lifting and rigging, service areas and caution areas for safety and to assist service personnel.
.5 Unit components shall be labeled, including pipe stub outs, refrigeration system components and electrical and controls components.
.6 Installation, Operation and Maintenance manual shall be supplied within the unit.
.7 Laminated color-coded wiring diagram shall match factory installed wiring and shall be affixed to the interior of the control compartment's access door.
.8 Unit nameplate shall be provided in two locations on the unit, affixed to the exterior of the unit and affixed to the interior of the control compartment's access door.

.2 Construction:
.1 Unit shall be completely factory assembled, piped, wired and shipped in one section.
.2 Unit shall be specifically designed for outdoor application.
.3 Condenser coils shall be mechanically protected from physical damage by painted galvanized steel louvers (wire grille) covering the full area of the coil.
.4 Access to condenser coils, condenser fans, compressors, and electrical and controls components shall be through hinged access doors with quarter turn, zinc cast, lockable handles.
.5 Exterior paint finish shall be capable of withstanding at least 1,000 hours, with no visible corrosive effects, when tested in a salt spray and fog atmosphere in accordance with ASTM B 117-95 test procedure.
.6 Unit shall include a fork-liftable base.

.3 Electrical:

.1 Unit shall be provided with standard power block for connecting power to the unit.

.2 Control circuit transformer and wiring shall provide 24 VAC control voltage from the line voltage provided to the unit.

.3 Unit shall be provided with phase and brown out protection which shuts down all motors in the unit if the electrical phases are more that 10% out of balance on voltage, the voltage is more that 10% under design voltage, or on phase reversal

.4 Refrigeration System

.1 Compressors shall be scroll type with thermal overload protection, circuited as indicated in equipment schedule, and carry a 5 year non-prorated warranty, from the date of original equipment shipment from the factory.

.2 Compressors shall include stages of capacity control as indicated in equipment schedule.

.3 Unit shall include a scroll compressor with hot gas bypass on the lead refrigeration circuit which shall be capable of modulation from 10-100% of its capacity

.4 Each compressor shall include a crankcase heater.

.5 Compressors shall be mounted in an isolated service compartment which can be accessed without affecting unit operation. Lockable hinged access doors shall provide access to the compressors.

.6 Compressors shall be isolated from the base pan with the compressor manufacturer's recommended rubber vibration isolators, to reduce any transmission of noise from the compressors into the building area.

.7 Each refrigeration circuit shall be equipped with automatic reset low pressure and manual reset high pressure refrigerant safety controls, Schrader type service fittings on both the high pressure and low pressure sides, and service valves for liquid and suction connections. Liquid line filter driers shall be factory provided. Finished field installed refrigerant circuits shall include the low side cooling components, refrigerant, thermal expansion valve, liquid line, (insulated hot gas bypass line), (insulated hot gas line) and insulated suction line.

.8 Unit shall include a factory holding charge of R-410A refrigerant and oil.

.9 Unit shall include 2 (4) stages of capacity control.

.10 Each compressor shall be equipped with a 5 minute off, delay timer to prevent compressor short cycling.

.11 The unit shall be capable of stable cooling operation to a minimum of 55°F outdoor temperature.

.5 Air Cooled Condenser:

.1 Condenser fans shall be vertical (horizontal) discharge, axial flow, direct drive fans.

.2 Fan motor shall be weather protected, single phase, direct drive, and open drip proof with inherent overload protection.

.3 Coils shall be designed for use with the HFC refrigerant being utilized and constructed of copper tubes with aluminum (copper) fins mechanically bonded to the tubes and aluminum end casings. Fin design shall be sine wave rippled.

.4 Coils shall be designed for a minimum of 10°F of refrigerant sub-cooling.

.5 Coils shall be helium leak tested.

.6 Provide expanded metal protective coil guard with lint screens.

.6 Controls
.1 Unit shall be provided with a terminal block for field installation of controls
.2 Compressor units to be complete with suction pressure transducer for modulating control from 10% to 100% of capacity.

3 Execution

3.1 INSTALLATION

.1 Install equipment and specialties in accordance with manufacturer's instructions.

.2 Install piping to conserve building space and not interfere with use of space. Route piping in orderly manner, plumbing and parallel to building structure, and maintain gradient. Group piping whenever practical at common elevations and locations. Slope piping one percent in direction of oil return.

.3 Provide non-conducting dielectric connections when joining dissimilar metals.

.4 Install piping to allow for expansion and contraction without stressing pipe, joints, or connected equipment. Provide clearance for installation of insulation and access to valves and fittings.

.5 Locate expansion valve sensing bulb immediately downstream of evaporator on suction line. Provide external equalizer piping on expansion valves with refrigerant distributor connected to evaporator.

.6 Install flexible connectors at right angles to axial movement of compressor.

.7 Provide for connection to electrical service.

.8 Install units on rubber-in-shear vibration isolation.

3.2 APPLICATION

.1 Provide line sized liquid indicators in main liquid line leaving condenser or in liquid line leaving receiver.

.2 Provide line size strainer upstream of each automatic valve. Where multiple expansion valves with integral strainers are used install single main liquid line strainer.

.3 On steel piping systems provide strainer in suction line.

.4 Provide shut-off valve on each side of strainer.

.5 Provide permanent filter-driers in low temperature systems.

.6 Provide replaceable cartridge filter-driers vertically in liquid line adjacent to receivers with three valve bypass assembly to permit isolation of driers for servicing.

.7 Provide replaceable cartridge filter driers, with three valve bypass assembly. Provide permanent filter driers for each solenoid valve.

.8 Provide solenoid valves in liquid line of systems operating with single pump-out or pump-down compressor control, in liquid line of single or multiple evaporator systems, and in oil bleeder lines from flooded evaporators to stop flow of oil and refrigerant into the suction line when the system shuts down.

.9 Provide refrigerant charging (packed angle) valve connections in liquid line between receiver shut-off valve and expansion valve.

.10 Utilize flexible connectors at or near compressors where within piping configuration does not absorb vibration.

3.3 FIELD QUALITY CONTROL

.1 Check unit for damage before and after placement.

.2 Protect and cover units during construction.

.3 Field inspection and testing will be performed under provisions of Section 01 70 00.

.4 Prepare system for start-up by having manufacturer's factory trained representative supervise testing, dehydration and charging of machine. Do start-up including co-ordination on start-up of condensers.

.5 Prior to testing ensure that system is complete. Protect relief valves during test procedure. After completion of test, reconnect and make good piping connections and leak test entire system.

.6 Provide sufficient refrigerant, dry nitrogen and refrigeration oil for pressure and operational testing under manufacturer's supervision. Replace losses of refrigerant and oil.

.7 Pressure test system with dry nitrogen to 1470 kPa. Perform final tests at 92 kPa vacuum and 1470 kPa using halide torch or electronic leak detector. Test to no leakage.

.8 Provide initial and cooling season start-up, and winter season shut down during first year of operation, including routine servicing and check out.

.9 Supply service of factory trained representative to supervise testing, dehydration and charging of machine, start-up, and instruction on operation and maintenance to Owner.

END OF SECTION

1 General

1.1 SUMMARY

.1 Section Includes:
  .1 Materials, components and installation for heat reclaim devices.

1.2 REFERENCES

.1 American Society of Heating, Refrigeration and Air-Conditioning Engineers (ASHRAE)
  .1 ASHRAE 84-1991, Method of Testing Air-to-Air Heat Exchangers (ANSI approved).
.2 Health Canada/Workplace Hazardous Materials Information System (WHMIS)
  .1 Material Safety Data Sheets (MSDS).

1.3 SUBMITTALS

.1 Product Data:
  .1 Submit manufacturer's printed product literature, specifications and datasheet in accordance with Section 01 33 00 - Submittal Procedures. Include product characteristics, performance criteria, and limitations.
    .1 Submit two copies of Workplace Hazardous Materials Information System (WHMIS) Material Safety Data Sheets (MSDS) in accordance with Section 01 33 00 - Submittal Procedures.

.2 Shop Drawings:
  .1 Submit shop drawings in accordance with Section 01 33 00 - Submittal Procedures.
  .2 Indicate following: airflows, pressure drops, unit operation at summer design and winter design, unit operation while in full defrost, defrost control method, motor information (if applicable), controls, wiring diagrams, required support.

.3 Quality assurance submittals: submit following in accordance with Section 01 33 00 - Submittal Procedures.
  .1 Certificates: submit certificates signed by manufacturer certifying that materials comply with specified performance characteristics and physical properties.
  .2 Instructions: submit manufacturer's installation instructions.

.4 Closeout Submittals:
  .1 Provide operation and maintenance data for incorporation into manual specified in Section 01 78 10 - Closeout Submittals.

.5 Certificates:
  .1 Catalogued or published ratings: obtained from tests carried out by manufacturer or those ordered from independent testing agency signifying adherence to codes and standards in force.
  .2 Provide confirmation of testing.

1.4 QUALITY ASSURANCE

.1 Health and Safety:
  .1 Do construction occupational health and safety in accordance with Section 01 35 26 – Environmental Protection.

1.6 MAINTENANCE

.1 Extra Materials:
- .1 Provide maintenance materials in accordance with Section 01 78 10 - Closeout Submittals.
- .2 Furnish list of individual manufacturer's recommended spare parts for equipment include:
  - .1 Bearings and seals.
  - .2 Addresses of suppliers.
  - .3 List of specialized tools necessary for adjusting, repairing or replacing.

2 Products

2.1 UNIT CONSTRUCTION

.1 Fabricate unit with extruded aluminum channel posts and galvanized panels secured with mechanical fasteners. All access doors shall be sealed with permanently applied bulb-type gasket.

.2 Panels and access doors shall be constructed as a 2-inch (50-mm) nominal thick; with injected polyurethane foam insulation. R value shall be 6.5 per inch of wall thickness. The outer panel shall be constructed of G90 galvanized steel. The inner liner shall be constructed of G90 galvanized steel. Module to module assembly shall be accomplished with self-adhering foam gaskets. Manufacturer shall supply test data demonstrating less than 0.2" deflection for an unsupported 48x48 panel under 30" W.C pressure. Units that cannot demonstrate this deflection are unacceptable.

.3 Access Doors shall be flush mounted to cabinetry, with minimum of two hinges, locking latch and full size handle assembly.

2.2 FANS

.1 Provide belt-driven centrifugal fans. Fan assemblies including fan, motor and sheaves shall be dynamically balanced by the manufacturer on all three planes and at all bearing supports. Manufacturer must ensure maximum fan RPM is below the first critical speed.

.2 Bearings shall be self-aligning, grease lubricated, ball or roller bearings with extended copper lubrication lines to access side of unit. Grease fittings shall be attached to the fan base assembly near access door. If not supplied at the factory, contractor shall mount copper lube lines in the field.

.3 Fan and motor shall be mounted internally on a steel base. Provide access to motor, drive, and bearings through hinged access door. Fan and motor assembly shall be mounted on 2" deflection spring vibration type isolators inside cabinetry.

2.3 BEARINGS AND DRIVES

.1 Bearings: Basic load rating computed in accordance with AFBMA - ANSI Standards, L-50 life at 200,000 hours - all fans, heavy duty pillow block type, self-aligning, grease-lubricated ball bearings.

.2 Shafts shall be solid, hot rolled steel, ground and polished, keyed to shaft, and protectively coated with lubricating oil. Hollow shafts are not acceptable.

.3 V-Belt drives shall be cast iron or steel sheaves, dynamically balanced, bored to fit shafts and keyed. Fixed sheaves, matched belts, and drive rated based on motor horsepower. Variable and adjustable pitch sheaves selected so required RPM is obtained with sheaves set at mid-position and rated based on motor horsepower. Contractor to furnish fixed sheaves when final RPM as determined by balancing contractor. Minimum of 2 belts shall be provided on all fans with 10 HP motors and above. Standard drive service factor shall be 1.3 S.F. (for 10HP and larger), calculated based on fan brake horsepower.

2.4 ELECTRICAL

.1 The unit shall bear an ETL listing label for the entire assembly. Units with only components bearing third party safety listing are unacceptable.

.2 All controls shall be located on the side of the unit for ease of servicing. Alternate manufacturers who supply units with controls on roof must supply a permanently installed ladder to access controls, and appropriate safety rails on roof of unit, meeting all applicable OSHA standards.

.3 Wiring Termination: Provide terminal lugs to match branch circuit conductor quantities, sizes, and materials indicated. All wires shall be number tagged and cross-referenced to the wiring diagram for ease of troubleshooting.

.4 Fan motors shall be 1800 rpm, open drip-proof (ODP) or1800 rpm, totally enclosed fan-cooled (TEFC) type. Motors shall be premium efficiency. Electrical characteristics shall be as shown in schedule.

.5 Supplier shall provide and mount variable speed drive with electrical characteristics for wheel defrost control, if heat wheel is proposed. Refer to 23 05 14 Variable Frequency Drives.

.6 Unit manufacturer shall provide and mount a damper hand-off-auto (HOA) switch.

2.5 RECOVERY CORE

.1 Design is based on Heat Wheel with VFD motor speed control for defrost. Energy Cores shall be Generation 3, comprised of precisely corrugated high grade aluminum.

.2 Maximum allowable face velocity across heat exchangers shall be 450 fpm. Heat exchanger face velocities exceeding 450 fpm are not acceptable.

2.6 CONTROLS

.1 Unit shall be complete with packaged controls to control recovery and defrost. Controls shall interface to DDC EMCS to enable recovery, refer to Sequence of Operation.

.2 Recovery cycles shall be controlled by internal programmed thermostats measuring both supply and exhaust air, and optimizing performance of both heat recovery and free cooling modes.

.3 Unit shall monitor temperatures in both air streams before and after the core.

.4 A motor speed board must be included to control the (supply/relief) motor through a 3 speed 24 VAC analog control board that converts a binary signal to a 0 – 10 VDC signal to modulate the fan output.

3 Execution

3.1 MANUFACTURER'S INSTRUCTIONS

.1 Compliance: comply with manufacturer's written recommendations or specifications, including product technical bulletins, handling, storage and installation instructions, and datasheet.

3.2 INSTALLATION

.1 Install in accordance with manufacturers recommendations.

.2 Support independently of adjacent ductwork with flexible connections.

.3 Do not operate units for any purpose, temporary or permanent, until ductwork is clean, filters are in place, bearings lubricated, and fan has been test run under observation.

3.3 CLEANING

.1 Proceed in accordance with Division 1.

.2 Upon completion and verification of performance of installation, remove surplus materials, excess materials, rubbish, tools and equipment.

.3 Unit shall be cleaned prior to placing into operation.

END OF SECTION

1 General

1.1 SECTION INCLUDES

.1 Air handling units.
.2 Heating coils.
.3 Mixing boxes.
.4 Combination filter/mixing boxes.
.5 Filter sections.
.6 Cooling coils.
.7 Energy Recovery.

1.2 REFERENCES

.1 AFBMA 9 - Load Ratings and Fatigue Life for Ball Bearings.
.2 AFBMA 11 - Load Ratings and Fatigue Life for Roller Bearings.
.3 AMCA 99 - Standards Handbook.
.4 AMCA 210 - Laboratory Methods of Testing Fans for Aerodynamic Performance Rating.
.5 AMCA 300 - Reverberant Room Method for Sound Testing of Fans.
.6 AMCA 301 - Method of Publishing Sound Ratings for Air Moving Devices.
.7 AMCA 500 - Method of Testing Louvres for Ratings.
.8 AMCA 5000 - Method of Testing Dampers for Ratings.
.9 ARI 410 - Forced-Circulation Air-Cooling and Air-Heating Coils.
.10 ARI 430 - Fabrication of Central Station Air Handling Units.
.11 ARI 435 - Application of Central-Station Air-Handling Units.
.12 SMACNA - HVAC Duct Construction Standards - Metal and Flexible.
.13 UL 900 - Air Filter Units.
.14 ASHRAE 90.1 Energy Code.
.15 ARI Standard 1060 - Rating Air-to-Air Heat Exchangers for Energy Recovery Ventilation Equipment.
.16 NEMA MG1 - Motors and Generators.
.17 NFPA 70 - National Electrical Code.
.18 UL 723 - Test for Surface Burning Characteristics of Building Materials.
.19 UL 1995 - Standard for Heating and Cooling Equipment.
.20 UL 94 - Test for Flammability of Plastic Materials for Parts in Devices and Appliances.
.21 IBC 2000, 2003 - International Building Code.
.22 NFPA 90A - Standard for the Installation of Air Conditioning and Ventilating Systems.
.23 NFPA 5000 - Building Construction and Safety Code.

1.3 SUBMITTALS

.1 Section 01 33 00: Procedures for submittals.

.2 Shop Drawings: Indicate assembly, unit dimensions, weight loading, required clearances, construction details, field connection details, and electrical characteristics and connection requirements.

.3 Product Data:

.1 Provide literature which indicates dimensions, weights, capacities, ratings, fan performance, gauges and finishes of materials, and electrical characteristics and connection requirements.

.2 Provide data of filter media, filter performance data, filter assembly, and filter frames.

.3 Provide fan curves with specified operating point clearly plotted and fan efficiencies.

.4 Submit sound power level data for both fan outlet and casing radiation at rated capacity.

.5 Submit electrical requirements for power supply wiring including wiring diagrams for interlock and control wiring, clearly indicating factory-installed and field-installed wiring.

.4 Manufacturer's Installation Instructions.

1.4 OPERATION AND MAINTENANCE DATA

.1 Maintenance Data: Include instructions for lubrication, filter replacement, motor and drive replacement, spare parts lists, and wiring diagrams.

1.5 DELIVERY, STORAGE, AND HANDLING

.1 Accept products on site in factory-fabricated protective containers, with factory-installed shipping skids and lifting lugs. Inspect for damage.

.2 Store in clean dry place and protect from weather and construction traffic. Handle carefully to avoid damage to components, enclosures, and finish.

1.6 ENVIRONMENTAL REQUIREMENTS

.1 Do not operate units for any purpose, temporary or permanent, until ductwork is clean, filters are in place, bearings lubricated, and fan has been test run under observation.

1.7 EXTRA MATERIALS

.1 Provide one set of spare fan belts for each fan.

.2 Provide extra filter sets as indicated, refer to Section 23 41 00 - Particulate Air Filtration.

1.8 QUALITY ASSURANCE

.1 Energy recovery unit manufacturer shall have a minimum of 10 years experience in the energy recovery market.

.2 Units shall be capable of transferring sensible, latent or total energy as listed in the equipment schedule. Energy transfer device shall be certified to ARI Standard 1060 and bear the ARI seal.

.3 Units shall carry the label of a Nationally Recognized Testing Laboratory (NRTL) or a Standards Council of Canada (SCC) approved lab (Testing Organization and Certifying Body).

.4 Units shall be constructed in accordance with CAN/CSA C22.2 No. 236 and UL 1995 (Heating and Cooling Equipment). Each unit shall bear an ETL or UL label under UL Standard 1995 indicating the complete unit is listed as an assembly. ETL or UL listing of individual components, or control panels only, is not acceptable.

.5 Units shall be constructed to provide smooth interior surfaces.

.6 Units shall comply with NFPA 70, "National Electrical Code," as applicable for installation and electrical connections of ancillary electrical components of air handling units.

.7 Unit internal insulation must have a flame spread rating not over 25 and smoke developed rating no higher than 50 complying with NFPA 90A, "Standard for the Installation of Air Conditioning and Ventilating Systems."

.8 Units shall deliver the specified volume of air at the scheduled static pressure.

.9 Airflow data shall comply with AMCA 210 method of testing.

.10 All electrical components and assemblies shall comply with NEMA standards.

2 Products

2.1 GENERAL DESCRIPTION

.1 Configuration: Fabricate with fan plus accessories, including:
- .1 Heating coil.
- .2 Mixing box section.
- .3 Combination filter/mixing box section.
- .4 Filter section.
- .5 Cooling coil section.
- .6 Energy Recovery

.2 Performance Base: 566m (1860') above Sea level conditions.

.3 Fabrication: Conform to AMCA 99 and ARI 430.

2.2 CASING

.1 Double wall construction: Fabricate on channel base and drain pan of welded galvanized steel with perforated inside casing. Assemble sections with gaskets and bolts.
- .1 Outside Casing: Galvanized Steel: 1.2 mm.
- .2 Inside Casing: Galvanized Steel: 0.6 mm.
- .3 Floor Plate: Galvanized Steel: 3.3 mm.

.2 Insulation: 50 mm thick, 24 kg per cu m density, neoprene coated, glass fibre insulation, "ksi" value at 42 degrees C maximum 0.037 W/m/Degree K, applied to internal surfaces with adhesive and weld pins. Coat exposed edges of insulation with adhesive. OR injected foam to R-13.

.3 Inspection Doors: 450 x 550 mm of galvanized steel for flush mounting, with gasket, latch, and handle assemblies and 300 x 300 mm inspection window of 6 mm thick plexiglass. Provide welded channel frame to set door out from casing to permit external insulation.

.4 Walk-in Access Doors: 450 x 1000 mm of galvanized steel insulated sandwich construction, for flush mounting, with hinges, gasket, latch, and handle assemblies and 300 x 300 mm inspection window of 6 mm thick plexiglass. Provide welded channel frame to set door out from casing to permit external insulation.

.5 Lights: Provide in accessible sections suitable for damp locations with wire guards, factory wired to weatherproof switch and pilot light mounted on casing exterior. In sprayed coil sections, provide lights suitable for wet locations.

.6 Drain Pans: Construct from single thickness galvanized steel with insulation between layers with welded corners. Cross break and pitch to drain connection. Provide drain pans under fan section.

.7 Strength: Provide structure to brace casings for suction pressure of 600 Pa, with maximum deflection of 1 in 200.

2.3 FANS

.1 Type: Forward curved, type fan.

.2 Performance Ratings: Conform to AMCA 210 and bear the AMCA Certified Rating Seal.

.3 Sound Ratings: AMCA 301; tested to AMCA 300 and bear AMCA Certified Sound Rating Seal.

.4 Bearings: Self-aligning, grease lubricated, ball or roller bearings with lubrication fittings extended to exterior of casing with copper tube and grease fitting rigidly attached to casing.

.5 Mounting: Locate fan and motor internally on welded steel base coated with corrosion resistant paint. Factory mount motor on slide rails. Provide access to motor, drive, and bearings through removable casing panels or hinged access doors. Mount base on vibration isolators.

.6 Flexible Connection: Separate fan and coil sections.

2.4 BEARINGS AND DRIVES

.1 Bearings: Basic load rating computed in accordance with AFBMA - ANSI Standards. The bearings shall be designed for service with an L-50 life of 200,000 hours and shall be a heavy duty pillow block, self-aligning, grease-lubricated ball or spherical roller bearing type..

.2 Shafts: Solid, hot rolled steel, ground and polished, with key-way, and protectively coated with lubricating oil.

.3 V-Belt Drive: Cast iron or steel sheaves, dynamically balanced, bored to fit shafts and keyed. Variable and adjustable pitch sheaves for motors 11.2 kW and under selected so required rpm is obtained with sheaves set at mid-position; fixed sheave for 15 kW and over, matched belts, and drive rated as recommended by manufacturer or minimum 1.5 times nameplate rating of the motor.

.4 Belt Guard: Fabricate to SMACNA Standard; 2.8 mm thick, 20 mm diamond mesh wire screen welded to steel angle frame or equivalent, prime coated. Secure to fan or fan supports without short circuiting vibration isolation, with provision for adjustment of belt tension, lubrication, and use of tachometer with guard in place.

2.5 ELECTRICAL CHARACTERISTICS AND COMPONENTS

.1 Motor: Refer to Mechanical Equipment Schedule and coordinate with Electrical

.2 Wiring Terminations: Provide terminal lugs to match branch circuit conductor quantities, sizes, and materials indicated.

.3 Fan motors shall be 1800 RPM, open drip-proof (ODP) type, inverter duty suitable for variable speed operation. Motors shall be premium efficiency. Electrical characteristics shall be as shown in schedule.

.4 Provide marine light and GFI receptacle in each fan section mounted and wired to a junction box and on-off switch mounted on the outside of the cabinet.

.5 Variable frequency inverters to be packaged with Air Handling Equipment.
OR
Variable frequency inverters by electrical.

2.6 COILS

.1 Casing: Provide access to both sides of coils. Enclose coils with headers and return bends exposed outside casing. Slide coils into casing through removable end panel with blank off sheets and sealing collars at connection penetrations.

.2 Drain Pans: 600 mm downstream of coil and down spouts for cooling coil banks more than one coil high.

.3 Eliminators: Three break of galvanized steel, mounted over drain pan.

.4 Air Coils: Certify capacities, pressure drops, and selection procedures to ARI 410.

.5 Fabrication:
- .1 Tubes: 16 mm OD seamless copper expanded into fins, brazed joints.
- .2 Fins: Aluminum.
- .3 Casing: Die formed channel frame of galvanized steel.

.6 Water Heating Coils:
- .1 Headers: Cast iron, seamless copper tube, or prime coated steel pipe with brazed joints.

.2 Configuration: Drainable, with threaded plugs for drain and vent; serpentine type with return bends on smaller sizes and return headers on larger sizes.

.7 Refrigerant Coils:

.1 Headers: Seamless copper tubes with silver brazed joints.

.2 Liquid Distributors: Brass or copper venturi type distributor with seamless copper distributor tubes.

.3 Configuration: Down feed with bottom suction.

2.7 FILTERS

.1 Filter Box: Section with filter guides, access doors from sides indicated on drawings, for side loading.

.2 Filter Media: UL 900 listed, Class I or Class II, approved by local authorities.

.3 Refer to equipment schedule for filter depth and required performance.

.4 Extended Surface: Filter box with holding frames and blank-off sheets, extended surface retained media filters. Refer to Section 23 40 00.

.5 Filter Gauges: 90 mm diameter diaphragm actuated dial in metal case, with static pressure tips.

2.8 DAMPERS

.1 Dampers shall meet requirements of Section 23 33 30

.2 Mixing Boxes: Section with factory mounted outside and return air dampers, in opposed blade arrangement with damper blades positioned across short air opening dimension.

3 Execution

3.1 INSTALLATION

.1 Install to manufacturer's written instructions.

.2 Install to ARI 435.

.3 Assemble high pressure units by bolting sections together. Isolate fan section with flexible duct connections.

.4 Install assembled unit on vibration isolators. Refer to Section 23 05 48.

.5 Do not operate units for any purpose, temporary or permanent, until ductwork is clean, filters are in place, bearings lubricated, and fan has been test run under observation.

.6 Fabricate to provide smooth air flow through components. Limit air leakage to 1% of rated air flow at 2.5 kPa suction pressure.

.7 Remove all internal hold-down bolts and shipping fasteners and install any parts which were shipped loose. Level spring isolators.

.8 Check and re-align all access doors and dampers to ensure smooth operating through the entire range of travel.

.9 Upon start-up, each fan motor is to be checked for fan rotations, and amp draw for each phase. Amp readings are to be marked on the fan scroll and recorded in the Operation and Maintenance Manual.

.10 All belt drives are to be re-adjusted for tension and alignment.

.11 Provide a drain valve on each coil drain fitting and a vent valve on each coil vent.

.12 All pipe and conduit penetrations to the casing are to be thoroughly sealed and caulked to prevent air leakage.

.13 All floor penetrations are to be thoroughly sealed to ensure the water tightness and integrity of the entire floor.

.14 The Contractor shall provide certified wiring schematics to the electrical division for the equipment and controls.

.15 The Controls Contractor shall provide all necessary control wiring as recommended by the manufacturer.

END OF SECTION

1 General

1.1 SUMMARY

.1 Section Includes:
- .1 Mechanical louvers; intakes; vents; and reinforcement and bracing for air vents, intakes and gooseneck hoods.
- .2 Sustainable requirements for construction and verification.

1.2 SECTION INCLUDES

.1 Packaged air conditioning units.

1.3 SUBMITTALS

.1 Submit shop drawings to requirements of Section 01 33 00.
.2 Indicate water, drain, electrical, and duct rough-in connections.
.3 Submit manufacturer's installation instructions to Section 01 33 00.
.4 Provide detailed wiring diagram and complete description of controls.

1.4 SUBMITTALS FOR INFORMATION

.1 Sections 01 33 00 and 01 78 00: Submission procedures.

.2 Manufacturer's Certificate: Certify that specified products meet or exceed specified requirements.

1.5 CLOSEOUT SUBMITTALS

.1 Section 01 33 00: Submission procedures.

1.6 OPERATION AND MAINTENANCE DATA

.1 Submit operation and maintenance data to requirements of Section 01 78 00.

.2 Include manufacturer’s descriptive literature, operating instructions, installation instructions, maintenance and repair data, and parts listing.

1.7 WARRANTY

.1 Provide a 5 year warranty to Section 01 78 00 and CCDC 2 General Conditions.

.2 Warranty: Include coverage of refrigerant compressors.

2 Products

2.1 DEDICATED ROOM AIR CONDITIONING UNITS

.1 Integrated package: to CAN/CSA-C656.

.2 System type:
- .1 Air flow arrangement: as noted on equipment schedule

.2 Cooling: direct expansion.
.3 Condensing: air cooled.

.3 Cooling capacity, with fan heat extracted: based on environment of 22 degrees C dry bulb and 50% R.H. (plus or minus 1 degree C and 5% R.H.), with minimum supply air temperature of 14 degrees C.

.4 Unit capacity: as indicated:

.5 Cabinet:
.1 Wall mounted, welded steel, unit construction, corrosion protected, 20 mm thick acoustic insulation, factory baked on external finish aesthetically compatible with typical computer and peripheral cabinets. Colour selected by Department Representative.
.2 Cabinet to house: cooling coil, fans, filters, unit environmental control system, motor starters or contactors and electrical disconnect switch.
.3 Provide adequate access to components for servicing.
.4 Corrosion protected welded structural steel floor stand having adjustable feet and locking device on corners, vibration isolators and compatible with raised floor system.
.5 Fans: DWDI centrifugal, statically and dynamically balanced, direct drive, with self-aligning, permanently lubricated, 100,000 hours minimum life ball or roller bearings.
.6 Fan Motors: Drip-proof permanently lubricated bearings for continuous duty, 40 degrees C maximum rise and variable pitch sheaves on belt driven systems.
.7 Provide hail guards over fins.

.6 Compressors:
.1 Semi hermetic type, minimum 2 required, with:
.1 Vibration isolators.
.2 Adjustable high and low pressure switches.
.3 Anti-slug device.
.4 Motor overload and over temperature protection pump down controls.
.5 Crank case heater.
.6 Compressor lead/lag switch.
.7 Refrigerant service valves.
.8 Capacity controls (variable speed compressor)

.7 Condenser:
.1 Outdoor Air cooled: free standing, welded steel unit construction, corrosion protected.
.1 Circuited to provide separate refrigerant circuit for each compressor/evaporator combination.
.2 Aluminum fins, mechanically bonded to copper tubes, tested to 3.1 MPa.
.3 Propeller or centrifugal type fans. Direct drive.
.4 Electrical and control components housed in weather-tight access panels with electrical disconnect switch and control cable for control interconnection and designed for year round operation.
.5 Vibration isolation: providing at least 95% isolation efficiency.
.6 Capacity: to heat rejection capacity of 35 degrees C.
.7 Variable speed compressor for capacity control.

.8 Filters:
- .1 Prefilters: Cleanable.
- .2 Mounting: in corrosion resistant racks with service access.

.9 Refrigerant Piping, Valves, Fittings, and Accessories within unit
- .1 To CSA B52.
- .2 Include for each refrigerant circuit:
  - .1 Thermal expansion valve, external equalizing type.
  - .2 Combination filter-dryer.
  - .3 Solenoid valves.
  - .4 Liquid sight glass with moisture indicator.
  - .5 Suction line insulation: flexible elastomeric unicellar to ASTM C547, 12 mm minimum thickness.
  - .6 Liquid refrigerant receiver.

.10 Environmental Controls
- .1 Solid state electronic control system.
- .2 Front mounted operating panel with visual display.
- .3 Panel to include following:
  - .1 Manual operation and adjustment:
    - .1 On-Off air conditioning system control.
    - .2 Room temperature set point, indicator and sensitivity adjustment controller.
    - .3 Alarm silencing switch for each alarm point.
    - .4 Alarm circuits test switch.
  - .2 Operational: Visual and Audible Alarm:
    - .1 Loss of air flow.
    - .2 Loss of liquid flow.
    - .3 High room temperature.
    - .4 Low room temperature.
    - .5 High head pressure.

.11 Refrigerant Charge
- .1 Charge refrigerant system at factory, seal and test.
- .2 Holding charge of refrigerant applied at factory.

.12 Capacity and Line Sizing
- .1 Manufacturer and Mechanical Contractor shall ensure that system will operate at capacities indicated in equipment schedule despite distance from condensing units to indoor units and elevation change.
- .2 Contractor shall ensure refrigerant liquid and suction lines are sized in accordance with manufacturer’s requirements for elevation change and distance between indoor and outdoor unit.
- .3 Pipe distance is assumed to be 40m (131 ft) with an elevation change of 13.7m (45 ft). Elevation change is included in pipe distance.

3 Execution

3.1 INSTALLATION

.1 Install in accordance with manufacturer's installation instructions.

.2 Coordinate installation of units with architectural, mechanical, and electrical work.

.3 Provide initial start-up and shut-down during first year of operation, including routine servicing and check-out.

.4 Mount condensing units at ground level in courtyard. Mount on raised metal stand to ensure minimum of 610mm clearance above ground with stand on concrete pads as indicated by Architect. Mechanical to provide stand.

.5 Supply units fully charged with refrigerant and filled with oil.

.6 Provide shut-off valves in condenser water inlet and outlet piping.

.7 Pipe drain pan condensate to nearest floor drain or mop sink as indicated on drawings.

.8 Mount on raised metal stand to ensure minimum of 610mm clearance above ground.

.9 Mechanical to pipe from condensing unit to wall along ground.

END OF SECTION

1 General

1.1 SECTION INCLUDES

.1 Baseboard radiation.
.2 Finned tube radiation.
.3 Unit heaters.
.4 Cabinet unit heaters.
.5 Unit ventilators.
.6 Radiant heaters.
.7 In-floor

1.2 SUBMITTALS FOR REVIEW

.1 Section 01 33 00: Procedures for submittals.

.2 Product Data: Provide typical catalogue of information including arrangements.

.3 Shop Drawings:
- .1 Indicate cross sections of cabinets, grilles, bracing and reinforcing, and typical elevations.
- .2 Submit schedules of equipment and enclosures typically indicating length and number of pieces of element and enclosure, corner pieces, end caps, cap strips, access doors, pilaster covers, and comparison of specified heat required to actual heat output provided.
- .3 Indicate mechanical and electrical service locations and requirements.,

1.3 OPERATION AND MAINTENANCE DATA

.1 Section 01 78 00: Submittals for project closeout.

.2 Operation and Maintenance Data: Include manufacturer's descriptive literature, operating instructions, installation instructions, maintenance and repair data, and parts listings.

1.4 QUALITY ASSURANCE

.1 Manufacturer Qualifications: Company specializing in manufacturing the Products specified in this section with minimum three years documented experience who issues complete catalogue data on such products.

1.5 REGULATORY REQUIREMENTS

.1 Products Requiring Electrical Connection: Listed and classified by Underwriters Laboratories Inc., as suitable for the purpose specified and indicated.

2 Products

2.1 PERFORMANCE

.1 Unit performance and capacity shall be as scheduled on equipment schedule.

.2 Electrical characteristics shall be as scheduled.

2.2 FINNED TUBE RADIATION

.1 Heating Elements: 32 mm ID seamless copper tubing, 3mm (1/8") minimum wall thickness mechanically expanded into evenly spaced aluminum fins sized 100 x 100 mm, suitable for soldered fittings.

.2 Element Hangers: Quiet operating, ball bearing cradle type providing unrestricted longitudinal movement, on enclosure brackets.

.3 Enclosures: 1.2 mm (18 gauge) steel up to 450 mm (18") in height, 1.5 mm (16 gauge) steel over 450 mm (18") in height, with easily jointed components for wall to wall installation. Support rigidly, on wall mounted brackets at 900 mm (36") centres maximum.

.4 Enclosure Finish: Factory applied baked primer coat unless specifically noted otherwise in equipment schedule.

.5 Damper: Where not thermostatically controlled, provide knob-operated internal damper at enclosure air outlet.

.6 Access Doors: For otherwise inaccessible valves, provide factory-made permanently hinged access doors, 150 x 175 mm minimum size, integral with cabinet.

2.3 UNIT HEATERS

.1 Coils: Seamless copper tubing, 0.6 mm (.025") minimum wall thickness, silver brazed to steel headers, and with evenly spaced aluminum fins mechanically bonded to tubing.

.2 Casing: 1.2 mm (18 gauge) steel with threaded pipe connections for hanger rods.

.3 Finish: Factory applied baked primer coat unless specifically noted otherwise in equipment schedule.

.4 Fan: Direct drive propeller type, statically and dynamically balanced, with fan guard; horizontal models with permanently lubricated sleeve bearings; vertical models with grease lubricated ball bearings.

.5 Air Outlet: Adjustable pattern diffuser on projection models and two way louvres on horizontal throw models.

.6 Motor: Permanently lubricated sleeve bearings on horizontal models, grease lubricated ball bearings on vertical models.

2.4 CABINET UNIT HEATERS

.1 Coils: Evenly spaced aluminum fins mechanically bonded to copper tubes, designed for maximum operating limits of 1380 kPa and 104 degrees C (200 psi and 220 deg.F.)

.2 Cabinet: 1.5 mm (16 gauge) steel with exposed corners and edges rounded, easily removed panels, glass fibre insulation and integral air outlet.

.3 Finish: Factory applied baked primer coat on visible surfaces of enclosure or cabinet.

.4 Fans: Centrifugal forward-curved double-width wheels, statically and dynamically balanced, direct driven.

.5 Motor: Tap wound multiple speed permanent split capacitor with sleeve bearings, resiliently mounted.

.6 Motor Speed Control: 4 position speed switch factory wired and CSA approved. Located in cabinet where accessible. Provide key operated wall mounted switch where inaccessible

.7 Filter: Easily removed 25 mm thick glass fibre throw-away type, located to filter air before coil.

2.5 HYDRONIC RADIANT PANELS

.1 Ceiling Panels: Constructed of modular aluminum extrusions manufactured and assembled to sizes and configurations indicated.

.2 Panels shall be Modular and matched to ceiling grid, refer to drawings. Copper tube shall be held in place on the panel by an aluminum saddle, with heat conductive paste (non-hardening) between the copper tube and aluminum face plate. The use of adhesive and/or clips to attach the copper tube to the extrusion will not be acceptable.

.3 Piping: Interconnect panels and provide accessories, as shown on drawings.

.4 Cross brace entire assembly with structural members.

.5 Insulate all active panels with 25 mm thick fibreglass insulation. Insulation shall be backed on both sides with aluminum foil.

2.6 IN-FLOOR HEATING

.1 Performance Requirements: Provide hydronic radiant floor heating system which has been manufactured, fabricated and installed to comply with regulatory agencies and to maintain performance criteria stated in equipment schedule without defects, damage or failure.

.2 Piping:

- .1 15.8 mm (5/8") I.D. cross-linked polyethylene pipe, with temperature rating to 82 deg.C (180 deg.F) and pressure rating of 690 kPa (100 psi). PEX tubing shall be ASTM F876 tested and approved for excessive temperature and pressure for 725 hours @ 210 degrees F (99 degrees C) at 150 psi (1035 kPa)
- .2 Piping to be complete with oxygen diffusion barrier to ASTM 876-855S21 standard.
- .3 PEX tubing shall be listed to a maximum 25 flame spread and maximum of 50 smoke developed per the requirements of CAN/ULC-S102.2.
- .4 PEX tubing penetrating a fire separation shall be sealed per CAN/ULC-S115

.3 Manifolds: Shall be of cast bronze or brass construction fully assembled and mounted on a durable bracket with air vent and drain on the return manifold sections. Manifold shall be designed to handle maximum 14 gpm for 8-loop manifold. Manifold shall have R32 unions on the inlet side of the manifold to allow for various connection adapters. Manifold shall be capable of full flow isolation on each loop and shall have integral circuit balancing valves, individual circuit control valves and actuators. Manifolds shall be provided complete with support brackets, end caps and pipe bend supports.

.4 Fittings: Shall be manufactured of dezincification resistant brass consisting of insert and a serrated compression ring and nut.

.5 Manifold Access: All manifolds shall be mounted within an access cavity in the wall, refer to architectural. Mechanical shall provide an access door complete with recess for drywall. The access door shall be lockable.

.1 Access Door: Recessed drywall panel door, 914x610, supplied with 5/8” drywall factory installed. Door: .080 aluminum extrusion with 5/8" drywall inserted into door panel. Door Frame: .080 aluminum extrusion recessed to provide similar edge to drywall bead to allow for finishing of wall surface. Hinge: Spring loaded hinge pin allows door panel to open to 90 degrees, and also allows for door panel to be removed from frame. Safety chain installed on door & frame for safety. Latch: cylinder lock & key. Finish: Mill Finish. Drywall is ready to be finished to match surrounding wall or ceiling surface. Specification is based on Acudor DW-5058.

3 Execution

3.1 PREPARATION

.1 Verify that electric power is available and of the correct characteristics (voltage and phase) prior to ordering pump.

3.2 INSTALLATION

.1 Install to manufacturer's written instructions.

.2 Install equipment exposed to finished areas after walls and ceiling are finished and painted. Avoid damage.

.3 Protection: Provide finished cabinet units with protective covers during balance of construction.

.4 Maintain sufficient clearance to permit performance of service maintenance.

.5 Check final location with Consultant if different from that indicated prior to installation. Should deviations beyond allowable clearances arise, request and follow Consultant's directive.

3.3 HYDRONIC UNITS

.1 Provide with shut-off valve on supply and balancing valve complete with isolation on return piping. Refer to drawings for balancing valve type.

.2 If balancing valve is not indicated, valve shall match type indicated for similar equipment.

.3 Provide each unit at high points with easily accessible manual air vent. If not easily accessible, extend vent to exterior surface of cabinet for easy servicing. For fan-coil units and unit heaters provide float operated automatic air vents with stop valve.

.4 For inaccessible valves, provide factory-made permanently hinged access doors, 150 mm x 175 mm (6" x 7") minimum size, integral with cabinet.

.5 Installation of radiant ceiling panel system to be in strict accordance with manufacturer's instructions and to be supervised by local supplier. Hanger wires shall be installed at minimum 1200 mm O.C., or as recommended by the manufacturer.

.6 Finned Tube Radiation: Locate on outside walls and run cover wall-to-wall unless otherwise indicated. Centre elements under windows. Where multiple windows occur over units, divide element into equal segments centred under each window. Install wall angles where units butt against walls.

.7 Unit Heaters: Hang from building structure, with pipe hangers anchored to building, not from piping. Mount as high as possible to maintain greatest headroom unless otherwise indicated.

.8 Cabinet Unit Heaters: Install as indicated. Coordinate to assure correct recess size for recessed units.

3.4 IN-FLOOR HEATING

.1 Installation of in-slab heating system to be in strict accordance with manufacturer's instructions and to be supervised by local supplier.

.2 Install hydronic radiant heat tubing loops in accordance with tubing manufacturer's recommendations and as indicated on Contract Drawings. Installation shall follow shop drawings for tube layout, tube spacing, manifold configuration, and manifold location. Comply with notes on shop drawings.

.3 Manifolds supply and return piping shall be isolated with ball valves and an automatic flow restrictor shall be installed to limit maximum flow. Refer to details and schematics.

.4 Fittings and manifolds shall be accessible for maintenance. The only exceptions are for repair splice with manufacturer's approved fittings and procedure for concealed connections.

.5 Install tubing loops without splices. It is acceptable to install a repair splice within the embedded loop should on-site damage occur and an emergency repair be authorized. Refer to PEX tubing manufacturer's installation handbook for instructions on the proper installation of the repair splice. Contractor must identify where emergency repair is located and receive authorization to proceed prior to proceeding.

.6 Ensure that no glues, solvents, sealants or chemicals come in contact with the tubing without prior permission from the tube manufacturer.

.7 Manufacturer's bend supports shall be used where tubing enters and exits the slab.

.8 Methods of tubing attachment shall be to manufacturer's installation handbook and in accordance with details.

.9 Pressurize tubing system with air to a pressure of 60 psi (413 kPa) for 24 hours prior to encasement of tubing system. Tubing shall remain pressurized during encasement and for a period of 24 hours thereafter to ensure system integrity. If any tube loop cannot hold pressure, encasement shall halt and tube shall be replaced before encasement can proceed.

.10 Comply with safety precautions when pressure testing, including use of compressed air, where applicable. Water shall not be used to pressurize the system if ambient air temperature has the possibility of dropping below 32 degrees F (0 degrees C).

.11 Ensure system is freeze proof should ambient air temperature be anticipated to drop below 32 degrees F (0 degrees C) and the system is not under full operation.

.12 Initial Balancing: Adjust flow to all loops as indicated on shop drawings.

.13 System shall not be operated during panel concrete curing period unless permission has been granted and specific instructions on panel pre-heating has been provided.

3.5 CLEANING

.1 After construction is completed, including painting, clean exposed surfaces of units. Vacuum clean coils and inside of cabinets.

.2 Touch-up marred or scratched surfaces of factory-finished cabinets, using finish materials provided by manufacturer.

.3 Install new filters.

END OF SECTION

1 General

1.1 SUMMARY

.1 Section Includes.

.1 Methods and procedures for start-up, verification and commissioning, for building Energy Monitoring and Control System (EMCS) and includes:

.1 Start-up testing and verification of systems.

.2 Check out demonstration or proper operation of components.

.3 On-site operational tests.

1.2 DEFINITIONS

.1 For additional acronyms and definitions refer to Section 25 05 01 - EMCS: General Requirements.

.2 AEL: ratio between total test period less any system downtime accumulated within that period and test period.

.3 Downtime: results whenever EMCS is unable to fulfill required functions due to malfunction of equipment defined under responsibility of EMCS contractor. Downtime is measured by duration, in time, between time that Contractor is notified of failure and time system is restored to proper operating condition. Downtime not to include following:

.1 Outage of main power supply in excess of back-up power sources, provided that:

.1 Automatic initiation of back-up was accomplished.

.2 Automatic shut-down and re-start of components was as specified.

.2 Failure of communications link, provided that:

.1 Controller automatically and correctly operated in stand-alone mode.

.2 Failure was not due to failure of any specified EMCS equipment.

.3 Functional failure resulting from individual sensor inputs or output devices, provided that:

.1 System recorded said fault.

.2 Equipment defaulted to fail-safe mode.

.3 AEL of total of all input sensors and output devices is at least 99% during test period.

1.3 DESIGN REQUIREMENTS

.1 Confirm with Departmental Representative that Design Criteria and Design Intents are still applicable.

.2 Commissioning personnel to be fully aware of and qualified to interpret Design Criteria and Design Intents.

1.4 SUBMITTALS

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

.2 Final Report: submit report to Departmental Representative.

.1 Include measurements, final settings and certified test results.

.2 Bear signature of commissioning technician and supervisor

.3 Report format to be approved by Departmental Representative before commissioning is started.

.4 Revise "as-built" documentation, commissioning reports to reflect changes, adjustments and modifications to EMCS as set during commissioning and submit to Departmental Representative in accordance with Section 01 78 00 - Closeout Submittals.

.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 Departmental Representative before interim acceptance in accordance with Section 01 78 00 - Closeout Submittals.

1.6 COMMISSIONING

.1 Carry out commissioning under direction of Departmental Representative and in presence of Departmental Representative, unless specifically arranged otherwise.

.2 Inform, and obtain approval from, Departmental Representative in writing at least 14 days prior to commissioning or each test. Indicate:

.1 Location and part of system to be tested or commissioned.

.2 Testing/commissioning procedures, anticipated results.

.3 Names of testing/commissioning personnel.

.3 Correct deficiencies, re-test in presence of Departmental Representative until satisfactory performance is obtained.

.4 Acceptance of tests will not relieve Contractor from responsibility for ensuring that complete systems meet every requirement of Contract.

.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 Departmental Representative.

1.8 ISSUANCE OF FINAL CERTIFICATE OF COMPLETION

.1 Final Certificate of Completion will not be issued until receipt of written approval indicating successful completion of specified commissioning activities including receipt of commissioning documentation.

2 Products

2.1 EQUIPMENT

.1 Provide sufficient instrumentation to verify and commission the installed system. Provide two-way radios.

.2 Instrumentation accuracy tolerances: higher order of magnitude than equipment or system being tested.

.3 Independent testing laboratory to certify test equipment as accurate to within approved tolerances no more than 2 months prior to tests.

.4 Locations to be approved, readily accessible and readable.

.5 Application: to conform to normal industry standards.

3 Execution

3.1 PROCEDURES

.1 Test each system independently and then in unison with other related systems.

.2 Controls Contractor to calibrate all sensors and complete point-to-point verification on entire EMCS (i.e. from operator screen to on-site device) and document on standard form. Form to be reviewed with departmental representative prior to start of verification to ensure sufficient information will be recorded.

.3 Verify every sequence of operation.

.4 Debug system software.

.5 Optimize operation and performance of systems by fine-tuning PID values and modifying CDLs as required.

.6 Test full scale emergency evacuation and life safety procedures including operation and integrity of smoke management systems under normal and emergency power conditions as applicable.

.7 Retest in presence of Departmental Representative once system passes Controls Contractor’s verification.

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 Departmental Representative.
- .3 Configure major components to be tested in same architecture as designed system. Include BECC equipment and 2 sets of Building Controller's including MCU's, LCU's, and TCU's.
- .4 Equip each Building Controller with sensor and controlled device of each type (AI, AO, DI, DO).
- .5 Additional instruments to include:
  - .1 DP transmitters.
  - .2 VAV supply duct SP transmitters.
  - .3 DP switches used for dirty filter indication and fan status.
- .6 In addition to test equipment, provide inclined manometer, digital micro-manometer, milli-amp meter, source of air pressure infinitely adjustable between 0 and 500 Pa, to hold steady at any setting and with direct output to milli-amp meter at source and to BECC.
- .7 After setting, test zero and span in 10 % increments through entire range while both increasing and decreasing pressure.
- .8 Contractor to mark instruments tracking within 0.5% in both directions as "approved for installation".
- .9 Transmitters above 0.5% error will be rejected.

.10 DP switches to open and close within 2% of setpoint.
.11 Be prepared to re-test as Departmental Representative witnesses.

.2 Completion Testing.
.1 General: test after installation of each part of system and after completion of mechanical and electrical hook-ups, to verify correct installation and functioning.
.2 Include following activities:
.1 Test and calibrate field hardware including stand-alone capability of each controller.
.2 Verify each A-to-D convertor.
.3 Test and calibrate each AI using calibrated digital instruments.
.4 Test each DI to ensure proper settings and switching contacts.
.5 Test each DO to ensure proper operation and lag time.
.6 Test each AO to ensure proper operation of controlled devices. Verify tight closure and signals.
.7 Test operating software.
.8 Test application software and provide samples of logs and commands.
.9 Verify each CDL including energy optimization programs.
.10 Debug software.
.11 Blow out flow measuring and static pressure stations with high pressure air at 700 kPa.
.12 Provide point verification list in table format including point identifier, point identifier expansion, point type and address, low and high limits and engineering units. Include space on commissioning technician and Departmental Representative. This document will be used in final startup testing.
.3 Final Startup Testing: Upon satisfactory completion of tests, perform system tests under direction of Departmental Representative and provide:
.1 Technical personnel capable of re-calibrating field hardware and modifying software.
.2 Detailed daily schedule showing items to be tested and personnel available.
.3 Departmental Representative's acceptance signature to be on executive and applications programs.
.4 Commissioning to commence during final startup testing.
.5 O&M personnel to assist in commissioning procedures as part of training.
.6 Commissioning to be supervised by qualified supervisory personnel and Departmental Representative.
.7 Commission systems considered as life safety systems before affected parts of the facility are occupied.
.8 Operate systems as long as necessary to commission entire project.
.9 Monitor progress and keep detailed records of activities and results.
.4 Final Operational Testing: to demonstrate that EMCS functions in accordance with contract requirements.
.1 Prior to beginning of 30 day test demonstrate that operating parameters (setpoints, alarm limits, operating control software, sequences of operation, trends, graphics and CDL's) have been implemented to ensure proper operation and operator notification in event of off-normal operation.
.1 Repetitive alarm conditions to be resolved to minimize reporting of nuisance conditions.
.2 Test to last at least 30 consecutive 24 hour days.
.3 Tests to include:
.1 Demonstration of correct operation of monitored and controlled points.

.2 Operation and capabilities of sequences, reports, special control algorithms, diagnostics, software.

.4 System will be accepted when:

.1 EMCS equipment operates to meet overall performance requirements. Downtime as defined in this Section must not exceed allowable time calculated for this site.

.2 Requirements of Contract have been met.

.5 In event of failure to attain specified AEL during test period, extend test period on day-to-day basis until specified AEL is attained for test period.

.6 Correct defects when they occur and before resuming tests.

.5 Departmental Representative to verify reported results.

3.3 ADJUSTING

.1 Final adjusting: upon completion of commissioning as reviewed by Departmental Representative, set and lock devices in final position and permanently mark settings.

3.4 DEMONSTRATION

.1 Demonstrate to Departmental Representative operation of systems including sequence of operations in regular and emergency modes, under normal and emergency conditions, start-up, shut-down interlocks and lock-outs in accordance with Section 01 79 00 - Demonstration and Training.

END OF SECTION

1 General

1.1 SUMMARY

.1 Section Includes.

.1 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 Departmental Representative 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 training program that training has been satisfactorily completed.

.4 Provide documentation signed by Owners representative that training was sufficient.

1.4 QUALITY ASSURANCE

.1 Provide competent instructors thoroughly familiar with aspects of EMCS installed in facility.

.2 Departmental Representative 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 Instruction time to be as specified under Section 21 05 01 - Common Work Results - Mechanical.

1.7 TRAINING MATERIALS

.1 Provide equipment, visual and audio aids, and materials for training at workstation.

.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 Time and sessions to be as specified in Section 21 05 01 - Common Work Results - Mechanical.

.2 Sessions to begin before 30 day test period at time mutually agreeable to Contractor and Departmental Representative.

.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.

.5 Provide complete training on Sequence of Operations.

1.9 ADDITIONAL TRAINING

.1 List courses offered by name, duration and approximate cost per person per week. Note courses recommended for training supervisory personnel.

2 Products

2.1 NOT USED

.1 Not Used.

3 Execution

3.1 NOT USED

.1 Not Used.

END OF SECTION

1 General

1.1 SUMMARY

.1 Section Includes:
- .1 General requirements for building Energy Monitoring and Control System (EMCS) that are common to NMS EMCS Sections.
- .2 Sustainable requirements for construction and verification.

1.2 REFERENCES

.1 American National Standards Institute (ANSI)/The Instrumentation, Systems and Automation Society (ISA).
- .1 ANSI/ISA 5.5-1985, Graphic Symbols for Process Displays.

.2 American National Standards Institute (ANSI)/ Institute of Electrical and Electronics Engineers (IEEE).
- .1 ANSI/IEEE 260.1-1993, American National Standard Letter Symbols Units of Measurement (SI Units, Customary Inch-Pound Units, and Certain Other Units).

.3 American Society of Heating, Refrigerating and Air-Conditioning Engineers, Inc. (ASHRAE).
- .1 ASHRAE STD 135-R2001, BACNET - Data Communication Protocol for Building Automation and Control Network.

.4 Canadian Standards Association (CSA International).
- .1 CAN/CSA-Z234.1-89(R1995), Canadian Metric Practice Guide.

.5 Consumer Electronics Association (CEA).
- .1 CEA-709.1-B-2002, Control Network Protocol Specification.

.6 Department of Justice Canada (Jus).
- .1 Canadian Environmental Assessment Act (CEAA), 1995, c. 37.
- .2 Canadian Environmental Protection Act (CEPA), 1999, c. 33.

.7 Electrical and Electronic Manufacturers Association (EEMAC).
- .1 EEMAC 2Y-1-1958, Light Gray Colour for Indoor Switch Gear.

.8 Health Canada/Workplace Hazardous Materials Information System (WHMIS).
- .1 Material Safety Data Sheets (MSDS).

.9 Transport Canada (TC).
- .1 Transportation of Dangerous Goods Act (TDGA), 1992, c. 34.

1.3 ACRONYMS AND ABBREVIATIONS

.1 Acronyms used in EMCS:
- .1 AEL - Average Effectiveness Level.
- .2 AI - Analog Input.
- .3 AIT - Agreement on International Trade.
- .4 AO - Analog Output.
- .5 BACnet - Building Automation and Control Network.

.6 BC(s) - Building Controller(s).
.7 BECC - Building Environmental Control Center.
.8 CAD - Computer Aided Design.
.9 CDL - Control Description Logic.
.10 CDS - Control Design Schematic.
.11 COSV - Change of State or Value.
.12 CPU - Central Processing Unit.
.13 DI - Digital Input.
.14 DO - Digital Output.
.15 DP - Differential Pressure.
.16 ECU - Equipment Control Unit.
.17 EMCS - Energy Monitoring and Control System.
.18 HVAC - Heating, Ventilation, Air Conditioning.
.19 IDE - Interface Device Equipment.
.20 I/O - Input/Output.
.21 ISA - Industry Standard Architecture.
.22 LAN - Local Area Network.
.23 LCU - Local Control Unit.
.24 MCU - Master Control Unit.
.25 NAFTA - North American Free Trade Agreement.
.26 NC - Normally Closed.
.27 NO - Normally Open.
.28 OS - Operating System.
.29 O&M - Operation and Maintenance.
.30 OWS - Operator Work Station.
.31 PC - Personal Computer.
.32 PCI - Peripheral Control Interface.
.33 PCMCIA - Personal Computer Micro-Card Interface Adapter.
.34 PID - Proportional, Integral and Derivative.
.35 RAM - Random Access Memory.
.36 SP - Static Pressure.
.37 ROM - Read Only Memory.
.38 TCU - Terminal Control Unit.
.39 USB - Universal Serial Bus.
.40 UPS - Uninterruptible Power Supply.
.41 VAV - Variable Air Volume.

1.4 DEFINITIONS

.1 Point: may be logical or physical.
.1 Logical points: values calculated by system such as setpoints, totals, counts, derived corrections and may include, but not limited to result of and statements in CDL's.
.2 Physical points: inputs or outputs which have hardware wired to controllers which are measuring physical properties, or providing status conditions of contacts or relays which provide interaction with related equipment (stop, start) and valve or damper actuators.

.2 Point Name: composed of two parts, point identifier and point expansion.
.1 Point identifier: comprised of three descriptors, "area" descriptor, "system" descriptor and "point" descriptor, for which database to provide 25 character field for each point identifier. "System" is system that point is located on.

.1 Area descriptor: building or part of building where point is located.
.2 System descriptor: system that point is located on.
.3 Point descriptor: physical or logical point description. For point identifier "area", "system" and "point" will be shortforms or acronyms. Database must provide 25 character field for each point identifier.

.2 Point expansion: comprised of three fields, one for each descriptor. Expanded form of shortform or acronym used in "area", "system" and "point" descriptors is placed into appropriate point expansion field. Database must provide 32 character field for each point expansion.

.3 Bilingual systems to include additional point identifier expansion fields of equal capacity for each point name for second language.
.1 System to support use of numbers and readable characters including blanks, periods or underscores to enhance user readability for each of the above strings.

.3 Point Object Type: points fall into following object types:
.1 AI (analog input).
.2 AO (analog output).
.3 DI (digital input).
.4 DO (digital output).
.5 Pulse inputs.

.4 Symbols and engineering unit abbreviations utilized in displays: to ANSI/ISA S5.5.
.1 Printouts: to ANSI/IEEE 260.1.
.2 Refer also to Section 25 05 54- EMCS: Identification.

1.5 SYSTEM DESCRIPTION

.1 Energy Management Control System (EMCS) shall consist of modular microcomputer controllers providing distributed processing capability, and allowing future expansion of both input/output points and processing control functions. Provide 10% spare capacity for both digital and analog point types. Provide 25% spare programming capacity for the above spare points. The system shall have further capabilities to expand and control a further 25% increase in points (including spare capacity above) without degrading the systems specified performance.

.2 Each field panel shall utilize direct digital control (DDC). DDC is defined to be where the field panel contains it=s own microprocessor and control algorithms to control the points connected directly without the need for communication with other panels.

.3 The EMCS shall effectively manage the facility and its activities to optimize the operation of HVAC systems to minimize energy consumption and extend equipment life during variations in occupancy, loads, schedules and weather conditions.

.4 The EMCS shall operate by enabling automatic operation and requiring minimal manual intervention and supervision.

.5 The modular design of the system software and hardware shall ensure easy maintenance and repairability. Self diagnostic programs will report errors without the need for operator interrogation. Maintenance on one module shall not affect the operation of other system components.

.6 Backup and fail safe criteria must be inherent. Any failure will not place the system in a hazardous condition.

.7 Output current and historical data on energy, building loads, equipment operation and control status.

.8 Provide English language operator interface using readily understand English language abbreviations and mnemonics.

.9 Controls Systems as provided shall incorporate, at minimum, the following integral features, functions and services:

.1 All automated monitoring, supervision, control, information storage and presentation as required by these Specifications.

.2 Operator information on all supervised building arrangements including but not limited to current status and value, historical archived information, summaries, analysis, displays, reports and operator control and management functions as required by the Specifications.

.3 The detection, annunciation and management of all alarm and non-expected conditions as required by the Specifications.

.4 The diagnostic monitoring and reporting of system functions, Nodes and communication networks.

.5 Interfaces between individual elements and the systems and networks provided by other trades as required by the Contract Documents.

.6 All other Controls Systems functions as required by the Contract Documents.

.10 The Controls System as provided shall comprise, at a minimum, the following primary elements:

.1 Operator Workstation(s) (as Specified)

.2 Web Server (as Specified)

.3 Network and Application Nodes.

.4 Field Devices.

.5 Control wiring.

.6 Portable Operating Tool (as Specified)

.11 The Controls System and all components shall be protected from power surges.

.12 Language Operating Requirements:

.1 Provide English operator selectable access codes.

.2 Use non-linguistic symbols for displays on graphic terminals wherever possible. Other information to be in English.

.3 Operating system executive: provide primary hardware-to-software interface specified as part of hardware purchase with associated documentation to be in English.

.4 System manager software: include in English system definition point database, additions, deletions or modifications, control loop statements, use of high level programming languages, report generator utility and other OS utilities used for maintaining optimal operating efficiency.

.5 Include, in English:

.1 Input and output commands and messages from operator-initiated functions, field related changes and alarms as defined in CDL's or assigned limits (i.e. commands relating to day-to-day operating functions and not related to system modifications, additions, or logic re-definements).

.2 Graphic "display" functions, point commands to turn systems on or off, manually override automatic control of specified hardware points. To be in English at specified OWS.

.3 Reporting function such as trend log, trend graphics, alarm report logs, energy report logs, maintenance generated logs.

1.6 COORDINATION

.1 Mechanical Contractor shall mount all motorized dampers supplied by Controls Contractor in their respective locations in the ductwork. The Mechanical Contractor shall also be responsible for distribution of dampers to the various locations on the job site.

.2 All electrical low-voltage control wiring, including interlock wiring, required for the equipment supplied by Mechanical, except where otherwise noted, shall be supplied and installed by the Control Supplier.

.3 All mechanical control wiring 50 volts or more shall be a minimum of #14 gauge wire. All mechanical control wiring less than 50 volts shall be minimum #18 gauge wire.

.4 All mechanical control wiring installed by the control supplier shall conform with the requirements of the local electrical authority and the Division 26 Electrical specifications.

.5 Electrical Contractor: Electrical shall provide the following:

- .1 All power wiring to equipment.
- .2 One 15 amp, 120V/60/1 phase fused power supply to each DDC control panel (minimum 12 circuits, 3 in AHU Mechanical Room, 3 in Boiler Room and 6 located throughout the facility). Electrical Contractor shall coordinate location and number with the controls contractor. Controls transformer shall be located within 5m (15ft) of electrical panel
- .3 Wiring of inline control devices on 120 Vac as indicated on drawings (remote solid state speed controllers for fan operation).

1.7 SUBMITTALS

.1 Make submittals in accordance with Section 01 33 00 - Submittal Procedures and 25 05 02 - EMCS: Shop Drawings, Product Data and Review Process.

.2 Quality Control:

- .1 Provide equipment and material from manufacturer's regular production, CSA certified, manufactured to standard quoted plus additional specified requirements.
- .2 Where CSA certified equipment is not available submit such equipment to inspection authorities for special inspection and approval before delivery to site.
- .3 Submit proof of compliance to specified standards with shop drawings and product data in accordance with Section 25 05 02 - EMCS: Shop Drawings, Product Data and Review Process. Label or listing of specified organization is acceptable evidence.
- .4 In lieu of such evidence, submit certificate from testing organization, approved by Departmental Representative, certifying that item was tested in accordance with their test methods and that item conforms to their standard/code.
- .5 For materials whose compliance with organizational standards/codes/specifications is not regulated by organization using its own listing or label as proof of compliance, furnish certificate stating that material complies with applicable referenced standard or specification.
- .6 Permits and fees: in accordance with general conditions of contract.
- .7 Existing devices intended for re-use: submit test report.

1.8 QUALITY ASSURANCE

.1 Have local office within Province staffed by trained personnel capable of providing instruction, routine maintenance and emergency service on systems,

.2 Have access to local supplies of essential parts and provide 7 year guarantee of availability of spare parts after obsolescence.

.3 Ensure qualified supervisory personnel continuously direct and monitor Work and attend site meetings.

.4 Health and Safety:

.1 Do construction occupational health and safety in accordance with Section 01 35 30 - Health and Safety Requirements.

2 Products

2.1 EQUIPMENT

.1 Control Network Protocol and Data Communication Protocol: to CEA 709.1 ASHRAE STD 135.

.2 Complete list of equipment and materials to be used on project and forming part of tender documents by adding manufacturer's name, model number and details of materials, and submit for approval.

2.2 ADAPTORS

.1 Provide adaptors between metric and imperial components.

2.3 CONTROLS SYSTEM ARCHITECTURE

.1 General

.1 The Controls Systems shall consist of Web Servers, Network and Application Nodes and their associated equipment connected by an industry standard communication network.

.2 The Interfaces provided shall incorporate complete tool sets, operational information displays, multi-Window displays and other interactive aids to assist interpretation and ease of use.

.3 The Workstations, Servers and principal network computer equipment shall be standard products of recognized major manufacturers available through normal PC and computer vendor channels. Clones assembled by a third-party subcontractor are not acceptable.

.4 Provide licenses for all software residing on and used by the Controls Systems and transfer these licenses to the Owner prior to completion.

.5 The networks shall, at minimum, comprise, as necessary, the following:

.1 Workstations - fixed as required by the Specifications.

.2 Network computer processing, data storage and communication equipment including Servers and digital data processors.

.3 Routers, bridges, switches, hubs, modems, interfaces and the like communication equipment.

.4 Active processing Network and Application Nodes including programmable field panels and controllers together with their power supplies and associated equipment.

.5 Addressable elements, sensors, transducers and end devices.
.6 Third-party equipment interfaces as required by the Contract Documents.
.7 Other components required for a complete and working Control Systems as specified.

.6 The system shall be modular in nature, and shall permit easy expansion through the addition of software applications, workstation hardware, network and application nodes sensors and actuators. The system architecture shall support 300% expansion capacity of all types of nodes and point types included in the initial installation and planned future expansion.

.7 The Specifications for the individual elements and component subsystems shall be minimum requirements and shall be augmented as necessary by the Contractor to achieve both compliance with all applicable codes, standards, the requirements of the AHJ (Authority having jurisdiction) at the site and to meet all requirements of the Contract Documents.

.8 The system shall have a concurrent, multi-tasking graphic operator interface with an easy-to-use, high level programming language and English language 13 character point descriptors.

.9 The system shall be usable in a standalone or network architectural with full peer-to-peer communication, remote access capacity, and four level password security resident on the single board machine.

.10 Controller shall provide commanded override capability from an operator interface.

.11 Each control panel shall provide adjustments for the functions specified. In addition, adjustments shall be provided for throttling ranges, setpoints, proportional bands, integral time, damper positioning, etc.

.2 Network

.1 The Controls Systems shall incorporate a primary Tier 1 network(s) utilizing standard Ethernet communications operating at a minimum speed of 10 Mb/sec. All Network Nodes, Web Servers, Configuration and Operator Workstations as a minimum shall reside on the primary Tier 1 network. At the Controls Contractor's option, they may also incorporate multiple and integrated secondary Tier 2 and tertiary Tier 3 networks.

.2 At least one level of the communication Network shall be based upon the following open architecture(s); BACnet in accordance with ANSI/ASHRAE Standard 135-2001 or LonMark as per ANSI/EAI 709 (LonWorks).

.3 The networks shall utilize only copper and optical fiber communication media as appropriate and to comply with the applicable codes, ordinances and regulations and the AHJ. They may also utilize digital wireless technologies if required by the Project and approved by the Architect or Owner and the AHJ.

.4 The control network shall NOT be connected through private or public telephones lines, ISDN lines etc. to an Internet Service Provider or have any external remote connection. The Controls Contractor shall identify the specific requirements in their shop drawing submittal.

2.4 OPERATOR INTERFACES

.1 General

.1 The Controls Systems Operator Interfaces shall be user friendly, readily understood and shall make maximum use of colors, graphics (floor plans, individual system schematics), icons, embedded images, animation, text based information and data visualization techniques to enhance and simplify the use and understanding of the displays by authorized users at the OWS.

.2 User access shall be protected by a flexible and Owner redefinable software-based password access protection. Password protection shall be multi-level and partition able to accommodate the varied access requirements of the different user groups to which individual users may be assigned. Provide the means to define

unique access privileges for each individual authorized user. Provide the means to on-line manage password access control under the control of a project specific Master Password.

.3 The Operator Interface shall incorporate comprehensive support for functions including, but not necessarily limited to, the following:

.1 User access for selective information retrieval and control command execution.

.2 Monitoring and reporting.

.3 Alarm and non-normal condition annunciation.

.4 Selective operator override and other control actions.

.5 Information manipulation, formatting, display and reporting.

.6 Controls Systems internal performance supervision and diagnostics.

.7 On-line access to user HELP menus.

.8 On-line access to current as-built records and documentation. At minimum, one (1) copy of all record documentation shall be stored on a designated OWS or Server and be accessible to the Owner.

.9 Means for the controlled re-programming, re-configuration of systems operation and for the manipulation of database information in compliance with the prevailing codes, approvals and regulations for the component applications and elements.

.4 Provide an audit trail of all user activity on the Controls Systems including all actions and changes.

.5 Provide on-line reports and displays making maximized use of simple English language descriptions and readily understood acronyms, abbreviations, icons and the like to assist user understanding and interpretation. All text naming conventions shall be consistent in their use and application throughout the Controls Systems.

.2 Operator Interface

.1 The Operator Interface provided shall include the functionality to selectively combine data and information from any system element or component in the Controls Systems Application on a single window display panel at the Operator=s option. This shall include both current information and historical data.

.2 Navigation Trees:

.1 Provide the capability to display multiple navigation trees that aid the operator in navigating throughout all systems and points connected. At minimum provide a tree that identifies all systems on the Controls Systems networks.

.2 Provide the capability for the Operator to add custom trees. The Operator shall be able to define any logical grouping of systems or points and arrange them on the tree in any selected order. Provide the capability to nest groups within other groups.

.3 Divisible Display Windows:

.1 Provide for the operator to divide the display area within a single window into multiple display panels. The content of each display panel can be any of the standard summaries and graphics provided in the Controls Systems Application.

.2 Provide each display panel with minimize, maximize and close icons.

.4 Alarms:

.1 Alarms shall be routed directly from primary Controls Systems Application Nodes to OWS and Server(s). Provide for specific alarms from specific points to be routed to selectable OWS and Server(s). The alarm management portion of the Controls Systems Operator Interface software shall, at minimum, provide the following functions:

.1 Log date and time of alarm occurrence.

.2 Generate a "Pop-Up" window on the display panel, with audible alarm, informing the Operator that an alarm has been received.

.3 Allow an Operator, with the appropriate password, to acknowledge, temporarily silence or cancel an alarm.

.4 Provide an audit trail for alarms by recording user acknowledgement, deletion or cancelling of an alarm. The audit trail shall include the ID of the user, the alarm, the action taken on the alarm and a time/date stamp.

.5 Provide the ability to direct alarms to an e-mail address or alphanumeric pager. This must be provided in addition to the pop-up window described herein. Controls Systems that use e-mail and pagers as the exclusive means of annunciating alarms are not acceptable.

.6 Provide for any attribute of any object in the Controls Systems to be designated to report as an alarm.

.7 Provide the ability to add, delete or modify alarms.

.2 The Controls Systems Application shall annunciate systems diagnostic alarms indicating system failures and non-normal operating conditions.

.3 Provide the on-line means to display alarms by date/time of occurrence, priority class, point designation, value or other defined text keywords.

.5 Operator Transactions:

.1 Provide the means to automatically record all Operator activities on the Controls Systems Application for the recall of same for reporting.

.2 Provide the means to sort and report activities by Operator, date/time, activity type and system area.

.3 Provide access protection to preclude the unauthorized removal or tampering with records.

.6 Reports:

.1 Reports shall be generated and directed to the user interface display or printer. As a minimum, the Controls Systems Application shall provide the following reports:

.1 All points in the Controls Systems Application.

.2 All points in a user-defined group of points.

.3 All points currently in alarm.

.4 All points locked out.

.5 All Controls Systems Application schedules.

.6 All user defined and adjustable variables, schedules, interlocks, diagnostics, systems status reports and the like.

.2 Provide all applicable original manufacturers standard reports for the Controls Systems.

.7 Dynamic Color Graphics:

.1 Provide for any number of real-time color graphic displays shall be able to be generated and displayed in the Controls Systems Application limited only by memory data storage capacity.

.2 Values of real-time attributes displayed on the graphics shall be dynamic and updated on the displays.

.3 The graphic displays shall be able to display and provide animation based on real-time data that is acquired, derived or entered into the operating Controls Systems.

.4 Provide for the Owner to be able to change values (setpoints) and states in system controlled equipment directly from the graphic display.

.5 Provide a graphic editing tool that allows for the creation and editing of graphic files. It shall be possible to edit the graphics directly while they are on line, or at an off line location for later downloading to the Controls Systems.

.8 Schedules:

.1 Provide multiple schedule input forms for automatic time-of-day scheduling and override scheduling of operations. At a minimum, the following schedule types shall be accommodated:

.1 Weekly schedules.

.2 Temporary override schedules.

.3 Special "Only Active If Today Is A Holiday" schedules.

.4 Monthly schedules.

.2 Schedules shall be provided for each group, system and sub-system in the Controls Systems Application. It shall be possible to include all or any commandable points residing within the Controls Systems in any custom schedule. Each point shall have a unique schedule of operation relative to the system use schedule, allowing for sequential starting and control of equipment within the system. Scheduling and rescheduling of points shall be accomplished easily via the system schedule spreadsheets.

.3 Multiple monthly calendars for a 12-month period shall be provided that allow for simplified scheduling of holidays and special days in advance. Holidays and special days shall be user-selected with the pointing device or keyboard, and shall automatically reschedule equipment operation as previously defined on the weekly schedules.

.9 Trending And Data Collection:

.1 Trend and store point data for all actual and virtual (software) points and values as required by the Owner.

.2 At a minimum, provide the capability to:

.1 Add / Modify and Delete Trends

.2 Display trend data in textural and / or graphical format

.3 Display multiple points in a single trend study.

.10 Operator Access Security (Combined Password and User ID):

.1 Provide for Operator access into the Controls Systems via the use of on-line Owner defined software Password and User Identification (ID) pairs, unique for each Operator and unique throughout the Controls Systems Application, to supplement standard OWS password access control.

.2 Stored password/user ID definitions shall be stored in encrypted formats.

.3 Password logins shall not be echoed on any screen or printer except during Master Password definition processes. An Operator defining a password shall be required to re-enter to confirm authenticity.

.4 Operator access privileges shall be definable in terms of functions and Project areas.

.5 As part of the access privileges definition for each user the Owner shall be able to define at minimum the following:

.1 Access times by day.

.2 Permanent or temporary, with expiry date, password.

.3 Number of incorrect access attempts allowed before the password is disabled.

.4 Whether or not the Operator is able to redefine their own password.

.5 A field for the Operator's e-mail address.

.6 A field for the Operator's contact phone number.

.7 Definition of the Operator's access privilege functionalities including viewing only, full control, selected functions, etc.

2.5 CONFIGURATION INTERFACES

.1 The Controls Systems Configuration Interface shall include all of the utilities, features and capabilities of the Operator Interface and in addition shall have the capability to create, modify and download the Controls Systems operating programs and databases to Web Servers, OWS, Network and Application Nodes.

.2 Workstations and Web Servers

.1 Provide the ability to add, replace, delete and configure Operator Workstations.

.2 Provide the ability to add, replace, delete and configure Web Servers.

.3 Network and Application Nodes

.1 Provide the ability to add, delete, modify Network Nodes including the following:

.1 Add, Delete Nodes

.2 Add, delete, modify job specific programming

.3 Upload and Download operating and job specific databases and programming.

.2 Provide the ability to add, delete, modify Application Nodes including the following;

.1 Add, Delete Nodes

.2 Add, delete, modify points (hardware inputs and software variables) associated with Application Nodes

.3 Add, delete, modify job specific programming

.4 Upload and Download operating and job specific databases and programming.

2.6 WEB SERVER

.1 General

.1 The Controls Systems shall support multiple remote Web based User Interfaces through a new Web Server.

.2 The Web Server shall support an unlimited number (non-simultaneous) of remote Web based User Interface(s) utilizing only local Intranet. The WEB serve shall not be connected to the Internet, telephone or cable modem, however, the system shall be capable in future for connection to external communications.

.2 Web Server

.1 The Web Server shall be installed with operating system, Browser, management, end user, and application specific software and database support facilities, including the associated original manufacturer software licenses. All software shall be to the original manufacturer's latest revision level at the time of delivery to Project site.

.2 Web Server hardware and software configuration shall support the number of installed Network and Application Nodes.

.3 Web Based User Interface

.1 The Web Interface(s) shall be provided to operate through an IT industry standard Web Browser such as Internet Explorer or Netscape.

.2 The Web Interface(s) provided shall incorporate complete tool sets, operational information displays, multi-Window displays and other interactive aids to assist interpretation and ease of use.

.3 The Web Interface(s) provided shall not require the procurement or licensing of any special or proprietary software from the Controls Contractor or its suppliers. In the event that specialized proprietary software is required, the Controls Contractor shall provide to the owner under this contract 10 licensed copies of the proprietary software.

.4 The Web Interface(s) shall support the following functions at a Minimum:

.1 User Name and Password restricted access.

.2 Easy to use "tree" diagram access to the following functions

.3 Display of Graphical System representations with dynamic real-time data.

.4 Trend Data Display

.5 Addition and Deletion of Trend Studies

.6 Scheduling display and adjustment

.7 Alarm Summary Display and Alarm Management Functions.

.8 Adjustment and Override of Operating Parameters

2.7 NETWORK AND APPLICATION NODES

.1 General

.1 The Controls Systems shall be composed of a mixture of Network and Application Nodes as required to meet the project requirements.

.2 The Nodes shall be designed, packaged, installed, programmed and commissioned in consideration of their specific service and prevailing operating conditions. They shall be proven standard product of their original manufacturer.

.3 A failure at a Node shall not cause failures or non-normal operation at any other system Node other than the possible loss of active real-time information from the failed Node.

.4 Ancillary equipment, including interfaces and power supplies, shall not be operated at more than 80% of their rated service capacity.

.2 Network Nodes

.1 The Controls Systems Tier 1 Network Nodes shall be designed and implemented entirely for use and operation on an Ethernet TCP/IP network such as the Internet or the Owner's Intranet. This functionality for operational access shall extend down to the field panel and field point level.

.2 The Tier 1 Network Nodes shall be fully IT compatible operating over industry standard IT infrastructure. The Controls Contractor shall coordinate with the IT infrastructure support staff or trade contractors to ensure compatibility and performance of the operation of the Controls Systems over the LAN/WAN made available for its shared use.

.3 The Tier 1 network shall be configured on IT industry standard off-the-shelf technologies

.4 Network Nodes may act as Application Nodes.

.3 Application Nodes:

.1 Application Nodes (AN) shall provide both standalone and networked direct digital control of mechanical and electrical building systems as required by the Specifications.

.2 Each AN shall retain program, control algorithms, and setpoint information for at least 72 hours in the event of a power failure and shall return to normal operation upon stable restoration of normal line power.

.3 Each AN shall monitor its communication status and provide a system advisory upon communication failure and restoration.

.4 The AN shall provide the functionality to download and upload configuration data locally from a portable service terminal, over the network

.5 The AN shall perform the functional monitoring of all Controls Application variables, both from real hardware points, software variables, and controller parameters such as setpoints.

.6 The AN shall be designed, packaged, installed, programmed and commissioned in consideration of their specific service and prevailing operating conditions. They shall be proven standard product of their original manufacturer and not a custom product for this project.

.7 Each AN shall directly support the temporary use of a portable service terminal to access the controls network based upon the security clearance of the operator.

.8 HVAC Systems

.1 Central HVAC Systems

.1 Standalone AN(s) shall be provided and programmed to control the Central Air Handlers, Heating and Cooling Plants as described in the sequence of operation

.2 Terminal HVAC Systems

.1 Standalone AN(s) shall be provided and configured to control heating and cooling elements such as Wall Fin Radiation, In-floor radiant Heating, Unit Heaters and Force Flows as called for in the sequences of operation.

.3 Mechanical Equipment with Microprocessor based Controls

.1 Controls Contractor shall integrate real-time data from building systems supplied by other trades and databases originating from other trades as called for in the sequences of operation.

.2 The Controls Systems shall include necessary hardware, equipment and software to allow data communications between the Controls Systems and building systems supplied by other trades.

.3 The trade contractors supplying other associated systems and equipment shall provide their necessary hardware and software at their cost and shall cooperate fully with the Controls Contractor in a timely manner and at their cost to ensure complete functional integration.

2.8 SOFTWARE

.1 General.
- .1 Include as minimum: operating system executive, communications, application programs, operator interface, and systems sequence of operation - CDL's.
- .2 Include "firmware" or instructions which are programmed into ROM, EPROM, EEPROM or other non-volatile memory.
- .3 Include initial programming of Controllers, for entire system.

.2 Program and data storage.
- .1 Store executive programs and site configuration data in ROM, EEPROM or other non-volatile memory.
- .2 Maintain CDL and operating data including setpoints, operating constants, alarm limits in battery-backed RAM or EEPROM for display and modification by operator.

.3 Programming languages.
- .1 Program Control Description Logic software (CDL) using English like or graphical, high level, general control language.
- .2 Structure software in modular fashion to permit simple restructuring of program modules if future software additions or modifications are required. GO TO constructs not allowed unless approved by Consultant.

.4 Operator Terminal interface.
- .1 Operating and control functions include:
  - .1 Multi-level password access protection to allow user/manager to limit workstation control.
  - .2 Alarm management: processing and messages.
  - .3 Operator commands.
  - .4 Reports.
  - .5 Displays.
  - .6 Point identification.

.5 Pseudo or calculated points.
- .1 Software to provide access to value or status in controller or other networked controller in order to define and calculate pseudo point. When current pseudo point value is derived, normal alarm checks must be performed or value used to totalize.
- .2 Inputs and outputs for process: include data from controllers to permit development of network-wide control strategies. Processes also to permit operator to use results of one process as input to number of other processes (e.g. cascading).

.6 Control Description Logic (CDL):
- .1 Capable of generating on-line project-specific CDLs which are software based, programmed into RAM or EEPROM and backed up to OWS. Owner must have access to these algorithms for modification or to be able to create new ones and to integrate these into CDLs on BC(s) from OWS.
- .2 Write CDL in high level language that allows algorithms and interlocking programs to be written simply and clearly. Use parameters entered into system (e.g. setpoints) to determine operation of algorithm. Operator to be able to alter operating parameters on-line from OWS and BC(s) to tune control loops.
- .3 Perform changes to CDL on-line.
- .4 Control logic to have access to values or status of points available to controller including global or common values, allowing cascading or inter-locking control.

.5 Energy optimization routines including enthalpy control, supply temperature reset, to be LCU or MCU resident functions and form part of CDL.

.6 MCU to be able to perform following pre-tested control algorithms:
.1 Two position control.
.2 Proportional Integral and Derivative (PID) control.

.7 Control software to provide ability to define time between successive starts for each piece of equipment to reduce cycling of motors.

.8 Provide protection against excessive electrical-demand situations during start-up periods by automatically introducing time delays between successive start commands to heavy electrical loads.

.9 Power Fail Restart: upon detection of power failure system to verify availability of Emergency Power as determined by emergency power transfer switches and analyze controlled equipment to determine its appropriate status under Emergency power conditions and start or stop equipment as defined by I/O Summary. Upon resumption of normal power as determined by emergency power transfer switches, MCU to analyze status of controlled equipment, compare with normal occupancy scheduling, turn equipment on or off as necessary to resume normal operation.

.7 Equipment Cycling Protection: Control software shall include a provision for limiting the number of times each piece of equipment may be cycled within any one-hour period. Limitations for each piece of equipment shall be determined in accordance with manufacturer's recommendations.

.8 The Application and/or Network Nodes shall support the following standard programming capabilities as required to achieve the specified sequences of operation.

.1 Execute custom, job-specific processes defined by the user to automatically perform calculations and special control routines using:
.1 System measured point data
.2 Calculated data
.3 The results from other processes
.4 User defined constants
.5 Arithmetic functions
.6 Boolean Logic Operators
.7 Proportional plus Integral plus Derivative Control Algorithms as required.
.8 Automatic control loop tuning

.2 The Application and/or Network Nodes shall incorporate the following software features:
.1 Event Messaging: Provide for the automatic execution of user-defined messages on the occurrence of each predefined real-time event including equipment/point status change, approaching limit or alarm, time of day and the like.
.2 Optimum Start/Stop: Provide software to start equipment on a sliding schedule based upon indoor and outdoor conditions. Determine the minimum time of HVAC system operation needed to satisfy the space environmental requirements. The program shall also determine the earliest possible time to stop the mechanical systems. The optimum start/stop program shall operate in conjunction with, and be coordinated with, the scheduled start/stop and night setback programs.
.3 Auto Alarm Lockout: Provide for scheduled and automatic lockout of alarm annunciation from equipment during non-normal operating conditions including shutdown, emergency power operation, filter alarm and the like.
.4 Event Initiated Programs and Custom Logic: Provide software to define custom logic sequences that reside in the Application and/or Network Nodes.

.3 Energy Management Applications: Network panels shall perform any and all of the following energy management routines applicable to the systems being controlled:
1. Time of day scheduling
2. Calendar based scheduling

3. Holiday scheduling
4. Temporary schedule overrides
5. Optimal start
6. Optimal stop
7. Night setback control
8. Optimized Speed control.
9. Heating/cooling interlock (system shall prevent simultaneous heating and cooling)
10. Hot water reset (I/O).
11 Hot Water Space Demand Reset.
12 Differential Enthalpy (economizer) Switchover.

All programs shall be executed automatically without the need for operator intervention, and shall be flexible enough to allow user customization. Programs shall be applied to building equipment as described under Sequence of Operation.

.4 Custom Process Programming Capability: Network panels shall be able to execute custom, job-specific processes defined by the user, to automatically perform calculations and special control routines.

1. Process Inputs and Variables: It shall be possible to use any of the following in a custom process:
   a) Any system-measured point data or status
   b) Any calculated data
   c) Any results from other processes
   d) User-defined constants
   e) Arithmetic functions (+,-,*,/, square root, exp, etc.)
   f) Boolean logic operators (and, or, exclusive or, etc.)
   g) On-delay/Off-delay/One-shot timers
2. Process Triggers: Custom processes may be triggered based on any combination of the following:
   a) Time interval
   b) Time of day
   c) Date
   d) Other processes
   e) Time programming
   f) Events (e.g., point alarms)
3. Dynamic Data Access: A single process shall be able to incorporate measured or calculated data from any and all other network panels on the local area network. In addition, a single process shall be able to issue commands to points in any land all other network panels on the local area network.
4. Advisory/Message Generation: Processes shall be able to generate operator messages and advisories to operator I/O devices. A process hall be able to directly send a message to a specified device, buffer the information in a follow-up file, or cause the execution of a dial-up connection to a remote device such as a printer or pager.
5. Custom Process Documentation: The custom control programming feature shall be self-documenting. All interrelationships defined by this feature shall be documented via graphical flowcharts and English language descriptors.

.5 Alarm Management: Alarm management shall be provided to monitor, buffer, and direct alarm reports to operator devices and memory files. Each network panel shall perform distributed, independent alarm analysis and filtering to minimize operator interruptions due to non-critical alarms, minimize network traffic, and prevent alarms from being lost. At no time shall the network panel's ability to report alarms be affected by either operator activity at a PC workstation or local I/O device, or communications with other panels on the network.

1. Point Change Report Description: All alarm or point change reports shall include the point's English language description, and the time and date of occurrence.

2. Prioritization: The user shall be able to define the specific system reaction for each point. Alarms shall be prioritized to minimize nuisance reporting and to speed operator response to critical alarms. A minimum of three priority levels shall be provided. Each network panel shall automatically inhibit the reporting of selected alarms during system shutdown and start-up. Users shall have the ability to manually inhibit alarm reporting for each point. The user shall also be able to define under which conditions point changes need to be acknowledged by an operator, and/or sent to follow-up files for retrieval and analysis at a later date.
3. Use management by exception concept for Alarm Reporting. This is system wide requirement. This approach will insure that only principal alarms are reported to OWS. Events which occur as direct result of primary event to be suppressed by system and only events which fail to occur to be reported. Such event sequence to be identified in I/O Summary and sequence of operation. Examples of above are, operational temperature alarms limits which are exceeded when main air handler is stopped, or General Fire condition shuts air handlers down, only Fire alarm status shall be reported. Exception is, when air handler which is supposed to stop or start fails to do so under event condition
4. Report Routing: Alarm reports, messages, and files will be directed to a user-defined list of operator devices, or PCs used by archiving alarm information. Alarms shall also be automatically directed to a default device in the event a primary device is found to be off-line.
5. Alarm Messages: In addition to the point=s descriptor and the time and date, the user shall be able to print, display or store a 65 character alarm message to more fully describe the alarm condition or direct operator response. Each standalone network panel shall be capable of storing a library of at least 250 alarm messages. Each message may be assignable to any number of points in the panel.
6. Auto-Dial Alarm Management: In Dial-up applications, only critical alarms shall initiate a call to a remote operator device. In all other cases, call activity shall be minimized by time-stamping and saving reports until an operator scheduled time, a manual request, or until the buffer space is full. The alarm buffer must store a minimum of 50 alarms.

.6 Transaction Logging: Operator commands and system events shall be automatically logged to disk in Personal Computer industry standard database format. Operator commands initiated from direct-connected workstations, dial-up workstations, and local network panel Network Terminal devices shall all be logged to this transaction file. This data shall be available at the Operator Workstation. Facility shall be provided to allow the user to search the transaction file using standard database query techniques, including searching by dates, operator name, data point name, etc. In addition, this transaction file shall be accessible with standard third party database and spreadsheet packages.

.7 Historical Data and Trend Analysis: A variety of historical data collection utilities shall be provided to automatically sample, store, and display system data in all of the following ways:

1. Continuous Point Histories: Standalone network panels shall store Point History Files for all analog and binary inputs and outputs. The point history routine shall continuously and automatically sample the value of all analog inputs at half hour intervals. Samples for all points shall be stored for the past 24 hours to allow the user to immediately analyze equipment performance and all problem-related events for the past day. Point History Files for binary input or output points and analog output points shall include a continuous record of the last ten status changes or commands for each point.
2. Control Loop Performance Trends: Standalone network panels shall also provide high resolution sampling capability with an operator-adjustable resolution of 10-300 seconds in one-second increments for verification of control loop performance.

3. Extended Sample Period Trends: Measured and calculated analog and binary data shall also be assignable to user-definable trends for the purpose of collecting operator-specified performance data over extended periods of time. Sample intervals of 1 minute to 2 hours, in one-minute intervals, shall be provided. Each standalone network panel shall have a dedicated buffer for trend data, and shall be capable of storing a minimum of 5000 data samples.
4. Data Storage and Archiving: Trend data shall be stored at the standalone network panels, and uploaded to hard disk storage when archival is desired. Uploads shall occur based upon either user-defined interval, manual commend, or when the trend buffers become full. All trend data shall be available in disk file form for use in 3rd Party personal computer applications.

.8 Runtime Totalization: Standalone network panels shall automatically accumulate and store runtime hours for binary input and output points as specified in the Execution portion of this specification.
1. The totalization routine shall have a sampling resolution of one minute or less.
2. The user shall have the ability to define a warning limit for runtime totalization. Unique, user-specified messages shall be generated when the limit is reached.

.9 Analog/Pulse Totalization: Standalone network panels shall automatically sample, calculate and store consumption totals on a daily, weekly, or monthly basis for user-selected analog and binary pulse input-type points.
1. Totalization shall provide calculation and storage of accumulations of up to 99,999.9 units (e.g. KWH, gallons, KBTU, tons, etc.)
2. The totalization routine shall have a sampling resolution of one minute or less.
3. The user shall have the ability to define a warning limit. Unique, user-specified messages shall be generated when the limit is reached.

.10 Event Totalization: Standalone network panels shall have the ability to count events such as the number of times a pump or fan system is cycled on and off. Event totalization shall be performed on a daily, weekly, or monthly basis.
1. The event totalization feature shall be able to store the records associated with a minimum of 9,999,999 events before reset.
2. The user shall have the ability to define a warning limit. Unique, user-specified messages shall be generated when the limit is reached.
3 Totalization routine to have sampling resolution of 1 min or less for analog inputs.

3 Execution

3.1 MANUFACTURER'S RECOMMENDATIONS

.1 Installation: to manufacturer's recommendations.

3.2 PAINTING

.1 Painting: in accordance with Section 09 91 23 - Interior Painting, supplemented as follows:
.1 Clean and touch up marred or scratched surfaces of factory finished equipment to match original finish.
.2 Restore to new condition, finished surfaces too extensively damaged to be primed and touched up to make good.
.3 Clean and prime exposed hangers, racks, fastenings, and other support components.
.4 Paint unfinished equipment installed indoors to EEMAC 2Y-1.

1 General

1.1 SUMMARY

.1 Section Includes.
- .1 Methods and procedures for shop drawings submittals, preliminary and detailed review process including review meetings, for building Energy Monitoring and Control System (EMCS).

1.2 DEFINITIONS

.1 Acronyms and definitions: refer to Section 25 05 01 - EMCS: General Requirements.

1.3 DESIGN REQUIREMENTS

.1 Preliminary Design Review: to contain following contractor and systems information.
- .1 Location of local office.
- .2 Description and location of installing and servicing technical staff.
- .3 Location and qualifications of programming design and programming support staff.
- .4 List of spare parts.
- .5 Location of spare parts stock.
- .6 Names of sub-contractors and site-specific key personnel.
- .7 Sketch of site-specific system architecture.
- .8 Specification sheets for each item including memory provided, programming language, speed, type of data transmission.
- .9 Descriptive brochures.
- .10 Sample CDL and graphics (systems schematics).
- .11 Response time for each type of command and report.
- .12 Item-by-item statement of compliance.
- .13 Proof of demonstrated ability of system to communicate utilizing Proprietary Communications Protocol, BACnet or Lontalk.

1.4 SUBMITTALS

.1 Submittals in accordance with Section 01 33 00 - Submittal Procedures and coordinate with requirements in this Section.

.2 Submit preliminary design document within 30 working days after tender closing and before contract award, for review by Departmental Representative.

.3 Shop Drawings to consist of one digital copy of design documents, shop drawings, product data and software.

.4 Hard copy to be completely indexed and coordinated package to assure compliance with contract requirements and arranged in same sequence as specification and cross-referenced to specification section and paragraph number.

1.5 PRELIMINARY SHOP DRAWING REVIEW

.1 Submit preliminary shop drawings within 30 working days of award of contract and include following:
- .1 Specification sheets for each item. To include manufacturer's descriptive literature, manufacturer's installation recommendations, specifications, drawings, diagrams, performance and characteristic curves, catalogue cuts, manufacturer's name, trade name, catalogue or model number, nameplate data, size, layout, dimensions, capacity, other data to establish compliance.
- .2 Detailed system architecture showing all points associated with each controller including, signal levels, pressures where new EMCS ties into existing control equipment.
- .3 Spare point capacity of each controller by number and type.
- .4 Controller locations.
- .5 Auxiliary control cabinet locations.
- .6 Single line diagrams showing cable routings, conduit sizes, spare conduit capacity between control centre, field controllers and systems being controlled.
- .7 Valves: complete schedule listing including following information: designation, service, manufacturer, model, point ID, design flow rate, design pressure drop, required Cv, Valve size, actual Cv, spring range, pilot range, required torque, actual torque and close off pressure (required and actual).
- .8 Dampers: sketches showing module assembly, interconnecting hardware, operator locations, operator spring range, pilot range, required torque, actual torque.
- .9 Flow measuring stations: complete schedule listing designation, service, point ID, manufacturer, model, size, velocity at design flow rate, manufacturer, model and range of velocity transmitter.

1.6 DETAIL SHOP DRAWING REVIEW

.1 Submit detailed shop drawings within 60 working days after award of contract and before start of installation and include following:
- .1 Corrected and updated versions (hard copy only) of submissions made during preliminary review.
- .2 Wiring diagrams.
- .3 Piping diagrams and hook-ups.
- .4 Interface wiring diagrams showing termination connections and signal levels for equipment to be supplied by others.
- .5 Shop drawings for each input/output point, sensors, transmitters, showing information associated with each particular point including:
  - .1 Sensing element type and location.
  - .2 Transmitter type and range.
  - .3 Associated field wiring schematics, schedules and terminations.
  - .4 Complete Point Name Lists.
  - .5 Setpoints, curves or graphs and alarm limits (high and low, 3 types critical, cautionary and maintenance), signal range.
  - .6 Software and programming details associated with each point.
  - .7 Manufacturer's recommended installation instructions and procedures.
  - .8 Input and output signal levels or pressures where new system ties into existing control equipment.

.6 Control schematics, narrative description, CDL's fully showing and describing automatic and manual procedure required to achieve proper operation of project, including under complete failure of EMCS.
.7 Graphic system schematic displays of air and water systems with point identifiers and textual description of system, and typical floor plans as specified.
.8 Complete system CDL's including companion English language explanations on same sheet but with different font and italics. CDL's to contain specified energy optimization programs.
.9 Listing and example of specified reports.
.10 Listing of time of day schedules.
.11 Type and size of memory with statement of spare memory capacity.
.12 Full description of software programs provided.
.13 Sample of "Operating Instructions Manual" to be used for training purposes.
.14 Outline of proposed start-up and verification procedures. Refer to Section 25 01 11 - EMCS: Start-up, Verification and Commissioning.

1.7 QUALITY ASSURANCE

.1 Preliminary Design Review Meeting: Convene meeting within 45 working days of award of contract to:
.1 Undertake functional review of preliminary design documents, resolve inconsistencies.
.2 Resolve conflicts between contract document requirements and actual items (e.g.: points list inconsistencies).
.3 Review interface requirements of materials supplied by others.
.4 Review "Sequence of Operations".

.2 Contractor's programmer to attend meeting.

.3 Departmental Representative retains right to revise sequence or subsequent CDL prior to software finalization without cost to Departmental Representative.

2 Products

2.1 NOT USED

.1 Not Used.

3 Execution

3.1 NOT USED

.1 Not Used.

END OF SECTION

1 General

1.1 SUMMARY

.1 Section Includes.

.1 Requirements and procedures for 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 acryonyms and definitions refer to Section 25 05 01 - EMCS: General Requirements.

1.3 SUBMITTALS

.1 Submittals in accordance with Section 01 78 00 - Closeout Procedures, supplemented and modified by requirements of this Section.

.2 Submit Record Documents, As-built drawings, and Operation and Maintenance Manual to Departmental Representative in English.

.3 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 2 copies 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 all 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.
.10 Update sequence of operations for all equipment as required to match exact site conditions and operation.

.2 Submit for final review by Departmental Representative.

.3 Provide before acceptance six (6) copies of all as-built documentation for inclusion in Mechanical Operating and Maintenance Manuals. Final copies shall incorporate all changes made during final review.

1.5 OPERATION AND MAINTENANCE 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 Provide 2 complete sets of hard and soft copies prior to system or equipment tests

.3 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.

.4 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 or planned for implementation in automatic mode.

.5 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.

.6 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.

.7 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.

.8 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.

.9 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.

.10 Provide copies (hard and soft, each) of final Controls Operation and Maintenance manuals for inclusion in Mechanical Operation and Maintenance Manuals, refer to 21 05 01 for count. Final copies shall incorporate all changes made during final review and during construction.

1.6 SOFTWARE

.1 Provide back-up for source code following any and all modifications and/or corrections implemented throughout the verification and commissioning of EMCS.

.2 Provide one copy of back-up for source code in each of the six Mechanical Operation and Maintenance Manuals.

2 Products

2.1 NOT USED

.1 Not Used.

3 Execution

3.1 NOT USED

.1 Not Used.

END OF SECTION

1 General

1.1 SUMMARY

.1 Section Includes.

.1 Requirements and procedures for identification of devices, sensors, wiring tubing, conduit and equipment, for building Energy Monitoring and Control System (EMCS) Work and nameplates materials, colours and lettering sizes.

1.2 REFERENCES

.1 Canadian Standards Association (CSA International).

.1 CSA C22.1-02, The Canadian Electrical Code, Part I (19th Edition), Safety Standard for Electrical Installations.

1.3 DEFINITIONS

.1 For acronyms and definitions refer to Section 25 05 01 - EMCS: General Requirements.

1.4 SYSTEM DESCRIPTION

.1 Language Operating Requirements: provide identification for control items in English.

1.5 SUBMITTALS

.1 Submittals in accordance with Section 01 33 00 - Submittal Procedures supplemented and modified by requirements of this Section.

.2 Submit to Departmental Representative for approval samples of nameplates, identification tags and list of proposed wording.

2 Products

2.1 NAMEPLATES FOR PANELS

.1 Identify by Plastic laminate, 3 mm thick, matt white finish, black core, square corners, lettering accurately aligned and engraved into core.

.2 Sizes: 25 x 67 mm minimum.

.3 Lettering: minimum 7 mm high, black.

.4 Inscriptions: machine engraved to identify function.

2.2 NAMEPLATES FOR FIELD DEVICES

.1 Identify by plastic encased cards attached by chain or plastic tie.

.2 Sizes: 50 x 100 mm minimum.

.3 Lettering: minimum 5 mm high produced from laser printer in black.

.4 Data to include: point name, point type, point address, associated controller, and description of service.

.5 Companion cabinet: identify interior components using plastic enclosed cards with point name and point address.

2.3 NAMEPLATES FOR ROOM SENSORS

.1 Identify by lamicoids using point identifier.

.2 Location: on sensor cover.

.3 Letter size: to suit, clearly legible.

2.4 WARNING SIGNS

.1 Equipment including motors, starters under remote automatic control: supply and install orange coloured signs warning of automatic starting under control of EMCS.

.2 Sign to read: "Caution: This equipment is under automatic remote control of EMCS".

2.5 WIRING

.1 Supply and install numbered tape markings on wiring at panels, junction boxes, splitters, cabinets and outlet boxes.

.2 Colour coding: to CSA C22.1. Use colour coded wiring in communications cables, matched throughout system.

.3 Power wiring: identify circuit breaker panel/circuit breaker number inside each EMCS panel.

2.6 CONDUIT

.1 Colour code EMCS conduit.

.2 Pre-paint box covers and conduit fittings.

.3 Coding: use fluorescent orange paint.

3 Execution

3.1 NAMEPLATES AND LABELS

.1 Ensure that manufacturer's nameplates, CSA labels and identification nameplates are visible and legible at all times.

.2 All labelling to follow RCMP site standards and the Signage Drawings for room names and numbers. Note that the signage drawings will match room labelling to be utilized in space but do not match the room numbering utilized for the construction set.

END OF SECTION

1 General

1.1 SUMMARY

.1 Section Includes.
- .1 Requirements and procedures for warranty and activities during warranty period and service contracts, for building Energy Monitoring and Control System (EMCS).

.2 References.
- .1 Canada Labour Code (R.S. 1985, c. L-2)/Part I - Industrial Relations.
- .2 Canadian Standards Association (CSA International).
  - .1 CSA Z204-94(R1999), Guidelines for Managing Indoor Air Quality in Office Buildings.

1.2 DEFINITIONS

.1 BC(s) - Building Controller(s).

.2 OWS - Operator Work Station.

.3 For additional acronyms and definitions refer to Section 25 05 01 - EMCS: General Requirements.

1.3 SUBMITTALS

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

.2 Submit detailed preventative maintenance schedule for system components to Departmental Representative.

.3 Submit detailed inspection reports to Departmental Representative.

.4 Submit dated, maintenance task lists to Departmental Representative and include the following sensor and output point detail, as proof of system verification:
- .1 Point name and location.
- .2 Device type and range.
- .3 Measured value.
- .4 System displayed value.
- .5 Calibration detail
- .6 Indication if adjustment required,
- .7 Other action taken or recommended.

.5 Submit network analysis report showing results with detailed recommendations to correct problems found.

.6 Records and logs: in accordance with Section 01 78 00 - Closeout Submittals.
- .1 Maintain records and logs of each maintenance task on site.
- .2 Organize cumulative records for each major component and for entire EMCS chronologically.
- .3 Submit records to Departmental Representative, after inspection indicating that planned and systematic maintenance have been accomplished.

.7 Revise and submit to Departmental Representative in accordance with Section 01 78 00 - Closeout Submittals "As-built drawings" documentation and commissioning reports to reflect changes, adjustments and modifications to EMCS made during warranty period.

1.4 MAINTENANCE SERVICE DURING WARRANTY PERIOD

.1 Provide services, materials, and equipment to maintain EMCS for specified warranty period. Provide detailed preventative maintenance schedule for system components as described in Submittal article.

.2 Emergency Service Calls:
- .1 Initiate service calls when EMCS is not functioning correctly.
- .2 Qualified control personnel to be available during warranty period to provide service to "CRITICAL" components whenever required at no extra cost.
- .3 Furnish Departmental Representative with telephone number where service personnel may be reached at any time.
- .4 Service personnel to be on site ready to service EMCS within 2 hours after receiving request for service.
- .5 Perform Work continuously until EMCS restored to reliable operating condition.

.3 Operation: foregoing and other servicing to provide proper sequencing of equipment and satisfactory operation of EMCS based on original design conditions and as recommended by manufacturer.

.4 Work requests: record each service call request, when received separately on approved form and include:
- .1 Serial number identifying component involved.
- .2 Location, date and time call received.
- .3 Nature of trouble.
- .4 Names of personnel assigned.
- .5 Instructions of work to be done.
- .6 Amount and nature of materials used.
- .7 Time and date work started.
- .8 Time and date of completion.

.5 Provide system modifications in writing.
- .1 No system modification, including operating parameters and control settings, to be made without prior written approval of Departmental Representative.

.6 Back-up software.

2 Products

2.1 NOT USED

.1 Not Used.

3 Execution

3.1 FIELD QUALITY CONTROL

.1 Perform as minimum two major inspections (more often if required by manufacturer) per year; one at start of heating season and one at start of cooling season. Provide detailed written report to Departmental Representative as described in Submittal article.

.2 Perform inspections during regular working hours, 0800 to 1630 h, Monday through Friday, excluding statutory holidays.

.3 Following inspections are minimum requirements and should not be interpreted to mean satisfactory performance:
- .1 Perform calibrations using test equipment having traceable, certifiable accuracy at minimum 50% greater than accuracy of system displaying or logging value.
- .2 Check and calibrate each field input/output device in accordance with Canada Labour Code - Part I and CSA Z204.
- .3 Provide dated, maintenance task lists, as described in Submittal article, as proof of execution of complete system verification.

.4 Minor inspections to include, but not limited to:
- .1 Perform visual, operational checks to BC's, peripheral equipment, interface equipment and other panels.
- .2 Check equipment cooling fans as required.
- .3 Review system performance with Departmental Representative to discuss suggested or required changes.

.5 Major inspections to include, but not limited to:
- .1 Minor inspection.
- .2 Clean OWS(s) peripheral equipment, BC(s), interface and other panels, micro-processor interior and exterior surfaces.
- .3 Check signal, voltage and system isolation of BC(s), peripherals, interface and other panels.
- .4 Verify calibration/accuracy of each input and output device and recalibrate or replace as required.
- .5 Run system software diagnostics as required.
- .6 Install software and firmware enhancements to ensure components are operating at most current revision for maximum capability and reliability.
  - .1 Perform network analysis and provide report as described in Submittal article.

.6 Rectify deficiencies revealed by maintenance inspections and environmental checks.

.7 Continue system debugging and optimization.

.8 Testing/verification of occupancy and seasonal-sensitive systems to take place during four (4) consecutive seasons, after facility has been accepted, taken over and fully occupied.
- .1 Test weather-sensitive systems twice: first at near winter design conditions and secondly under near summer design conditions.

END OF SECTION

1 General

1.1 SUMMARY

.1 Section Includes:
- .1 System requirements for Local Area Network (LAN) for Building Energy Monitoring and Control System (EMCS).

1.2 REFERENCES

.1 Canadian Standards Association (CSA International).
- .1 CSA T529-95(R2000), Telecommunications Cabling Systems in Commercial Buildings (Adopted ANSI/TIA/EIA-568-A with modifications).
- .2 CSA T530-99(R2004), Commercial Building Standard for Telecommunications Pathways and Spaces (Adopted ANSI/TIA/EIA-569-A with modifications).

.2 Institute of Electrical and Electronics Engineers (IEEE)/Standard for Information technology - Telecommunications and information exchange between systems - Local and metropolitan area networks - Specific requirements.
- .1 IEEE Std 802.3™-2002, Part 3: Carrier sense multiple access with collision detection (CSMA/CD) access method and physical layer specifications.

.3 Telecommunications Industries Association (TIA)/Electronic Industries Alliance (EIA)
- .1 TIA/EIA-568-March 2004, Commercial Building Telecommunications Cabling Standards Set, Part 1 General Requirements Part 2 Balanced Twisted-Pair Cabling Components Part 3 Optical Fiber Cabling Components Standard.
- .2 TIA/EIA-569-A-December 2001, Commercial Building Standard for Telecommunications Pathways and Spaces.

.4 Treasury Board Information Technology Standard (TBITS).
- .1 TBITS 6.9-2000, Profile for the Telecommunications Wiring System in Government Owned and Leased Buildings - Technical Specifications.

1.3 DEFINITIONS

.1 Acronyms and definitions: refer to Section 25 05 01 - EMCS - General Requirements.

1.4 SYSTEM DESCRIPTION

.1 Data communication network to link Operator Workstations and Master Control Units (MCU) in accordance with CSA T529, TIA/EIA-568, CSA T530, TIA/EIA-569-A and TBITS 6.9.
- .1 Provide reliable and secure connectivity of adequate performance between different sections (segments) of network.
- .2 Allow for future expansion of network, with selection of networking technology and communication protocols.

.2 Data communication network to include, but not limited to:
- .1 EMCS-LAN.
- .2 Network interface cards.
- .3 Network management hardware and software.
- .4 Network components necessary for complete network.

1.5 DESIGN REQUIREMENTS

.1 EMCS Local Area Network (EMCS-LAN).
- .1 High speed, high performance, local area network over which MCUs and OWSs communicate with each other directly on peer to peer basis in accordance with IEEE 802.3/Ethernet Standard.
- .2 EMCS-LAN to: Proprietary Protocol.
- .3 Each EMCS-LAN to be capable of supporting at least 50 devices.
- .4 Support of combination of MCUs and OWSs directly connected to EMCS-LAN.
- .5 High speed data transfer rates for alarm reporting, quick report generation from multiple controllers, upload/download information between network devices. Bit rate to be 10 Megabits per second minimum.
- .6 Detection and accommodation of single or multiple failures of either OWSs, MCUs or network media. Operational equipment to continue to perform designated functions effectively in event of single or multiple failures.
- .7 Commonly available, multiple sourced, networking components and protocols to allow system to co-exist with other networking applications including office automation.

.2 Dynamic Data Access.
- .1 LAN to provide capabilities for OWSs, either network resident or connected remotely, to access point status and application report data or execute control functions for other devices via LAN.
- .2 Access to data to be based upon logical identification of building equipment.

.3 Network Medium.
- .1 Network medium: shielded twisted cable, or fibre optic cable compatible with network protocol to be used within buildings.

2 Products

2.1 NOT USED

.1 Not Used.

3 Execution

3.1 NOT USED

.1 Not Used.

END OF SECTION

1 General

1.1 SUMMARY

.1 Section Includes:

.1 Hardware and software requirements for an Operator Work Station (OWS) in a Building Energy Monitoring and Control System (EMCS), including primary, secondary, portable and remote OWS's.

1.2 DEFINITIONS

.1 Acronyms and definitions: refer to Section 25 05 01 - EMCS: General Requirements.

.2 Secondary OWS: serves as backup to primary OWS, is storage and retrieval facility of soft copy of as-built contractor supplied data as described in Section 25 05 03 - EMCS: Project Record Documents.

.3 Portable OWS: used as remote dial-up OWS with same capabilities as primary OWS including graphic display.

.4 Remote Auxiliary OWS: performs identical user interface functions as primary OWS.

1.3 SUBMITTALS

.1 Make submittals in accordance with Section 25 05 02 - EMCS: Shop Drawings, Product Data and Review Process.

2 Products

2.1 OPERATOR WORK STATION

.1 The Operator Workstations (OWS) shall provide the primary means of operator communication with the Controls Systems and shall be used for monitoring, operations, management, audit, reporting and other related functions. The OWS shall comprise PC and related facilities that have as their primary function the Operator Interface functionality.

.2 The OWS shall be provided by Others (Not In Contract) due to infrastructure requirements. Controls contractor shall provide recommended requirements for Operator Workstations (OWS) to Departmental Representative and coordinate with Departmental Representative to ensure Work Station is delivered to site with the correct requirements and appropriate time in the project schedule.

.3 The OWS shall be provided with all required and installed operating system (as recommended by Controls Contractor). Application specific software and database support facilities, including the associated original manufacturer software licenses, shall be part of the base work and price of the Controls Contract. All software shall be to the original manufacturer’s latest revision level at the time of delivery to Project site. Controls contractor to load all required application specific software and utilities onto OWS. Software shall comprise the latest versions available at the time of delivery of the OWS.

.4 Transfer all Controls Systems software licenses to the Owner, at no additional cost to the Owner, before the time of acceptance for the Work.

.5 The Controls Contractor will use the OWS and associated equipment as necessary for the purposes of setting up, calibrating and verifying the Work. This equipment and facilities shall be delivered to site into the care of the Controls Contractor. The Controls Contractor shall install the OWS as late as is feasible in the scheduling of the Work.

2.2 PORTABLE OPERATORS' TERMINAL:

.1 The Portable Terminal (PT) shall communicate with all controllers via an RS232C connection. Through the PT, operators shall be able to view points and change parameters on any controller from any unit on the Level 2 communication bus.

.2 Provide one portable terminal (PT) pocket PC or laptop for connection to any controller or networking communications unit/peer line bridge (PLB) in the system. The PT terminal shall comprise a portable computer, QWERTY keyboard and display with 40 characters x 25 lines minimum or 40 characters x 8 lines with a movable window to allow viewing of all 25 lines.

.3 The operator's name and password will require to be entered before access to the system is granted.

.4 For auditing purposes the operator logging in or out of the system shall be recorded at the workstation. Logging in will require the operator's name (up to 15 characters) and individual password (4 to 10 characters). Three access levels will be provided:

1. Level 1 - read values and parameters only.
2. Level 2 - as Level 1, plus alter values and parameters, e.g. output and inputs may be preset to aid commissioning.
3. Level 3 - as Level 2, plus alter installation configuration parameters.

.5 Any alterations made will be up-line loaded to the workstation after receipt of a command from the workstation.

.6 If no entries are made in a preset programmable time, the operator will automatically be logged off.

.7 It shall be possible to access data from any other RPU on the peer network that the PT is plugged into.

3 Execution

3.1 NOT USED

END OF SECTION

1 General

1.1 SUMMARY

.1 Section Includes:
- .1 Materials and installation for building automation controllers including:
  - .1 Master Control Unit (MCU).
  - .2 Local Control Unit (LCU).
  - .3 Equipment Control Unit (ECU).
  - .4 Terminal Control Unit (TCU).

1.2 REFERENCES

.1 American Society of Heating, Refrigeration and Air-Conditioning Engineers, Inc. (ASHRAE).
- .1 ASHRAE 2003, Applications Handbook, SI Edition.

.2 Canadian Standards Association (CSA International).
- .1 C22.2 No.205-M1983 (R1999), Signal Equipment.

.3 Institute of Electrical and Electronics Engineers (IEEE).
- .1 IEEE C37.90.1-02, Surge Withstand Capabilities (SWC) Tests for Relays and Relay Systems Associated with Electric Power Apparatus.

1.3 DEFINITIONS

.1 Acronyms and definitions: refer to Section 25 05 01 - EMCS: General Requirements.

1.4 SYSTEM DESCRIPTION

.1 General: Network of controllers comprising of MCU('s), LCU('s), ECU('s) or TCU('s) to be provided 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 Controller quantity, and point contents to be reviewed and approved by Consultant at time of preliminary design review. Any approval does not negate the Contractors duty to fulfill the requirements of the Contract.

.2 Controllers: stand-alone intelligent Control Units.
- .1 Incorporate programmable microprocessor, non-volatile program memory, RAM, power supplies, as required to perform specified functions.
- .2 Incorporate communication interface ports for communication to LANs to exchange information with other Controllers.
- .3 Capable of interfacing with operator interface device.
- .4 Execute its logic and control using primary inputs and outputs connected directly to its onboard input/output field terminations or slave devices, and without need to interact with other controller. Secondary input used for reset such as outdoor air temperature may be located in other Controller(s).
  - .1 Secondary input used for reset such as outdoor air temperature may be located in other Controller(s).

.3 Interface to include provisions for use of dial-up modem for interconnection with remote modem.
- .1 Dial-up communications to use 56 Kbit modems and voice grade telephone lines.
- .2 Each stand-alone panel may have its own modem or group of stand-alone panels may share modem.

1.5 DESIGN REQUIREMENTS

.1 To include:
- .1 Scanning of AI and DI connected inputs for detection of change of value and processing detection of alarm conditions.

.2 Perform On-Off digital control of connected points, including resulting required states generated through programmable logic output.
.3 Perform Analog control using programmable logic, (including PID) with adjustable dead bands and deviation alarms.
.4 Control of systems as described in sequence of operations.
.5 Execution of optimization routines as listed in this section.

.2 Total spare capacity for MCUs and LCUs: at least 25 % of each point type distributed throughout the MCUs and LCUs.

.3 Field Termination and Interface Devices:
.1 To: CSA C22.2 No.205.
.2 Electronically interface sensors and control devices to processor unit.
.3 Include, but not be limited to, following:
.1 Programmed firmware or logic circuits to meet functional and technical requirements.
.2 Power supplies for operation of logics devices and associated field equipment.
.3 Lockable wall cabinet.
.4 Required communications equipment and wiring (if remote units).
.5 Leave controlled system in "fail-safe" mode in event of loss of communication with, or failure of, processor unit.
.6 Input Output interface to accept as minimum AI, AO, DI, DO functions as specified.
.7 Wiring terminations: use conveniently located screw type or spade lug terminals.
.4 AI interface equipment to:
.1 Convert analog signals to digital format with 10 bit analog-to-digital resolution.
.2 Provide for following input signal types and ranges:
.1 4 - 20 mA;
.2 0 - 10 V DC;
.3 100/1000 ohm RTD input;
.3 Meet IEEE C37.90.1 surge withstand capability.
.4 Have common mode signal rejection greater than 60 dB to 60 Hz.
.5 Where required, dropping resistors to be certified precision devices which complement accuracy of sensor and transmitter range specified.
.5 AO interface equipment:
.1 Convert digital data from controller processor to acceptable analog output signals using 8 bit digital-to-analog resolution.
.2 Provide for following output signal types and ranges:
.1 4 - 20 mA.
.2 0 - 10 V DC.
.3 Meet IEEE C37.90.1 surge withstand capability.
.6 DI interface equipment:
.1 Able to reliably detect contact change of sensed field contact and transmit condition to controller.
.2 Meet IEEE C37.90.1 surge withstand capability.
.3 Accept pulsed inputs up to 2 kHz.
.7 DO interface equipment:
.1 Respond to controller processor output, switch respective outputs. Each DO hardware to be capable of switching up to 0.5 amps at 24 V AC.
.2 Switch up to 5 amps at 220 V AC using optional interface relay.

.4 Controllers and associated hardware and software: operate in conditions of 0 degrees C to 44 degrees C and 20 % to 90 % non-condensing RH.

.5 Controllers (MCU, LCU): mount in wall mounted cabinet with hinged, keyed-alike locked door.
.1 Provide for conduit entrance from top, bottom or sides of panel.

.2 ECUs and TCUs to be mounted in equipment enclosures or separate enclosures.
.3 Mounting details as approved by Consultant for ceiling mounting.

.6 Cabinets to provide protection from water dripping from above, while allowing sufficient airflow to prevent internal overheating.

.7 Provide surge and low voltage protection for interconnecting wiring connections.

1.6 MAINTENANCE PROCEDURES

.1 Provide manufacturers recommended maintenance procedures for insertion in Operation and Maintenance Manuals.

2 Products

2.1 MASTER CONTROL UNIT (MCU)

.1 General: primary function of MCU is to provide co-ordination and supervision of subordinate devices in execution of optimization routines such as demand limiting or enthalpy control.

.2 Include high speed communication LAN Port for Peer to Peer communications with OWS(s) and other MCU level devices.
.1 MCU must support Proprietary Protocol.

.3 MCU local I/O capacity as follows:
.1 MCU I/O points as allocated in I/O Summary Table referenced in MD13800.
.2 LCUs may be added to support system functions.

.4 Central Processing Unit (CPU).
.1 Processor to consist of minimum 16 bit microprocessor capable of supporting software to meet specified requirements.
.2 CPU idle time to be more than 30 % when system configured to maximum input and output with worst case program use.
.3 Minimum addressable memory to be at manufacturer's discretion but to support at least performance and technical specifications to include but not limited to:
.1 Non-volatile EEPROM to contain operating system, executive, application, sub-routine, other configurations definition software. Tape media not acceptable.
.2 Battery backed (72 hour minimum capacity) RAM (to reduce the need to reload operating data in event of power failure) to contain CDLs, application parameters, operating data or software that is required to be modifiable from operational standpoint such as schedules, setpoints, alarm limits, PID constants and CDL and hence modifiable on-line through operator panel or remote operator's interface. RAM to be downline loadable from OWS.
.4 Include uninterruptible clock accurate to plus or minus 5 secs/month, capable of deriving year/month/day/hour/minute/second, with rechargeable batteries for minimum 72 hour operation in event of power failure.
.5 Local Operator Terminal (OT): Provide OT for each MCU
.1 Mount access/display panel in MCU or in suitable enclosure beside MCU as approved by Consultant.
.2 Support operator's terminal for local command entry, instantaneous and historical data display, programs, additions and modifications.
.3 Display simultaneously minimum of 16 point identifiers to allow operator to view single screen dynamic displays depicting entire mechanical systems. Point identifiers to be in English.
.4 Functions to include, but not be limited to, following:
.1 Start and stop points.
.2 Modify setpoints.

.3 Modify PID loop parameters.
.4 Override PID control.
.5 Change time/date.
.6 Add/modify/start/stop weekly scheduling.
.7 Add/modify setpoint weekly scheduling.
.8 Enter temporary override schedules.
.9 Define holiday schedules.
.10 View analog limits.
.11 Enter/modify analog warning limits.
.12 Enter/modify analog alarm limits.
.13 Enter/modify analog differentials.

.6 Provide access to real and calculated points in controller to which it is connected or to other controller in network. This capability not to be restricted to subset of predefined "global points" but to provide totally open exchange of data between OT and other controller in network.

.7 Operator access to OTs: same as OWS user password and password changes to automatically be downloaded to controllers on network.

.8 Provide prompting to eliminate need for user to remember command format or point names. Prompting to be consistent with user's password clearance and types of points displayed to eliminate possibility of operator error.

.9 Identity of real or calculated points to be consistent with network devices. Use same point identifier as at OWS's for access of points at OT to eliminate cross-reference or look-up tables.

2.2 LOCAL CONTROL UNIT (LCU)

.1 Provide multiple control functions for typical built-up and package HVAC systems, hydronic systems and electrical systems.

.2 Minimum of 16 I/O points of which minimum be 4 AOs, 4 AIs, 4 DIs, 4 DOs.

.3 Points integral to one Building System to be resident on only one controller.

.4 Microprocessor capable of supporting necessary software and hardware to meet specified requirements as listed in previous MCU article with following additions:
.1 Include minimum 2 interface ports for connection of local computer terminal.
.2 Design so that shorts, opens or grounds on input or output will not interfere with other input or output signals.
.3 Physically separate line voltage (70V and over) circuits from DC logic circuits to permit maintenance on either circuit with minimum hazards to technician and equipment.
.4 Include power supplies for operation of LCU and associated field equipment.

.5 In event of loss of communications with, or failure of, MCU, LCU to continue to perform control. Controllers that use defaults or fail to open or close positions not acceptable.
.6 Provide conveniently located screw type or spade lug terminals for field wiring.

2.3 TERMINAL/EQUIPMENT CONTROL UNIT (TCU/ECU)

.1 Microprocessor capable of supporting necessary software and hardware to meet TCU/ECU functional specifications.
.1 TCU/ECU definition to be consistent with those defined in ASHRAE HVAC Applications Handbook section 45.

.2 Controller to communicate directly with EMCS through EMCS LAN and provide access from EMCS OWS for setting occupied and unoccupied space temperature setpoints, flow setpoints, and associated alarm values, permit reading of sensor values, field control values (% open) and transmit alarm conditions to EMCS OWS.

.3 VAV Terminal Controller.

.1 Microprocessor based controller with integral flow transducer, including software routines to execute PID algorithms, calculate airflow for integral flow transducer and measure temperatures as per I/O Summary required inputs. Sequence of operation to ASHRAE HVAC Applications Handbook.

.2 Controller(s) to support point definition; in accordance with Sequence of Operation

.3 Controller to operate independent of network in case of communication failure.

.4 Controller to include damper actuator and terminations for input and output sensors and devices.

2.4 LEVELS OF ADDRESS

.1 Upon operator's request, EMCS to present status of any single 'point', 'system' or point group, entire 'area', or entire network on printer or OWS as selected by operator.

.1 Display analog values digitally to 1 place of decimals with negative sign as required.

.2 Update displayed analog values and status when new values received.

.3 Flag points in alarm by blinking, reverse video, different colour, bracketed or other means to differentiate from points not in alarm.

.4 Updates to be change-of-value (COV)-driven or if polled not exceeding 2 second intervals.

2.5 POINT NAME SUPPORT

.1 Controllers (MCU, LCU) to support point naming convention as defined in Section 25 05 01 - EMCS: General Requirements.

3 Execution

3.1 LOCATION

.1 Location of Controllers to be approved by Consultant.

3.2 INSTALLATION

.1 Install Controllers in secure locking enclosures as indicated.

.2 Provide necessary power from local 120V branch circuit panel for equipment.

.3 Install tamper locks on breakers of circuit breaker panel.

.4 Use uninterruptible Power Supply (UPS) and emergency power when equipment must operate in emergency and co-ordinating mode.

END OF SECTION

1 General

1.1 SUMMARY

.1 Section Includes:
  .1 Control devices integral to the Building Energy Monitoring and Control System (EMCS)

1.2 REFERENCES

.1 American National Standards Institute (ANSI).
  .1 ANSI C12.7-1993(R1999), Requirements for Watthour Meter Sockets.
  .2 ANSI/IEEE C57.13-1993, Standard Requirements for Instrument Transformers.
.2 American Society for Testing and Materials International, (ASTM).
  .1 ASTM B148-97(03), Standard Specification for Aluminum-Bronze Sand Castings.
.3 National Electrical Manufacturer's Association (NEMA).
  .1 NEMA 250-03, Enclosures for Electrical Equipment (1000 Volts Maximum).
.4 Air Movement and Control Association, Inc. (AMCA).
  .1 AMCA Standard 500-D-98, Laboratory Method of Testing Dampers For Rating.
.5 Canadian Standards Association (CSA International).
  .1 CSA-C22.1-02, Canadian Electrical Code, Part 1 (19th Edition), Safety Standard for Electrical Installations.

1.3 DEFINITIONS

.1 Acronyms and Definitions: refer to Section 25 05 01 - EMCS: General Requirements.

1.4 SUBMITTALS

.1 Submit shop drawings and manufacturer's installation instructions in accordance with Section 25 05 01 EMCS: General Requirements

1.5 EXISTING CONDITIONS

.1 Cutting and Patching: in accordance with Section 23 05 00 General Mechanical Requirements and Division 1 supplemented as specified herein.

.2 Repair surfaces damaged during execution of Work.

2 Products

2.1 GENERAL

.1 Control devices of each category to be of same type and manufacturer.

.2 External trim materials to be corrosion resistant. Internal parts to be assembled in watertight, shockproof, vibration-proof, heat resistant, assembly.

.3 Operating conditions: 0 - 32 degrees C with 10 - 90% RH (non-condensing) unless otherwise specified.

.4 Terminations: use standard conduit box with slot screwdriver compression connector block unless otherwise specified.

.5 Transmitters and sensors to be unaffected by external transmitters including walkie talkies.

.6 Account for hysteresis, relaxation time, maximum and minimum limits in applications of sensors and controls.

.7 Outdoor installations: use weatherproof construction in NEMA 4 enclosures.

.8 Devices installed in user occupied space not exceed Noise Criteria (NC) of 35. Noise generated by any device must not be detectable above space ambient conditions.

.9 Range: including temperature, humidity, pressure, as required to accomplish Sequence of Operation.

2.2 TEMPERATURE SENSORS

.1 General: except for room sensors to be resistance or thermocouple type to following requirements:
- .1 Thermocouples: limit to temperature range of 200 degrees C and over.
- .2 RTD's: 1000 ohm at 0 degrees C (plus or minus 0.2 ohms) platinum element or better with strain minimizing construction, 3 integral anchored leadwires. Coefficient of resistivity: 0.00385 ohms/ohm degrees C.
- .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 deg.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.
- .7 Analog temperature sensors shall provide an output signal that varies continuously with the sensed temperature, within a specified range.
- .8 Binary temperature sensors shall provide an output signal that is either on or off depending upon whether the sensed temperature is above or below the setpoint temperature.

.2 Room temperature sensors and display wall modules.
- .1 Temperature sensing and display wall module.
  - .1 LCD display to show space temperature ed and temperature setpoint.
  - .2 Buttons for occupant selection of temperature setpoint and occupied/ unoccupied mode.
  - .3 Jack connection for plugging in laptop personal computer and contractor supplied zone terminal unit for access to zone bus.
  - .4 Integral thermistor sensing element 10,000 ohm at 24 degrees.
  - .5 Accuracy 0.2 degrees C over range of 0 to 70 degrees C.
  - .6 Stability 0.02 degrees C drift per year.
  - .7 Separate mounting base for ease of installation.
- .2 Room temperature sensors.
  - .1 Wall mounting, in slotted type covers having brushed aluminum finish, with guard as indicated.
  - .2 Element 10-50mm long RTD with ceramic tube or equivalent protection or thermistor, 10,000 ohm, accuracy of plus or minus 0.2 degrees C.

.3 Duct temperature sensors:
- .1 General purpose duct type: suitable for insertion into ducts at various orientations, insertion length 460 mm and complete with moisture resistant transmitter.

.2 Averaging duct type: incorporates numerous sensors inside assembly which are averaged to provide one reading. Minimum insertion length 6000 mm. Bend probe at field installation time to 100 mm radius at point along probe without degradation of performance. The output shall be compatible with the panel it serves. The sensing element shall be of sufficient length to provide a minimum of one (1) foot of element for every two (2) square feet of coil area.

.4 Outdoor air temperature 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 NEMA 4 enclosure. Transmitter shall be mounted to minimize building film effects.

.5 Pipe / Tank Temperature Transmitter:

.1 Shall contain an RTD sensing element to monitor water temperature. The Contractor shall provide brass wells of sufficient size for the pipe to be installed. The output shall be compatible with the panel it serves. Transmitter shall be factory calibrated to an accuracy of + 1% over the full range. Immersion element shall be installed complete with heat transfer compound.

.6 Low Limit Thermostats

.1 Shall be of manual reset type, with setpoint adjustment.

.2 The sensing element shall be of sufficient length to provide a minimum of one (1) foot of element for every two (2) square feet of coil area. The element shall run fully across the coil on each pass. When any one foot of the element senses a temperature as low as the setpoint, the thermostat contacts shall open. These shall contain double pole switches for simultaneous remote alarms.

2.3 TEMPERATURE TRANSMITTERS

.1 Requirements:

.1 Input circuit: to accept 3-lead, 1000 ohm at 0 degrees C, platinum resistance detector type sensors.

.2 Power supply: 24 V DC into load of 575 ohms. Power supply effect less than 0.01 degrees C per volt change.

.3 Output signal: 4 - 20 mA into500 ohm maximum load.

.4 Input and output short circuit and open circuit protection.

.5 Output variation: less than 0.2 % of full scale for supply voltage variation of plus or minus 10 %.

.6 Combined non-linearity, repeatability, hysteresis effects: not to exceed plus or minus 0.5 % of full scale output.

.7 Maximum current to 100 or 1000 ohm RTD sensor: not to exceed 25 mA.

.8 Integral zero and span adjustments.

.9 Temperature effects: not to exceed plus or minus 1.0 % of full scale/ 50degrees C.

.10 Long term output drift: not to exceed 0.25 % of full scale/ 6 months.

.11 Transmitter ranges: select narrowest range to suit application from following:

.1 Minus 50 degrees C to plus 50 degrees C, plus or minus 0.5 degrees C.

.2 0 to 100 degrees C, plus or minus 0.5 degrees C.

.3 0 to 50 degrees C, plus or minus 0.25 degrees C.

.4 0 to 25 degrees C, plus or minus 0.1 degrees C.

.5 10 to 35 degrees C, plus or minus 0.25 degrees C.

2.4 HUMIDITY SENSORS

.1 Room or Duct Requirements:
- .1 Range: 5 - 90 % RH minimum.
- .2 Operating temperature range: 0 - 60 degrees C.
- .3 Absolute accuracy:
  - .1 Duct sensors: plus or minus 3 %.
  - .2 Room sensors: plus or minus 2 %.
- .4 Sheath: stainless steel with integral shroud for specified operation in air streams of up to 10 m/s.
- .5 Maximum sensor non-linearity: plus or minus 2% RH with defined curves.
- .6 Room sensors: locate in air stream near RA grille.
- .7 Duct mounted sensors: locate so that sensing element is in air flow in duct.

.2 Outdoor Humidity Requirements:
- .1 Range: 0 - 100 % RH minimum.
- .2 Operating temperature range: -40 - 50 deg C.
- .3 Absolute accuracy: plus or minus 2%.
- .4 Temperature coefficient: plus or minus 0.03%RH/ degrees C over 0 to 50 deg C.
- .5 Must be unaffected by condensation or 100% saturation.
- .6 No routine maintenance or calibration is required.

2.5 HUMIDITY TRANSMITTERS

.1 Requirements:
- .1 Input signal: from RH sensor.
- .2 Output signal: 4 - 20 mA onto 500 ohm maximum load.
- .3 Input and output short circuit and open circuit protection.
- .4 Output variations: not to exceed 0.2 % of full scale output for supply voltage variations of plus or minus 10 %.
- .5 Output linearity error: plus or minus 1.0% maximum of full scale output.
- .6 Integral zero and span adjustment.
- .7 Temperature effect: plus or minus 1.0 % full scale/ 6 months.
- .8 Long term output drift: not to exceed 0.25 % of full scale output/ 6 months.
- .9 Transmitter shall have non-corroding outside weather enclosure.

2.6 PRESSURE TRANSDUCERS

.1 Requirements:
- .1 Combined sensor and transmitter measuring pressure.
  - .1 Internal materials: suitable for continuous contact with industrial standard instrument air, compressed air, water, steam, as applicable.
- .2 Output signal: 4 - 20 mA into 500 ohm maximum load.
- .3 Output variations: less than 0.2 % full scale for supply voltage variations of plus or minus 10 %.
- .4 Combined non-linearity, repeatability, and hysteresis effects: not to exceed plus or minus 0.5 % of full scale output over entire range.
- .5 Temperature effects: not to exceed plus or minus 1.5 % full scale/ 50 degrees C.
- .6 Over-pressure input protection to at least twice rated input pressure.
- .7 Output short circuit and open circuit protection.
- .8 Accuracy: plus or minus 1% of Full Scale.
- .9 Shall be suitable for the media and pressure measured.
- .10 Units shall have temperature compensation so that thermal effects are no more then 0.05% of the full scale from 0 - 175 Deg.F.

2.7 DIFFERENTIAL PRESSURE TRANSMITTERS

.1 Requirements:
- .1 Internal materials: suitable for continuous contact with industrial standard instrument air, compressed air, water, steam, as applicable.
- .2 Output signal: 4 - 20 mA into 500 ohm maximum load.
- .3 Output variations: less than 0.2 % full scale for supply voltage variations of plus or minus 10 %.
- .4 Combined non-linearity, repeatability, and hysteresis effects: not to exceed plus or minus 0.5 % of full scale output over entire range.
- .5 Integral zero and span adjustment.
- .6 Temperature effects: not to exceed plus or minus 1.5 % full scale/ 50 degrees C.
- .7 Over-pressure input protection to at least twice rated input pressure.
- .8 Output short circuit and open circuit protection.
- .9 Unit to have 12.5 mm N.P.T. conduit connection. Enclosure to be integral part of unit.
- .10 Shall be suitable for the media and pressure measured.
- .11 Units shall have temperature compensation so that thermal effects are no more then 0.05% of the full scale from 0 - 175 Deg.F.

.2 Differential Pressure Switch for water shall have a single-pole, single-throw (SPST) contact, adjustable setpoint, UL rated 6 amperes at 120 volts, 100 psig design.

.3 Differential Pressure Switch for air shall have a single-pole, single-throw (SPST) contact, adjustable setpoint, UL rated 9.8 amperes at 120 volts

2.8 STATIC PRESSURE SENSORS

.1 Requirements:
- .1 Multipoint element with self-averaging manifold.
  - .1 Maximum pressure loss: 160 Pa at 10 m/s. (Air stream manifold).
- .2 Accuracy: plus or minus 1 % of actual duct static pressure.

2.9 STATIC PRESSURE TRANSMITTERS

.1 Requirements:
- .1 Output signal: 4 - 20 mA linear into 500 ohm maximum load.
- .2 Calibrated span: not to exceed 150 % of duct static pressure at maximum flow.
- .3 Accuracy: 0.4 % of span.
- .4 Repeatability: within 0.5 % of output.
- .5 Linearity: within 1.5 % of span.
- .6 Deadband or hysteresis: 0.1% of span.
- .7 External exposed zero and span adjustment.
- .8 Unit to have 12.5 mm N.P.T. conduit connection. Enclosure to be integral part of unit

2.10 VELOCITY PRESSURE SENSORS

.1 Requirements:
- .1 Multipoint static and total pressure sensing element with self-averaging manifold with integral air equalizer and straightener section.
- .2 Maximum pressure loss: 37Pa at 1000 m/s.
- .3 Accuracy: plus or minus 1 % of actual duct velocity.

2.11 VELOCITY PRESSURE TRANSMITTERS

.1 Requirements:
- .1 Output signal: 4 - 20 mA linear into 500 ohm maximum load.
- .2 Calibrated span: not to exceed 125 % of duct velocity pressure at maximum flow.
- .3 Accuracy: 0.4 % of span.
- .4 Repeatability: within 0.1 % of output.
- .5 Linearity: within 0.5 % of span.
- .6 Deadband or hysteresis: 0.1% of span.
- .7 External exposed zero and span adjustment.
- .8 Unit to have 12.5 mm N.P.T. conduit connection. Enclosure to be integral part of unit.

2.12 PRESSURE AND DIFFERENTIAL PRESSURE SWITCHES

.1 Requirements:
- .1 Internal materials: suitable for continuous contact with compressed air, water, steam, etc., as applicable.
- .2 Adjustable setpoint and differential.
- .3 Switch: snap action type, rated at 120V, 15 amps AC.
- .4 Switch 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 switches with isolation valve and snubber, where code allows, between sensor and pressure source.
- .7 Switches on steam and high temperature hot water service: provide pigtail syphon.

2.13 TEMPERATURE SWITCHES

.1 Requirements:
- .1 Operate automatically. Reset automatically, except as follows:
  - .1 Low temperature detection: manual reset.
  - .2 High temperature detection: manual reset.
- .2 Adjustable setpoint and differential.
- .3 Accuracy: plus or minus 1degrees C.
- .4 Snap action rating: 120V, 15 amps as required. Switch to be DPST for hardwire and EMCS connections.
- .5 Type as follows:
  - .1 Room: for wall mounting on standard electrical box with protective guard as indicated.
  - .2 Duct, general purpose: insertion length = 460 mm.
  - .3 Thermowell: stainless steel, with compression fitting for NPS 3/4 thermowell. Immersion length: 100 mm.
  - .4 Low temperature detection: continuous element with 6000 mm insertion length, duct mounting, to detect coldest temperature in any 30 mm length.
  - .5 Strap-on: with helical screw stainless steel clamp.

2.14 TANK LEVEL SWITCHES

.1 Requirements:
- .1 Indicate high/low water level and to alarm.

.2 For mounting on top of tank.
.3 Maximum operating temperature: 120 degrees C.
.4 Snap action contacts rated 15 amp at 120 V.
.5 Adjustable setpoint and differential.
.6 Shall include level readout visible to operator at tank.

2.15 SUMP LEVEL SWITCHES

.1 Requirements:
.1 Liquid level activated switch sealed in waterproof and shockproof enclosure.
.2 Complete with float, flexible cord, weight. Instrument casing to be suitable for immersion in measured liquid.
.3 N.O./N.C. Contacts rated at 15 amps at 120V AC. CSA approval for up to 250 volt 10 amps AC.

2.16 AIR PRESSURE GAUGES

.1 Diameter: 38 mm minimum.

.2 Range: zero to two times operating pressure of measured pressure media or nearest standard range.

2.17 ELECTROMECHANICAL RELAYS

.1 Requirements:
.1 Double voltage, DPDT, plug-in type with termination base.
.2 Coils: rated for 120V AC. Other voltage: provide transformer.
.3 Contacts: rated at 5 amps at 120 V AC.
.4 Relay to have visual status indication

2.18 SOLID STATE RELAYS

.1 General:
.1 Relays to be socket or rail mounted.
.2 Relays to have LED Indicator
.3 Input and output Barrier Strips to accept 14 to 28 AWG wire.
.4 Operating temperature range to be -20 degrees C to 70 degrees C.
.5 Relays to be CSA Certified.
.6 Input/output Isolation Voltage to be 4000 VAC at 25 degrees C for 1 second maximum duration.
.7 Operational frequency range, 45 to 65 HZ.

.2 Input:
.1 Control voltage, 3 to 32 VDC.
.2 Drop out voltage, 1.2 VDC.
.3 Maximum input current to match AO (Analog Output) board.

.3 Output.
.1 AC or DC Output Model to suit application.

2.19 CURRENT TRANSDUCERS

.1 Requirements:

.2 Purpose: combined sensor/transducer, to 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 MCC.

.7 Current Sensing Transducers shall be self-powered, solid state with adjustable trip current. Each transducer shall be selected to match the current and voltage of the application. The output shall be compatible with the panel it serves. Each transducer shall include an LED to indicate output status.

2.20 CURRENT SENSING RELAYS

.1 Requirements:
- .1 Suitable to detect belt loss or motor failure.
- .2 Trip point adjustment, output status LED.
- .3 Split core for easy mounting.
- .4 Induced sensor power.
- .5 Relay contacts: capable of handling 0.5 amps at 30 VAC / DC. Output to be NO solid state.
- .6 Suitable for single or 3 phase monitoring. For 3-Phase applications: provide for discrimination between phases.
- .7 Adjustable latch level.

2.21 CONTROL VALVES

.1 Valves shall be sized by the control manufacturer and guaranteed to meet the required capacity. Valve shall be sized to achieve reasonable authority at minimum pressure drop. In general, valve shall have pressure drop equal to pressure drop of controlled device. In general valve shall be line size or one size smaller.

.2 Nominal body rating shall be not less than 125 PSI. However, the valve body and packing selected shall be sized to withstand the system static head plus the maximum pump head and the maximum temperature of the control medium.

.3 Two-way modulating valves shall have close-off ratings exceeding the maximum pressure difference, at any load condition, between the outlet and inlet. Each valve shall be equipped with proper packing to assure there will be no leakage at the valve stem.

.4 Terminal unit two-way control valves shall have equal percentage characteristics. Terminal unit three-way control valves shall have linear flow characteristics.

.5 Physical sizes of valves will be such that they will fit within the physical space provided within equipment enclosures. Verify before ordering materials.

.6 NPS 50mm (2") and under:
- .1 Screwed National Pipe Thread (NPT) tapered female connections.
- .2 Valves to ANSI Class 250, valves to bear ANSI mark.
- .3 Rangeability 50:1minimum.

.7 NPS 64mm (2-1/2") and larger:
- .1 Flanged connections.
- .2 Valves to ANSI Class 150 or 250 as indicated, valves to bear ANSI mark.
- .3 Rangeability 100:1minimum.

.8 Valves are to be provided complete with mounting plate for installation of actuators.

.9 Leakage rate ANSI class IV, 0.01% of full open valve capacity.

2.22 ELECTRONIC / ELECTRIC VALVE AND DAMPER ACTUATORS

.1 Damper and valve operator shall be electric and be provided for each automatic damper or valve and shall be of sufficient capacity to operate the damper or valve under all conditions and to guarantee tight close-off of valves, as specified, against system pressure encountered.

.2 Each central system damper or valve operator shall be provided with spring-return for normally closed or normally open position for fail safe operation to account for fire, low temperatures, or power interruption as indicated or as appropriate.

.3 Valve Actuator Requirements:
- .1 Construction: steel, cast iron, aluminum.
- .2 Control signal: 0-10V DC.
- .3 Positioning time: to suit application. 90 sec maximum.
- .4 Scale or dial indication of actual control valve position.
- .5 Size actuator to meet requirements and performance of control valve specifications.
- .6 For interior and perimeter terminal heating and cooling applications floating control actuators are acceptable.

.4 Damper Actuator Requirements:
- .1 Direct mount proportional type as indicated.
- .2 Operator: size to control dampers against maximum pressure and dynamic closing/opening pressure, whichever is greater.
- .3 Power requirements: 5 VA maximum at 24 V AC.
- .4 Operating range: 0 - 10 V DC or 4 - 20 mA DC.
- .5 For VAV box applications floating control type actuators may be used.
- .6 Damper actuator to drive damper from full open to full closed in less than 120 seconds.
- .7 Damper motors shall be provided with adjustable metal mounting brackets. Damper motor shall be rigidly attached so as not to deflect when operating damper from 0 to 100% position.
- .8 Damper operator arms shall be double yoke linkages with double set screws for fastening to damper shaft.

.9 Damper operators shall be direct drive and equal to those manufactured by Belimo. Provide sufficient quantity of damper operators to provide a minimum of 5 in-lbs of torque for every square foot of damper area.

2.23 PANELS

.1 Free-standing enamelled steel cabinets with hinged and key-locked front door.

.2 Multiple panels as required to handle requirements with additional space to accommodate 25% additional capacity as required by Consultant without adding additional cabinets.

.3 Panels to be lockable with same key.

2.24 WIRING

.1 In accordance with Division 26.

.2 For wiring under 70 volts use FT6 rated wiring where wiring is not run in conduit. Other cases use FT4 wiring.

.3 Wiring must be continuous without joints.

.4 Sizes:
.1 Field wiring to digital device: #18AWG.
.2 Analog input and output: shielded #18 minimum solid copper.

2.25 LOCAL FAN CONTROL BUTTON (Rooms 143, 144, 146, and 147)

.1 Button shall be low voltage, low profile stainless steel push button activation.

.2 Push button shall be mounted on stainless steel plate, mounted flush to wall.

.3 Plate shall be secured with security screws.

.4 Wiring shall route in conduit within concrete wall from inset service box to mechanical room above.

3 Execution

3.1 INSTALLATION

.1 Install equipment, components so that manufacturer's and CSA labels are visible and legible after commissioning is complete.

.2 Install field control devices in accordance with manufacturers recommended methods, procedures and instructions.

.3 Temperature transmitters, humidity transmitters, current-to-pneumatic transducers, solenoid air valves, controllers, relays: install in NEMA I enclosure or as required for specific applications. Provide for electrolytic isolation in cases when dissimilar metals make contact.

.4 Support field-mounted panels, transmitters and sensors on pipe stands or channel brackets.

.5 Fire stopping: provide space for fire stopping in accordance with Division 7 - Firestopping. Maintain fire rating integrity.

.6 Electrical:
- .1 Complete installation in accordance with Division 26.
- .2 Modify existing starters to provide for EMCS as indicated in I/O Summaries and as indicated.
- .3 Terminate wires with screw terminal type connectors suitable for wire size, and number of terminations.
- .4 Install communication wiring in conduit.
  - .1 Provide complete conduit system to link Building Controllers, field panels and OWS(s).
  - .2 Conduit sizes to suit wiring requirements and to allow for future expansion capabilities specified for systems.
  - .3 Maximum conduit fill not to exceed 40%.
  - .4 Design drawings do not show conduit layout.
- .5 Do not run exposed conduits in normally occupied spaces unless otherwise indicated or unless impossible to do otherwise. Consultant to review before starting Work. Wiring in mechanical rooms, wiring in service rooms and exposed wiring must be in conduit.

.7 VAV Terminal Units: supply controls for factory mounting, install field components and adjust as required.
- .1 Air probe, actuator and associated VAV controls.
- .2 Tubing from air probe to dp sensor as well as installation and adjustment of air flow sensors and actuators.
- .3 Co-ordinate air flow adjustments with balancing trade.

3.2 TEMPERATURE and HUMIDITY SENSORS

.1 Stabilize to ensure minimum field adjustments or calibrations.

.2 Readily accessible and adaptable to each type of application to allow for quick easy replacement and servicing without special tools or skills.

.3 Outdoor installation:
- .1 Protect from solar radiation and wind effects by non-corroding shields.
- .2 Install in NEMA 4 enclosures.

.4 Duct installations:
- .1 Do not mount in dead air space.
- .2 Locate within sensor vibration and velocity limits.
- .3 Securely mount extended surface sensor used to sense average temperature.
- .4 Thermally isolate elements from brackets and supports to respond to air temperature only.
- .5 Support sensor element separately from coils, filter racks.

.5 Averaging duct type temperature sensors.
- .1 Install averaging element horizontally across the ductwork starting 300 mm from top of ductwork. Each additional horizontal run to be no more than 300 mm from one above it. Continue until complete cross sectional area of ductwork is covered. Use multiple sensors where single sensor does not meet required coverage.
- .2 Wire multiple sensors in series for low temperature protection applications.
- .3 Wire multiple sensors separately for temperature measurement.

.4 Use software averaging algorithm to derive overall average for control purposes.

.6 Thermowells: install for piping installations.
- .1 Locate well in elbow where pipe diameter is less than well insertion length.
- .2 Thermowell to restrict flow by less than 30%.
- .3 Use thermal conducting paste inside wells.

3.3 PANELS

.1 Arrange for conduit and tubing entry from top, bottom or either side.

.2 Wiring and tubing within panels: locate in trays or individually clipped to back of panel.

.3 Identify wiring and conduit clearly.

3.4 MAGNEHELIC PRESSURE INDICATORS

.1 Install adjacent to fan system static pressure sensor and duct system velocity pressure sensor as reviewed by Consultant.

.2 Locations: as indicated.

3.5 PRESSURE AND DIFFERENTIAL PRESSURE SWITCHES AND SENSORS

.1 Install isolation valve and snubber on sensors between sensor and pressure source where code allows.
- .1 Protect sensing elements on steam and high temperature hot water service with pigtail syphon between valve and sensor.

3.6 I/P TRANSDUCERS

.1 Install air pressure gauge on outlet.

3.7 AIR PRESSURE GAUGES

.1 Install pressure gauges on pneumatic devices, I/P, pilot positioners, motor operators, switches, relays, valves, damper operators, valve actuators.

.2 Install pressure gauge on output of auxiliary cabinet pneumatic devices.

3.8 AIR FLOW MEASURING STATIONS

.1 Protect air flow measuring assembly until cleaning of ducts is completed.

3.9 TESTING AND COMMISSIONING

.1 Calibrate and test field devices for accuracy and performance in accordance with Section 25 01 11 - EMCS: Start-up, Verification and Commissioning.

END OF SECTION

1 General

1.1 SYSTEM DESCRIPTION

.1 This section defines the manner and method by which controls function.

.2 Requirements for each type of control system operation are specified.

.3 Equipment, devices, and system components required for control systems are specified in other Sections.

1.2 SUBMITTALS FOR REVIEW

.1 Division 1: Procedures for submittals.

1.3 SUBMITTALS AT PROJECT CLOSEOUT

.1 Division 1: Submittals for project closeout.

.2 Project Record Documents: Record actual locations of components and set points of controls, including changes to sequences made after submission of shop drawings.

1.4 QUALITY ASSURANCE

.1 Design system under direct supervision of a Professional Engineer experienced in design of this Work and licensed in Canada.

2 Products

2.1 Not Used

3 Execution

3.1 GENERAL DEFINITIONS

.1 Terminal Unit Valve Position: actual or calculated position based on stroke.

.2 Damper Position: actual or calculated position based on stroke. Dampers separating building from exterior shall be complete with end switch to alarm on failure to close.

3.2 ENERGY MANAGEMENT ROUTINES

.1 The Energy Management Routines stated below shall be incorporated under each and every Sequence of Operation to which they apply. Controls Contractor shall write energy management routines into Sequence of Operation submitted for review. This includes, but is not limited to, the following:

- .1 Optimal Start/Stop: To be incorporated for each and every system being scheduled through the EMCS. Optimal start/stop to include recovery time from night setback.
- .2 Night Setback Control: To be incorporated for each and every comfort heating and cooling systems that are operational through unoccupied periods, unless noted otherwise.
- .3 Hot Water Reset: Hot water loop to be reset based on ambient conditions and space demand (indoor/outdoor reset and demand reset).
- .4 Fan Speed/Flow Rate Control: EMCS to control and optimize variable flow rate systems based on demand reset through differential pressure. Differential pressure sensor to be located as shown on drawings.

.5 Night Purge Control: To be incorporated for each and every comfort heating and cooling systems that are operational through unoccupied periods, unless noted otherwise.
.6 Optimized demand control ventilation both on a zone level and system level.
.7 Contractor shall establish actual schedules for all spaces with owner during training.

3.3 FORCE FLOWS

.1 Schedule of Operation:
.1 EMCS shall schedule occupied/unoccupied zone control. Initial schedule shall be as follows:

Occupied Monday to Friday: 7:00 AM to 6:00 PM

.2 Temperature Control:
.1 Units shall be controlled by EMCS.
.2 Wall sensor shall be stainless steel plate sensor with temperature setpoint adjustable from Operation Workstations (OWS).
.3 EMCS shall modulate the three-way or two-way (refer to drawings) heating control valve to suit space setpoint.
.4 EMCS shall sequence the fan operation to energize only on a call for heat. The fan shall continue to operate for 5-minutes (adjustable) after heating valve is fully closed.
.5 Alarm at OWS on low temperature, initially set to 10 Deg.C (adjustable). Ensure alarm delay for vestibules is sufficient to prevent nuisance alarms.
.6 Utilize unoccupied setpoint during unoccupied periods

.3 Operator Work Station: the operator will be able to view and/or modify the following:
.1 Space temperature
.2 Space temperature setpoint
.3 Low temperature alarm setpoint, initially 10 Deg.C.
.4 Fan on/off/alarm.
.5 Valve position.
.6 Unoccupied space temperature setpoint

.4 Alarm Conditions: The following alarms will not shut the system down:
.1 Low temperature alarm: 15 minute delay.

3.4 UNIT HEATERS

.1 Schedule of Operation:
.1 EMCS shall schedule occupied/unoccupied zone control. Initial schedule shall be as follows:

Occupied Monday to Friday: 7:00 AM to 6:00 PM

.2 Temperature Control:
.1 Unit shall be controlled by EMCS.
.2 Space sensor shall be stainless steel plate sensor with temperature setpoint adjustable from Operation Workstations (OWS). Mechanical room and Service Spaces shall have adjustable thermostat.
.3 EMCS shall modulate the three-way or two-way control valve to suit space setpoint. Valve type as indicated on drawings.

.4 EMCS shall sequence the fan operation to energize only on a call for heat. The fan shall continue to operate for 5-minutes after heating valve is fully closed.
.5 Alarm at OWS on low temperature, initially set to 10 Deg.C (adjustable).
.6 Utilize unoccupied setpoint during unoccupied periods.

.3 Operator Work Station: The operator will be able to view and/or modify the following:
- .1 Space temperature
- .2 Space temperature setpoint
- .3 Low temperature alarm setpoint, initially 10 Deg.C.
- .4 Fan on/off/alarm.
- .5 Valve position.
- .6 Unoccupied space temperature setpoint

.4 Alarm Conditions: The following alarms will not shut the system down:
- .1 Low temperature alarm: 15 minute delay.

3.5 AIR HANDLING UNIT AHU-2

.1 Schedule of Operation:
- .1 EMCS shall have ability to schedule occupied/unoccupied control. Initial schedule shall be as follows:
  Occupied 24/7

.2 EMCS shall control detachment ventilation system comprised of air handling unit with hot water heating coil, coil circ pump, supply fan, return fan, and DX cooling and economizer dampers. System to be interlocked with building ERV-1.

.3 Fan Control:
- .1 When system is off (unoccupied schedule), close outside air and relief dampers and open mixed air damper 100%. System shall be on during occupied periods.
- .2 At start, EMCS shall energize the supply fan and return fan. Once flow is established, system shall modulate control dampers to occupied setpoint.
- .3 Supply fan SF-2 speed shall modulate to maintain static pressure setpoint. Control static pressure shall be measured 1200mm from the last VAV box on the index duct run (run with the largest pressure drop, assumed to be VAV-101).
- .4 Return fan RF-2 speed shall track supply fan with flow offset based on ventilation rate supplied from ERV.
- .5 Operation of ERV-1 shall be interlocked with AHU-2.
- .6 EMCS shall monitor high static pressure alarm sensors and alarm and shut down AHU if limits are breached.
- .7 High static pressure sensors shall be located as follows:
  - .1 One in outside air intake duct, upstream from AHU.
  - .2 One in the supply air discharge plenum
- .8 Failure of SF-2 and/or RF-2 shall shut down system and initiate alarm. This will not shut down the ERV exhaust.

.4 Outside Air Control:
- .1 System shall incorporate differential dry-bulb economizer control to increase outside air for free cooling when ambient conditions permit.
- .2 When system is not in economizer mode. The EMCS shall use ERV to maintain ventilation rate matched to building exhaust with 10% pressurization. AHU-2 remote outside air damper and the relief damper shall be closed.
- .3 Remote AHU-2 outside air damper shall be open during free cooling and economizer dampers shall modulate to meet free cooling mixed air temperature.

.5 Temperature Control:
- .1 EMCS shall maintain discharge air temperature based on space demand reset.
- .2 When heating coil is on, discharge air shall be set to 12.2 Deg.C - (54 Deg.F.).

.3 When cooling with economizer air, discharge air temperature shall be permitted to rise to a maximum, initially set to 18 Deg.C. Discharge air shall reset down when a set number of spaces, initially set to 2, cannot maintain temperature.

.6 Economizer Mode:

.1 When mechanical heating is required, system shall operate under minimum ventilation (ERV airflow).

.2 As system enters economizer mode, EMCS shall continue to operate ERV.

.3 In economizer mode, economizer dampers shall modulate to maintain discharge air temperature setpoint until system is on 100% fresh air.

.4 When mechanical cooling is required, the EMCS shall continue to use 100% outside air if the outside air is 1 Deg.C. DB (adjustable) or more below the return air temperature.

.5 When Outside air temperature approaches return Air temperature (less than 1 Deg.C below exhaust air) system shall revert to minimum ventilation.

.6 When outside air rises 1.5 Deg.C. (adjustable) above return air temperature, system shall enable full energy recovery at ERV-1.

.7 Heating Mode:

.1 When discharge air temperature is below setpoint, system shall operate coil pump and modulate three way control valve to maintain discharge air temperature setpoint.

.2 When ambient temperatures fall below low temperature setpoint, initially set to 5 Deg.F. (-15 Deg.C.), the pump shall run continuously regardless of fan operation.

.3 During heating, the DX coil and associated system shall be off.

.8 Cooling Mode:

.1 When discharge air temperature is above setpoint and ambient is above cooling lockout, the DX system comprised of 2 circuits – one variable and one constant, shall operate to maintain discharge air temperature setpoint.

.2 EMCS shall utilize the following staging:

.1 Stage 1: Compressor with HGBP

.2 Stage 2: Turn on second compressor and modulate lead compressor with HGBP.

.3 When in cooling mode the heating coil control valve shall be closed and the pump off.

.9 Protection:

.1 One manually reset low temperature freeze stat located downstream of the heating coil will shut down the fans, close the outside air dampers and modulate heating coil valves to maintain the heating coil discharge air temperature. A second digital sensor shall monitor temperature downstream of heating coil but upstream of cooling coil.

.2 Monitor Relief discharge static pressure and alarm if high static setpoint is reached (Initially set to 1.5 times maximum working pressure. High static alarm shall shut down system

.3 Monitor Outside air intake static pressure and alarm if high negative static setpoint is reached (Initially set to 1.5 times maximum working pressure). High static alarm shall shut down system.

.4 Monitor Supply discharge static pressure and alarm if high static setpoint is reached (Initially set to 1.5 times maximum working pressure. High static alarm shall shut down system.

.10 Operator Work Station: The operator will be able to view and/or modify the following (for each AHU):
- .1 Supply Fan (SF-2): Start, Stop, Speed, Status, Alarm.
- .2 All System damper positions (each damper shall be controlled individually as follows - outside air, Mixed Air Damper, Relief Air Damper, remote outside air damper)
- .3 Freezestat alarm setpoint
- .4 Freezestat temperature (minimum of two sensors, one manual, one digital)
- .5 Supply air discharge air temperature
- .6 Supply air discharge air temperature setpoint (12.2 Deg.C. reset by space demand)
- .7 Pump (P-4) - Start, Stop, Status, Alarm
- .8 Heating Coil control valve (HC-2)
- .9 Heating Coil leaving water temperature
- .10 Heating Coil entering water temperature
- .11 Cooling Coil Circuit 1 –Compressor with HGBP
- .12 Cooling Coil Circuit 2 –Compressor
- .13 Control Static Pressure (located at VAV noted above)
- .14 Control Static Pressure Setpoint
- .15 Return Air Temperature (discharge from fan)
- .16 Mixed Air Temperature (upstream of heating coil)
- .17 Status of ERV.
- .18 Return Fan RF-2: Start, Stop, Speed, Status, Alarm.
- .19 Supply Discharge Static Pressure (after fan, before first potential obstruction)
- .20 Intake Static Pressure (before fan, after intake damper)
- .21 Relief Static Pressure (after fan, before damper)
- .22 Pressure alarm setpoints (all)
- .23 All adjustable setpoints

.11 Alarm Conditions:
- .1 The following system alarms will shut down the system on which the alarm occurs:
  - .1 Freeze stat trip (Mechanical)- manual reset, initial setpoint 3 Deg.C., 5 minute delay
  - .2 Supply Fan failure
  - .3 Return Fan failure
  - .4 High Negative Static on intake
  - .5 Failure of coil circ pump when outside air temperature is below -20 Deg.C.
  - .6 High Relief static pressure
  - .7 High supply air static pressure
- .2 The following system alarms will not shut down the system on which the alarm occurs:
  - .1 Failure of coil circ pump when outside air temperature is above -20 Deg.C.
  - .2 Failure of ERV, if ERV fails system shall open remote O/A damper, and use the economizer outside air damper, mixed air damper and relief damper to maintain an adjustable mixed air temperature initially set to 10 Deg.C.

3.6 AIR HANDLING UNIT AHU-1

.1 Schedule of Operation:
- .1 EMCS shall have ability to schedule occupied/unoccupied control. Initial schedule shall be as follows:
  Occupied 24/7

.2 EMCS shall control ventilation system comprised of air handling unit with hot water heating coil, coil circ pump, supply fan, DX cooling, exhaust fan, integral energy recovery wheel (ERW), and dampers.

.3 Space Temperature Control:

.1 Wall sensor to be an adjustable sensor complete with occupancy override. Provide plexiglass tamper resistant cover with key access.

.2 Adjustable sensors shall have a midpoint setpoint with a space adjustable slider to increase and decrease setpoint by an operator adjustable amount, initially set to 1.5 Deg.C. The midpoint shall reset between an adjustable summer setpoint, initially set to 24 Deg.C. and an adjustable winter setpoint, initially set to 18 Deg.C. Reset shall be based on the following:

Outdoor Temperature	Setpoint
28 Deg.C. and above	Summer Setpoint (24 Deg. C.)
16 Deg.C. and below	Winter Setpoint (18 Deg.C.)

.3 During unoccupied periods, EMCS shall control heating to unnoccupied setpoint. Cooling shall be disabled. Optimum start shall ensure space is at setpoint prior to next scheduled occupied period.

.4 Fan Control:

.1 When system is off (unoccupied schedule), close outside air and exhaust dampers. System shall be on during occupied periods.

.2 At start, EMCS shall open dampers and once proven shall start the supply fan and exhaust fan.

.3 Supply fan SF-1 speed shall modulate to maintain constant airflow (determined on site with Air Balancer).

.4 Exhaust fan RF-1 speed shall modulate to maintain constant airflow (determined on site with Air Balancer).

.5 EMCS shall monitor high static pressure alarm sensors and alarm and shut down AHU if limits are breached.

.6 High static pressure sensors shall be located as follows:

.1 One in outside air intake duct, upstream of AHU.

.2 One in the supply air discharge plenum

.3 One on exhaust discharge.

.7 Failure of SF-1 or RF-1 shall shut down system and initiate alarm.

.5 Outside Air Control:

.1 System is 100% fresh air.

.2 EMCS shall utilize ERW when outside air temperature is not suitable to meet space requirements (i.e. mechanical heating or cooling is required) with a dead band of plus/minus 1.5 deg.C. Deadband is measured as difference between outside air temperature and return air temperature. In cooling ERW shall be used if return air is 1.5 Deg.C below outside air temperature. In heating ERW shall be used if return air is 1.5 Deg.C above outside air temperature.

.3 ERW shall be denergized when not required for tempering.

.6 Discharge Temperature Control:

.1 EMCS shall maintain discharge air temperature based on space demand reset.

.2 When heating space, discharge air temperature shall reset up to meet space setpoint with a maximum limit of 32.2 Deg.C. (90 Deg.F.).

.3 When mechanical cooling, discharge air temperature setpoint shall reset down to a minimum of 12.2 Deg.C.

.7 Economizer Mode:

.1 Unit operates at 100% fresh air.

.8 Heating Mode:

.1 When discharge air temperature is below setpoint, system shall operate coil pump and modulate three way control valve to maintain discharge air temperature setpoint.

.2 When ambient temperatures fall below low temperature setpoint, initially set to 5 Deg.F. (-15 Deg.C.), the pump shall run continuously regardless of fan operation.

.3 During heating, the DX cooling coil and associated system shall be off.

.9 Cooling Mode:

.1 When discharge air temperature is above setpoint and ambient is above cooling lockout, the DX system comprised of 2 circuits – one variable and one constant, shall operate to maintain discharge air temperature setpoint.

.2 EMCS shall utilize the following staging:

.1 Stage 1: Compressor with HGBP

.2 Stage 2: Turn on second compressor and modulate lead compressor with HGBP.

.3 When in cooling mode the heating coil control valve shall be closed and the pump off.

.10 Defrost Control:

.1 During energy recovery operation, EMCS shall modulate heat wheel to prevent formation of frost in accordance with requirements of Manufacturer during cold weather operation. Wheel shall slow down to meet defrost limits and if limit cannot be maintained at minimum speed, wheel shall turn off until outside air temperature rises 5 Deg.C (adjustable)

.11 Protection:

.1 One manually reset low temperature freeze stat located downstream of the heating coil will shut down the fans, close the outside air dampers and modulate heating coil valves to maintain the heating coil discharge air temperature. A second digital sensor shall monitor temperature downstream of heating coil but upstream of cooling coil.

.2 Monitor Exhaust discharge static pressure and alarm if high static setpoint is reached (Initially set to 1.5 times maximum working pressure. High static alarm shall shut down system

.3 Monitor Outside air intake static pressure and alarm if high negative static setpoint is reached (Initially set to 1.5 times maximum working pressure). High static alarm shall shut down system.

.4 Monitor Supply discharge static pressure and alarm if high static setpoint is reached (Initially set to 1.5 times maximum working pressure. High static alarm shall shut down system.

.12 Operator Work Station: The operator will be able to view and/or modify the following:

.1 Supply Fan (SF-1): Start, Stop, Speed, Status, Alarm.

.2 All System damper positions (each damper shall be controlled individually as follows - outside air damper, Exhaust Air Damper)

.3 Freezestat alarm setpoint

.4 Freezestat temperature (minimum of two sensors, one manual, one digital)

.5 Supply air discharge air temperature

.6 Supply air discharge air temperature setpoint (reset by space demand)

.7 Pump (P-3) - Start, Stop, Status, Alarm

.8 Heating Coil control valve (HC-1)

.9 Heating Coil leaving water temperature

.10 Heating Coil entering water temperature

.11 Cooling Coil Circuit 1 – On/Off Compressor with HGPB

.12 Cooling Coil Circuit 2 – On/Off Compressor

.13 Return Air Temperature (upstream of ERW, exhaust side)

.14 Exhaust Air Temperature (upstream of exhaust fan, downstream of ERW)

.15 Outside Air Temperature (Upstream of ERW, Supply side)

.16 Recovered Air Temperature (upstream of heating/cooling coil, downstream of ERW)
.17 Exhaust Fan RF-1: Start, Stop, Status, Alarm, Speed.
.18 Space temperature
.19 Space temperature median setpoint
.20 Space Temperature occupancy offset
.21 Temperature sensor occupancy adjustment limits for thermostat.
.22 Space low temperature alarm, initially set to 15 Deg.C.
.23 ERW Start, Stop, Status, Speed, Alarm
.24 ERW Defrost modulating control.
.25 Supply Discharge Static Pressure (after fan, before first potential obstruction)
.26 Intake Static Pressure (before fan, after intake damper)
.27 Relief Static Pressure (after fan, before damper)
.28 Pressure alarm setpoints (all)
.29 All adjustable setpoints

.13 Alarm Conditions:
.1 The following system alarms will shut down the system on which the alarm occurs:
.1 Freeze stat trip (Mechanical)- manual reset, initial setpoint 3 Deg.C, 5 minute delay
.2 Supply Fan failure
.3 Return Fan failure
.4 High Negative Static on intake
.5 Failure of coil circ pump when outside air temperature is below -20 Deg.C.
.6 High Relief static pressure
.7 High supply air static pressure
.2 The following system alarms will not shut down the system on which the alarm occurs:
.1 Failure of coil circ pump when outside air temperature is above -20 Deg.C.
.2 Failure of ERW, if ERW fails system shall continue to operate

3.7 BUILDING ENERGY RECOVERY VENTILATOR (ERV-1)

.1 Schedule of Operation:
.1 EMCS shall interface with the on board controller (BacNet or LonWorks - coordinate with supplier) to interlock ERV to AHU-2

.2 EMCS contractor responsible to install and wire field sensors and devices including temperature sensors (sensors supplied by manufacturer).

.3 Fan Control:
.1 EMCS to schedule start/stop of unit. ERV shall operate when AHU-2 is operating.
.2 At start, on board controller shall start the supply fan and exhaust fan.
.4 On board controller shall operate ERV fans when AHU-2 is in economizer mode but shall stop wheel.
.5 On board controller shall control Exhaust fan
.6 On board controller shall control Outside Air Fan.
.7 EMCS shall monitor high static pressure alarm sensors and alarm and shut down ERV if limits are breached.

.5 High static pressure sensors shall be located as follows:
.1 One in outside air intake duct, upstream from ERV.

.6 Defrost Control:
.1 During energy recovery operation, the on board controller shall modulate ERV system operation to prevent formation of frost.

.7 Energy Recovery Control
- .1 On board controller shall operate wheel based on control signal from EMCS.
- .2 During heating, energy recovery rate shall decrease to maintain desired mixed air temperature at AHU when ERV discharge air temperature begins to approach desired mixed air temperature.
- .3 During heating, when ERV cannot decrease energy transfer rate further, ERV shall shut off and AHU revert to economizer mode.
- .4 EMCS shall enable full recovery during mechanical cooling (refer to AHU-2 sequence).
- .5 Defrost control shall be by on-board controller.

.8 Protection:
- .1 EMCS shall monitor Outside air intake static pressure and alarm if high negative static setpoint is reached (Initially set to 1.5 times maximum working pressure). High static alarm shall shut down system.

.9 Operator Work Station: The operator will be able to view and/or modify the following:
- .1 ERV-1: Start, Stop, Status, Alarm (alarm to be from on board controller)
- .2 SF-3: Speed, Status, Alarm (to be controlled from on board controller)
- .3 EF-9: Speed, Status, Alarm (to be controlled from on board controller)
- .4 Outside air intake static pressure
- .5 Outside air intake static pressure alarm setpoint
- .6 The on-board controller shall provide the following for display on the operator work station: ERV supply air discharge air temperature, ERV exhaust air discharge temperature (after exhaust fan), ERV exhaust air intake temperature (before ERV core), Outside Air Temperature (before core), ERV Alarm, ERV Fault.
- .7 Outside Air Temperature
- .8 Supply Air Temperature to AHU-2
- .9 Exhaust Air Temperature (from building, before wheel)
- .10 Exhaust Air Temperature (leaving ERV, after wheel)
- .11 EMCS shall provide Running Total of Calculated Energy Saving based on Exhaust airflow rate and differential temperature across exhaust side of core. Exhaust airflow rate shall be determined for each system in conjunction with air balancer.
- .12 Wheel Enable
- .13 Desired wheel speed (from EMCS)
- .14 Actual wheel speed (from on board controller)

.10 Alarm Conditions:
- .1 The following system alarms will shut down the ERV, note that AHU-2 shall remain operating:
  - .1 Exhaust Fan failure
- .2 The following system alarms will not shut down the ERV, note that AHU-2 shall remain operating:
  - .1 Supply Fan fan failure (wheel will stop, EF will continued to operate)
  - .2 High Negative Static on outside air intake (wheel will stop, EF will continued to operate)

3.8 HEATING PLANT

.1 Schedule of Operation:
- .1 An EMCS adjustable summer/winter flag shall enable and disable the heating plant based on date.
- .2 The EMCS shall enable the heating plant any time the ambient temperature falls below an operator adjustable low temperature setpoint, initially set to 15 Deg.C.

.2 Boiler Control:

.1 The EMCS shall interface to Boiler Plant Controller provided by boiler manufacturer. EMCS contractor to mount and wire Boiler Controller and coordinate tuning and commissioning with boiler manufacturer.

.2 EMCS shall provide Boiler Plant Control with primary pump status.

.3 EMCS shall provide to Boiler Plant Controller the HWS temperature setpoint. HWS setpoint shall reset based on outside air, initially set as follows:

Outdoor Temperature	Heating Water Supply Temperature
5 Deg.C. and above	110 Deg.F. (43.3 Deg.C.)
at -20 Deg.C	160 Deg.F. (71.1 Deg.C.)

.4 Provide wiring for all boiler controls and safeties.

.5 Boiler Controller to provide to EMCS the following information:

.1 Boiler starts per boiler.

.2 Boiler run time per boiler

.3 Boiler Isolation valve position per boiler.

.4 Plant By-pass valve position (if required)

.5 Boiler status.

.6 Boiler firing rate per boiler.

.7 Alarms including type of alarm.

.8 Temperature in and out of each boiler.

.6 Boiler plant controller to optimize condensing through boiler sequencing. Boiler sequencing shall ensure that over cycling of boilers is minimized. On initial call for heat, a boiler shall fire for a minimum time period at minimum fire (time period to be determined on site to ensure adequate operating time while maintaining water temperature at boiler below system max temperature, this will cause system to overshoot setpoint). Boiler shall be sequenced to prevent over cycling i.e. second boiler shall not be engaged until first boiler is firing at three times the minimum firing rate. Boilers shall unload when boilers reach minimum firing rate.

.7 When no boilers are operational, the Plant by-pass valve shall be open. By-pass valve shall open following boiler post operation purge. Final boiler isolation valve shall not close until by-pass valve is open.

.8 On plant start, the boiler controller shall open lead boiler isolation valve. Once valve is fully open, plant by-pass valve shall close.

.9 Boilers will not fire if Primary Pumps are off.

.3 Primary Heating Pump Control:

.1 An EMCS control algorithm shall provide lead/lag and alternator sequencing of the main heating Pumps P-1A and P-1B. Pumps to operate in parallel, lead pump to ramp up to full speed before lag pump starts. When lag pump starts, both pumps to modulate together to meet load i.e. lead pump slows and lag pump speeds up until both are at the same speed and then both ramp together to meet load.

.2 When unloading pumps, both pumps to ramp down to minimum speed. A further reduction to speed shall shut down lag pump. Lead pump to ramp up to suit requirements.

.3 Pumps shall circulate on a call for heat from the space or when ambient temperatures are below primary pump low temperature setpoint, initially set to 5 Deg.C. Below this temperature, pumps shall operate continuously in accordance with sequencing.

.4 Following any pump initiation, the pump shall operate a minimum of 30 minutes before shutting off.

.5 EMCS shall modulate pump speeds to suit Boiler Plant Load. EMCS shall guarantee minimum flow when 1, OR both boilers are operating as required by Boiler manufacturer. Minimum flow requirements and associated setpoints shall be determined on site with Balancing Contractor.

.6 EMCS shall ramp pumps up from minimum flow requirements, tracking Plant firing rate.

.7 Pump speed shall reset down if plant return water temperature increases above minimum Delta T.

.4 Operator Work Station: The operator will be able to view and/or modify the following:
- .1 Boiler B-1: Start, Stop, Firing Rate, Alarm (including type).
- .2 Boiler B-2: Start, Stop, Firing Rate, Alarm (including type).
- .3 Primary Circ Pump P-1A Start, Stop, Status, Speed, Alarm
- .4 Primary Circ Pump P-1B Start, Stop, Status, Speed, Alarm
- .5 System seasonal shut down/start (date)
- .6 Plant temperature enable flag (initially 15 Deg.C.)
- .7 Boiler isolation valve position (both boilers)
- .8 Boiler Plant By-pass valve position (only required if boiler does not have means to shut down flow when off)
- .9 Pump auto-run setpoint (initially 5 Deg.C.)
- .10 HWS temperature Setpoint (Indoor/Outdoor reset)
- .11 Plant HWS temperature
- .12 Plant HWR temperature
- .13 Boiler HWS temperature (both boilers)
- .14 Boiler HWR temperature (may be common)
- .15 outdoor air temperature
- .16 Boiler run times (both boilers)
- .17 Boiler starts (both boilers)
- .18 Pump run times (P-1A and P-1B)
- .19 Pump lead/lag alternator setpoint
- .20 Plant Load
- .21 Pump speed minimum setpoint for one boiler firing
- .22 Pump speed minimum setpoint for two boilers firing
- .23 Minimum delta T setpoint (initially 30 Deg.F.)

.5 Alarm Conditions:
- .1 The following alarms will not shut the system down:
  - .1 Boiler Failure (alarm shall note boiler and type of alarm)
  - .2 Pump Failure (alarm shall note pump)
  - .3 Boiler Isolation Valve (alarm shall note valve)

3.9 LOW TEMPERATURE HEATING PUMP CONTROL

.1 Schedule of Operation:
- .1 Pumps shall be disabled by boiler plant seasonal flag.
- .2 The EMCS shall enable the pumps on a call for heat and when ambient temperature falls below primary pump low temperature flag setpoint, noted under Primary Pump sequence.

.2 Pump Control:
- .1 An EMCS control algorithm shall provide lead/lag and alternator sequencing of the main heating Pumps P-2A and P-2B. Pumps to operate in parallel, lead pump to ramp up to full speed before lag pump starts. When lag pump starts, both pumps to modulate together to meet load i.e. lead pump slows and lag pump speeds up until both are at the same speed and then both ramp together to meet load.
- .2 Pumps shall circulate on a call for heat from the space or when ambient temperatures are below low temperature setpoint.
- .3 Following a call for heat, pumps shall operate a minimum of 30 minutes before shutting off.
- .4 EMCS shall modulate pump speed to ensure differential pressure setpoint at sensor located at CUH-1. Note that sensor must be located on system side of automatic flow restrictor.

.5 Pump speed shall modulate down to minimum setting. Coordinate minimum VFD setting with VFD manufacturer.

.3 Pressure By-pass:

.1 The three-way control valves for unit heaters and force flows, as indicated on drawings, shall act as pressure by-pass (open loop) for system.

.4 Temperature Control:

.1 EMCS to modulate the three-way valve to maintain low temperature water supply.

.2 EMCS shall reset LTWS setpoint based on outside air, initially set as follows:

Outdoor Temperature	Heating Water Supply Temperature
5 Deg.C. and above	110 Deg.F. (43.3 Deg.C.)
at -20 Deg.C	125 Deg.F. (71.1 Deg.C.)

.3 EMCS to alarm LTWS high limit

.4 Operator Work Station: The operator will be able to view and/or modify the following:

.1 Heating Circ Pump P-2a Start, Stop, Status, Alarm, Speed
.2 Heating Circ Pump P-2b Start, Stop, Status, Alarm, Speed
.3 Static pressure high limit alarm setpoint (installed on pump discharge before isolation valve, determine setpoint on site)
.4 Pump run times (P-2a and P-2b)
.5 Pump lead/lag alternator setpoint
.6 Differential control pressure (located across CUH-1)
.7 Differential control pressure setpoint
.8 LTWS temperature
.9 LTWR temperature
.10 LTWS Setpoint
.11 HWR temperature prior to low temperature valve.
.12 LTWS high limit (initially set to 140 Deg.F.)

.5 Alarm Conditions:

.1 The following alarms will shut the system down:
.1 LTWS high limit

.2 The following alarms will not shut the system down:
.1 Pump high static alarm (will shut down pump affected)
.2 Pump Failure (alarm shall note pump)

3.10 GLYCOL FILL

.1 Provide for installation/wiring of packaged fill system remote sensors.

.2 A pressure switch sensing the pressure in the total system return section line of each system shall start the glycol feed pump when it senses a pressure below its setpoint. Set differential pressure to 35 kPa. A flow switch in the boiler discharge shall disable the glycol pump when it senses a no flow condition in the piping. Wire the flow switch to the automatic side of the glycol pump starter. A level control in the glycol tank shall disable the glycol pump on both hand and automatic setting of the starter. Interlock the algorithm to the glycol feed pump. Provide for manual operation of agitator.

.3 EMCS shall monitor system fill alarm.

3.11 DOMESTIC WATER HEATING PLANT

.1 Domestic water heaters to operate under their own controls.

.2 EMCS to operate Recirculation Pump P-5.

.3 EMCS Temperature:
- .1 Monitor HSW discharge temperature from each water heater and combined discharge to building.
- .2 Alarm at EMCS if temperature rises above high limit.
- .3 Monitor domestic hot water recirc temperature upstream of pump.

.4 Operator Work Station: The operator will be able to view and/or modify the following:
- .1 HSW supply temperature from plant
- .2 HSW supply temperature from each tank
- .3 Domestic water recirc temperature
- .4 High temperature alarm, initially set to 62.7 Deg.C (145 Deg.F)
- .5 Pump P-5 start, stop, and alarm

.5 Alarm Conditions: The following alarms will not shut the system down:
- .1 High temperature alarm: 1 minute delay
- .2 Pump Failure

3.12 LAN ROOM DEDICATED COOLING UNIT

.1 Provide for wiring of packaged conditioner and condensing unit, thermostat supplied with unit.

.2 EMCS Temperature:
- .1 EMCS shall monitor space temperature with stainless steel thermostat.
- .2 Alarm at EMCS if room temperature rises above high limit.

.3 Operator Work Station: The operator will be able to view and/or modify the following:
- .1 Space temperature
- .2 High temperature alarm, initially set to 27 Deg.C.

.4 Alarm Conditions: The following alarms will not shut the system down:
- .1 High temperature alarm: 5 minute delay

3.13 ZONE CONTROL - RADIATION ONLY

.1 Schedule of Operation:
- .1 EMCS shall schedule occupied/unoccupied zone control. Initial schedule shall be as follows:

  Occupied Monday to Friday: 7:00 AM to 6:00 PM

.2 Temperature Control:
- .1 Wall sensor to be an adjustable sensor complete with occupancy override.
- .2 Adjustable sensors shall have a midpoint setpoint with a space adjustable slider to increase and decrease setpoint by an operator adjustable amount, initially set to 1.5 Deg.C. The midpoint shall reset between an adjustable summer setpoint, initially set to 24 Deg.C and an adjustable winter setpoint, initially set to 22 Deg.C. Reset shall be based on the following:

Outdoor Temperature	Setpoint
26 Deg.C and above	Summer Setpoint (24 Deg. C.)
16 Deg.C and below	Winter Setpoint (22 Deg.C.)

- .3 On a call for heat, EMCS shall modulate the two-way valve to satisfy the space.
- .4 During unoccupied periods, EMCS shall control heating to unnoccupied setpoint. Cooling shall be disabled. Optimum start shall ensure space is at setpoint prior to next scheduled occupied period.

.3 Operator Work Station: The operator will be able to view and/or modify the following:
- .1 Space temperature
- .2 Space temperature median setpoint
- .3 Space Temperature occupancy offset
- .4 Temperature sensor occupancy adjustment limits for each thermostat.
- .5 Low temperature alarm, initially set to 10 Deg.C.

.4 Alarm Conditions: The following alarms will not shut the system down:
- .1 Low temperature alarm: 15 minute delay

3.14 TYPICAL ZONE CONTROL - VAV WITH INFLOOR and REHEAT

.1 Schedule of Operation:
- .1 EMCS shall schedule occupied/unoccupied zone control. Initial schedule shall be as follows:

  Occupied Monday to Friday: 7:00 AM to 6:00 PM

.2 Airflow Control:
- .1 EMCS shall maintain supply airflow at minimum according to occupied or unoccupied mode at all times except where temperature control requires airflow to increase for cooling.
- .2 EMCS shall increase airflow to suit space requirements in cooling mode up to maximum.

.3 Temperature Control:
- .1 Wall sensor to be an adjustable sensor.
- .2 Adjustable sensors shall have a midpoint setpoint with a space adjustable slider to increase and decrease setpoint by an operator adjustable amount, initially set to 1.5 Deg.C. The midpoint shall reset between an adjustable summer setpoint, initially set to 24 Deg.C and an adjustable winter setpoint, initially set to 22 Deg.C. Reset shall be based on the following:

Outdoor Temperature	Setpoint
26 Deg.C and above	Summer Setpoint (24 Deg. C.)
16 Deg.C and below	Winter Setpoint (22 Deg.C.)

- .3 Heating Control, on a call for heat the EMCS shall:
  - .1 Control the infloor loop valves to satisfy the space.
  - .2 maintain VAV box at minimum airflow.
  - .3 modulate reheat control valve to maintain discharge air temperature at 1 Deg.C below room setpoint.
  - .4 On a further call for heat, modulate the reheat control valve to increase discharge air temperature up to maximum. (note that this will only occur if there is an issue with the in-floor heat)
- .4 Cooling Control, on a call for cooling the EMCS shall:
  - .1 ensure infloor valves are closed
  - .2 if mechanical cooling is disabled (due to ambient temperature), modulate heating coil valve to control VAV discharge temperature to suit space setpoint. VAV box shall be at minimum flow.
  - .3 When discharge air temperature is 54 Deg.F., increase airflow to suit further call for cooling.
  - .4 When mechanically cooling, heating coil valve shall be closed.
- .5 During unoccupied periods, EMCS shall control heating to unoccupied setpoint. Cooling shall be disabled. Optimum start shall ensure space is at setpoint prior to next scheduled occupied period.

.4 Operator Work Station: The operator will be able to view and/or modify the following:
- .1 VAV Box Air Flow
- .2 VAV Box Air Flow set point (occupied/unoccupied minimum and maximum)
- .3 VAV Damper Position
- .4 Discharge air Temperature
- .5 In-floor valve positions
- .6 Reheat Coil Valve Position
- .7 Space temperature
- .8 Space temperature median setpoint
- .9 Space Temperature occupancy offset
- .10 Temperature sensor occupancy adjustment limits
- .11 Low temperature alarm, initially set to 10 Deg.C.

.5 Alarm Conditions: The following alarms will not shut the system down:
- .1 Low temperature alarm: 15 minute delay

3.15 TYPICAL ZONE CONTROL - VAV WITH REHEAT (Internal Cooling Only Zone)

.1 Schedule of Operation:
- .1 EMCS shall schedule occupied/unoccupied zone control. Initial schedule shall be as follows:

Occupied Monday to Friday: 7:00 AM to 6:00 PM

.2 Airflow Control:
- .1 EMCS shall maintain supply airflow at minimum according to occupied or unoccupied mode at all times except where temperature control requires airflow to increase for cooling.
- .2 EMCS shall increase airflow to suit space requirements in cooling mode up to maximum.

.3 Temperature Control:
- .1 Wall sensor to be an adjustable sensor.
- .2 Adjustable sensors shall have a midpoint setpoint with a space adjustable slider to increase and decrease setpoint by an operator adjustable amount, initially set to 1.5 Deg.C. The midpoint shall reset between an adjustable summer setpoint, initially set to 24 Deg.C and an adjustable winter setpoint, initially set to 22 Deg.C. Reset shall be based on the following:

Outdoor Temperature	Setpoint
26 Deg.C and above	Summer Setpoint (24 Deg. C.)
16 Deg.C and below	Winter Setpoint (22 Deg.C.)

- .3 Heating Control, on a call for heat the EMCS shall:
  - .1 maintain VAV box at minimum airflow.
  - .2 modulate reheat control valve to maintain discharge air temperature at 1 Deg.C below room setpoint.
  - .3 On a further call for heat, modulate the reheat control valve to increase discharge air temperature up to maximum. (note that this will only occur when increases space temperature setpoint)
  - .4 When mechanically cooling, heating coil valve shall be closed.
- .4 Cooling Control, on a call for cooling the EMCS shall:
  - .1 if mechanical cooling is disabled (due to ambient temperature), modulate heating coil valve to control VAV discharge temperature to suit space setpoint. VAV box shall be at minimum flow.
  - .2 When reheat valve is fully closed, increase airflow to suit further call for cooling.

.5 During unoccupied periods, EMCS shall control heating to unoccupied setpoint. Cooling shall be disabled. Optimum start shall ensure space is at setpoint prior to next scheduled occupied period.

.4 Operator Work Station: The operator will be able to view and/or modify the following:
- .1 VAV Box Air Flow
- .2 VAV Box Air Flow set point (occupied/unoccupied minimum and maximum)
- .3 VAV Damper Position
- .4 Discharge air Temperature
- .5 Reheat Coil Valve Position
- .6 Space temperature
- .7 Space temperature median setpoint
- .8 Space Temperature occupancy offset
- .9 Temperature sensor occupancy adjustment limits
- .10 Low temperature alarm, initially set to 10 Deg.C.

.5 Alarm Conditions: The following alarms will not shut the system down:
- .1 Low temperature alarm: 15 minute delay

3.16 ZONE CONTROL - VAV WITH INFLOOR and REHEAT and WINDOW INTERRUPT (Room 113 and 112)

.1 Schedule of Operation:
- .1 EMCS shall schedule occupied/unoccupied zone control. Initial schedule shall be as follows:

Occupied Monday to Friday: 7:00 AM to 6:00 PM

.2 Airflow Control:
- .1 EMCS shall maintain supply airflow at minimum according to occupied or unoccupied mode at all times except where temperature control requires airflow to increase for cooling.
- .2 EMCS shall increase airflow to suit space requirements in cooling mode up to maximum.

.3 Temperature Control:
- .1 Wall sensor to be an adjustable sensor.
- .2 Adjustable sensors shall have a midpoint setpoint with a space adjustable slider to increase and decrease setpoint by an operator adjustable amount, initially set to 1.5 Deg.C. The midpoint shall reset between an adjustable summer setpoint, initially set to 24 Deg.C and an adjustable winter setpoint, initially set to 22 Deg.C. Reset shall be based on the following:

Outdoor Temperature	Setpoint
26 Deg.C and above	Summer Setpoint (24 Deg. C.)
16 Deg.C and below	Winter Setpoint (22 Deg.C.)

- .3 Heating Control, on a call for heat the EMCS shall:
  - .1 Control the infloor loop valves to satisfy the space.
  - .2 maintain VAV box at minimum airflow.
  - .3 modulate reheat control valve to maintain discharge air temperature at 1 Deg.C below room setpoint.
  - .4 On a further call for heat, modulate the reheat control valve to increase discharge air temperature up to maximum. (note that this will only occur if there is an issue with the in-floor heat)
- .4 Cooling Control, on a call for cooling the EMCS shall:
  - .1 ensure infloor valves are closed
  - .2 if mechanical cooling is disabled (due to ambient temperature), modulate

heating coil valve to control VAV discharge temperature to suit space setpoint. VAV box shall be at minimum flow.

.3 When reheat valve is fully closed, increase airflow to suit further call for cooling.

.4 When mechanically cooling, heating coil valve shall be closed.

.5 During unoccupied periods, EMCS shall control heating to unoccupied setpoint. Cooling shall be disabled. Optimum start shall ensure space is at setpoint prior to next scheduled occupied period.

.4 Window Interrupt:

.1 EMCS shall monitor window controller output (low voltage dry contact - refer to Window Specification 08 51 31) to determine if window is open.

.2 When window is open, EMCS shall close VAV box dampers for VAV-106 and VAV-107.

.3 Heating (via infloor) shall be permitted when windows are open when mechanical cooling is not engaged. If mechanical cooling is operating, infloor shall be locked out.

.5 Operator Work Station: The operator will be able to view and/or modify the following:

.1 VAV Box Air Flow
.2 VAV Box Air Flow set point (occupied/unoccupied minimum and maximum)
.3 VAV Damper Position
.4 Discharge air Temperature
.5 In-floor valve positions
.6 Reheat Coil Valve Position
.7 Space temperature
.8 Space temperature median setpoint
.9 Space Temperature occupancy offset
.10 Temperature sensor occupancy adjustment limits
.11 Low temperature alarm, initially set to 10 Deg.C.
.12 Window position (open or closed)

.6 Alarm Conditions: The following alarms will not shut the system down:

.1 Low temperature alarm: 15 minute delay

3.17 ELECTRONIC TRAP SEAL PRIMERS

.1 EMCS shall wire low voltage 24 DC from controls circuits to electronic trap seal primer modules.

3.18 ROOM 148 (May contain vehicles)

.1 Schedule of Operation:

.1 EMCS shall schedule occupied/unoccupied zone control. Initial schedule shall be as follows: Occupied 24/7.

.2 Temperature Control:

.1 Unit heater shall be controlled by EMCS.

.2 Wall sensor shall be stainless steel plate sensor with temperature setpoint adjustable from Operation Workstations (OWS). Location to be confirmed on site prior to installing.

.3 EMCS shall modulate the three-way heating control valve to suit space setpoint.

.4 EMCS shall sequence the fan operation to energize only on a call for heat. The fan shall continue to operate for 5-minutes after heating valve is fully closed.

.5 Alarm at OWS on low temperature, initially set to 10 Deg.C (adjustable). Ensure alarm delay for space is sufficient to prevent nuisance alarms from opening/closing door.

.6 When outside air temperature is below adjustable setpoint (initially -10 Deg.C.) the EMCS shall energize the unit heater fan and run continuously, modulating valve to maintain space.

.3 Fan Control

.1 The space shall be monitored by one carbon monoxide / NOx sensors. Sensor location shall be determined on site prior to installation.

.2 EF-2 shall operate during all scheduled occupied periods (minimum ventilation) and motorized outside air damper shall be partially open (approximately 50%).

.3 When the space exceeds the gas upper limit setpoint, initially set to 20 PPM for CO and 2 PPM for NOx, exhaust fan EF-3 shall energize and intake damper shall open fully.

.4 When the space Carbon Monoxide level drops below the lower limit setpoint, initially set to 5 PPM for CO and 1 PPM for NOx, Exhaust fan EF-3 shall deenergize and intake dampers shall revert to minimum position.

.5 If both fans are off or power is lost, outside air damper shall close.

.6 Alarm space and EMCS on gas high level detection.

.7 If EF-2 fails, EF-3 shall energize during scheduled occupied periods.

.8 During unoccupied mode, EF-2 shall energize upon detection of gas and deenerigze when gas levels reach 0, EF-3 shall operate as normal.

.4 Operator Work Station: the operator will be able to view and/or modify the following:

.1 Low temperature alarm setpoint, initially 10 Deg.C.

.2 Exhaust Fan EF-2 on/off/status/alarm.

.3 Exhaust Fan EF-3 on/off/status/alarm.

.4 Intake Damper position.

.5 Unit Heater UH-1 Valve Position.

.6 Unit Heater UH-1 start/stop.

.7 Space temperature.

.8 Space temperature setpoint.

.9 Carbon Monoxide level

.10 NOx level

.11 Carbon Monoxide lower limit setpoint

.12 Carbon Monoxide upper limit setpoint

.13 NOx lower limit setpoint

.14 NOx upper limit setpoint

.15 Carbon Monoxide 10 minute high limit alarm setpoint

.16 Carbon Monoxide 60 minute high limit alarm setpoint

.17 NOx 10 minute high limit alarm setpoint

.18 NOx 60 minute high limit alarm setpoint

.5 Alarm Conditions: The following alarms will not shut the system down:

.1 Low temperature alarm: 15 minute delay

.2 EF-2 failure alarm: 3 minute delay (EF-3 shall operate as minimum ventilation)

.3 EF-3 failure alarm: 3 minute delay

.4 Carbon Monoxide 10 minute high limit alarm initially set to 198 ppm: 10 minute delay (to alarm locally and at EMCS).

.5 Carbon Monoxide 60 minute high limit alarm initially set to 30 ppm: 60 minute delay (to alarm locally and at EMCS).

.6 NOx 10 minute high limit alarm initially set to 5 ppm: 10 minute delay (to alarm locally and at EMCS).

.7 NOx 60 minute high limit alarm initially set to 3 ppm: 60 minute delay (to alarm locally and at EMCS).

3.19 EXHAUST FAN EF-4 (Room 135)

.1 EMCS shall control Exhaust Fan EF-4 from schedule. Initial schedule to be 24/7.

.2 Operator Work Station: The operator will be able to view and/or modify the following:
.1 Exhaust Fan EF-4 Start/Stop/Status/Alarm.

.3 Alarm Conditions: The following alarms will not shut the system down:
.1 EF-4 failure alarm: 3 minute delay

3.20 EXHAUST FAN CONTROL (Room 143, 144, 146, and 147)

.1 EMCS shall control Exhaust Fan EF-5 to EF-8 from local wall activation button.

.2 Button shall activate associated room exhaust fan and fan shall run for adjustable time period (initially set to 1 hour).

.3 Operator Work Station: The operator will be able to view and/or modify the following (for each system):
.1 Exhaust Fan Start/Stop/Status/Alarm (EF-5, EF-6, EF-7, and EF-8)
.2 Button Activation for each system (four in total)
.3 Fan operating time (per activation), initially set to one hour.

.4 Alarm Conditions: The following alarms will not shut the system down:
.1 EF failure alarm: 3 minute delay (EF-5, EF-6, EF-7, and EF-8)

3.21 STORM PIPE HEATING

.1 EMCS shall modulate control heating valve for storm pipe heating loop based on ambient temperature reset.

Outdoor Temperature	Setpoint
1 Deg.C and above	Valve closed
1 Deg.C to -10 Deg.C.	Valve 100% Open
-10 and below	Valve closed

.2 Operator Work Station: The operator will be able to view and/or modify the following (for each system):
.1 Valve position

3.22 SMOKE DAMPERS

.1 Provide field wiring of sensor (supplied with damper, factory mounted) to actuator (supplied with damper, factory mounted) for each smoke damper.
.2 Indicator connection to fire alarm by electrical.

3.23 ROOM 157 (May contain vehicles)

.1 Schedule of Operation:
.1 Local control shall control system, system shall not be linked to EMCS.

.2 Fan Control
.1 The space shall be monitored by one line voltage carbon monoxide / NOx sensors. Sensor location shall be determined on site prior to installation.
.2 EF-1 shall operate based on CO/NOx.

.3 When the space exceeds the gas upper limit setpoint, initially set to 5 PPM for CO and 1 PPM for NOx, exhaust fan EF-1 shall energize and intake damper shall open fully.

.4 When the space Carbon Monoxide and NOx levels drop to zero, EF-1 shall deenergize and intake dampers shall close.

.5 Alarm space and EMCS on gas high level detection.

.3 Alarm Conditions: The following alarms will not shut the system down:

.1 Carbon Monoxide 10 minute high limit alarm initially set to 198 ppm: 10 minute delay (to alarm locally and at EMCS).

.2 Carbon Monoxide 60 minute high limit alarm initially set to 30 ppm: 60 minute delay (to alarm locally and at EMCS).

.3 NOx 10 minute high limit alarm initially set to 5 ppm: 10 minute delay (to alarm locally and at EMCS).

.4 NOx 60 minute high limit alarm initially set to 3 ppm: 60 minute delay (to alarm locally and at EMCS).

END OF SECTION

Part 1 General

1.1 SECTION INCLUDES

.1 This Section covers items common to Sections of Electrical Contractor. This section supplements requirements of Division 00 – Procurement and Contracting Requirements, Division 01 – General Requirements, Division 02 – Existing Conditions.

.2 Provide complete and fully operational electrical systems with facilities and services to meet requirements described herein, as shown on the drawings, and in complete accord with applicable codes and ordinances.

.3 Only those items that are specifically indicated as not in contract (N.I.C.) will be omitted.

.4 Contract documents of Divisions 26, 27, and 28 are diagrammatic and approximately to scale, unless detailed otherwise. They establish scope, material and installation quality, and are not detailed installation instructions.

.5 Follow manufacturers' recommended installation details and procedures for equipment supplemented by details given herein and on plans subject to approval of the Consultant.

.6 Examine all drawings to ensure that work under this Division can be properly installed without interference.

.7 Where discrepancies, ambiguities, obvious omissions or errors have been made in drawings and specifications, it shall be the responsibility of the contractor to clarify same prior to tender closing. No allowance will be made after contract award for any expense incurred by him for having to adjust his work to properly conform.

1.2 REFERENCES

.1 The Electrical Contractor shall be bound by industry standards, as interpreted by the Consultant, whether or not specifically referenced in this document. Comply with Electrical Protection Act and rules and regulations made pursuant thereto, including the Canadian Electrical Code. Also, comply with applicable standards of the following:

.1 CSA C22.1-2012, Canadian Electrical Code, Part 1.
.2 Electrical and Electronic Manufacturers Association of Canada (EEMAC).
.3 National Electrical Manufacturers Association (NEMA).
.4 National Building Code 2010 (NBC 2010)
.5 National Fire Protection Association (NFPA)
.6 Institute of Electrical and Electronic Engineers (IEEE).
.7 Audio Engineering Society (AES).
.8 Other Applicable CSA and UL approvals.

1.3 CODES AND STANDARDS

.1 The electrical installation shall comply with all SaskPower requirements and regulations.

.2 In the event of any inspection authority requesting deviation from the design, notify the Consultant and obtain approval before proceeding with any change.

.3 In no instance, shall the standard established by the drawings and specification be reduced by any code or ordinance. All references to codes and standards shall be to the latest edition.

1.4 CARE, OPERATION AND START-UP

.1 Instruct operating personnel in the operation, care and maintenance of systems, system equipment and components.

.2 Connect to equipment furnished in other Divisions and by Owner including start-up and test.

.3 Arrange and pay for services of manufacturer's factory service engineer to supervise start-up of installation, check, adjust, balance and calibrate components and instruct operating personnel.

.4 Provide these services for such period, and for as many visits as necessary to put equipment in operation, and ensure that operating personnel are conversant with all aspects of its care and operation.

1.5 VOLTAGE RATINGS

.1 Operating voltages: to CAN3-C235-83

.2 Motors, electric heating, control and distribution devices and equipment to operate satisfactorily at 60 Hz within normal operating limits established by above standard. Equipment to operate in extreme operating conditions established in above standard without damage to equipment.

1.6 PERMITS, FEES AND INSPECTION

.1 Submit to SaskPower necessary number of drawings and specifications for examination and approval prior to commencement of work.

.2 Pay associated fees.

.3 Notify Consultant of changes required by Electrical Inspection Department prior to making changes.

.4 Furnish Certificates of Acceptance from Electrical Inspection Department and authorities having jurisdiction on completion of work to Consultant.

1.7 MATERIALS AND EQUIPMENT

.1 Provide materials and equipment in accordance with Section 01 61 00 - Common Product Requirements.

.2 All goods and materials shall be new and carry CSA approval seal. Equipment and material shall be CSA certified. Where there is no alternative to supplying equipment which is not

CSA certified, obtain special approval from the Consultant and the Electrical Inspection Department.

.3 All fire alarm equipment shall carry ULC approval seal.

.4 No deviation from specified materials shall be allowed, except where alternative materials have been specifically accepted in writing.

.5 Where materials are not directly specified by catalogue number and manufacturer's name, a high industry specification grade product shall be provided. The Consultant shall be the sole judge of whether this standard is being met.

.6 All references to known standard specifications shall mean and intend the latest edition of such specifications.

.7 Each major component of equipment shall have manufacturer's name, address, catalogue and serial number in a conspicuous place.

.8 Upon request, provide a complete list of all materials and their manufacture. The contractor will be required to use the materials indicated. Changes in manufactures at a future date will not be acceptable.

.9 Factory assemble panels and component assemblies.

1.8 WORKMANSHIP

.1 All work under this Division shall be executed in a workmanlike and substantial manner, neat in its mechanical appearance and arrangement.

.2 A competent representative shall constantly supervise the work of this Division from beginning to completion and final acceptance. So far as possible, the same supervisor and workmen shall be employed throughout the project's duration.

.3 Material and workmanship not meeting the standard intended and required by this specification shall, upon instruction from the Consultant, be properly replaced without further charge or consideration.

1.9 ELECTRICAL DRAWINGS

.1 They indicate the general location and route of conduit and cable to be installed. Conduit shall be installed in coordination with other services. These include both new and existing services. Prior to excavation anywhere on site, arrange to have all existing services marked. Where space is indicated for future equipment or plant use, leave space clear.

.2 Install equipment generally in locations and routes shown, close to building structure with minimum interference with other services or free space. Remove and replace improperly installed equipment to the satisfaction of the Consultant at no extra cost.

.3 Ceiling and floor outlet symbols are scaled to centre line of symbol; symbol does not indicate the size or shape. Mounting height shall be measured to the lowest point on ceiling mounted equipments, and above finished surface for wall mounted equipment.

.4 Wall outlets are scaled to the perpendicular centre line of the symbol. Mounting heights for all wall mounted outlets shall be measured to the horizontal centre line.

.5 Where outlets are mounted in masonry walls, outlets should be mounted to the nearest coursing line.

1.10 WORK PROVIDED FOR OTHER DIVISIONS

.1 Provide information as to exact size and location of all required concrete bases, housekeeping pads and curbs required for the installation of equipment of Divisions 26, 27, and 28.

.2 Provide information as to the location and exact size of all openings through floors and walls.

.3 Provide information as to the location and exact size of all equipment supports required within walls, and roof support structure.

.4 Provide electrical connections, circuit protection and disconnect devices for all equipment supplied by other Divisions, including the Owners. Provide motor starters, disconnect switches, thermal switches, etc., for motors supplied by mechanical contractor. Special control equipment being supplied by mechanical contractor shall be installed and wired by that contractor.

1.11 WORK PROVIDED BY OTHER DIVISIONS

.1 All concrete bases, housekeeping pads and curbs required for the installation of equipment of Divisions 26, 27, and 28.

.2 Installation and framing of all openings in walls or floors larger than 150 mm diameter, or rectangular, with one dimension greater than 150 mm.

.3 Openings in millwork for electrical outlets and conduits.

.4 Painting of all panelboard and communication panel trims to match colour scheme where exposed in finished areas.

.5 Firestopping shall be the responsibility of the General Contractor.

1.12 WORK NOT PROVIDED BY THIS DIVISION

.1 Control wiring below 50V for Mechanical Contractor equipment beyond terminal section of each motor control centre, unless specifically indicated otherwise.

1.13 COORDINATION WITH OTHER DIVISIONS

.1 Cooperate fully with the Consultant and other trades of electrically operated equipment to ensure proper arrangement of and provision for all electrical equipment.

.2 Where outlets or equipment may affect architectural or site treatment desired, contact Consultant and for instructions or detailed drawings.

.3 Refer to other Divisions including mechanical, millwork, kitchen equipment, owner supplied equipment, etc, for electrical work in connection with these drawings and specifications.

.4 Location of lighting outlets and receptacles in mechanical or equipment rooms and similar areas shall be finalized during construction to give optimum arrangement. The Consultant shall approve final location before installation.

.5 Supply and install all motor connections, including starters and overload protection and disconnecting devices at motors where required. All motor driven equipment shall be provided with a lockable disconnecting device within line of site of the motor to be disconnected.

.6 Supply and install complete wiring requirements for full voltage in-line devices on single phase equipment such as thermostats, multi-speed switches for unit heaters, force flows, cabinet heaters, etc.

.7 Cutting of openings for electrical outlets in millwork and other similar types of custom-made equipment shall be done by the supplier of this equipment.

.8 Check other Divisions to ensure that suitable provisions have been provided for all motors. It is possible that some motors may vary in size, numbers and characteristics, depending on the equipment manufacturer's specific requirements. Any variations in this regard will not constitute cause for further consideration. The mechanical coordination schedule supplied on the drawings shall be updated with nameplate specifications.

.9 Assume full responsibility for layout of this work and for any damage caused the Owner or other Divisions by improper location or carrying out of this work.

.10 Before commencing work, examine the work of other Divisions, and report at once any defects or interference affecting the work under this Division, or the guarantee of same.

.11 Location of lighting outlets and receptacles in mechanical or equipment rooms and similar areas shall be finalized during construction to give optimum arrangement. The Consultant shall approve final location before installation.

.12 Allow for all hoisting and setting of material and equipment.

1.14 OWNER SUPPLIED EQUIPMENT

.1 Connect all electrically operated equipment supplied by the Owner, as designated on the drawings.

.2 Reconnect all existing electrical services from new and existing electrical sources modified by the work of this contract.

1.15 INSPECTION AND TESTING

.1 During construction and up to final acceptance, make accessible any equipment or wiring for inspection purposes.

.2 All electrically operating equipment shall be left as a complete installation in perfect operating condition, and receive final test in the presence of the Consultant.

.3 Ensure that all power circuitry is properly tested and meets the CSA Ground Resistance Requirements. For any 600 volt systems, a 600 volt megger or hi-pot procedures shall be used for all such tests. Provide documentation for each test within maintenance/commissioning manuals.

.4 On the request of the Consultant, a staff supervisor shall be made available to assist in this inspection work.

.5 At the completion of the installation, voltage tests shall be conducted in the presence of the Consultant. Transformer taps shall be adjusted, and any other corrective measures implemented to assure the proper operation of all electrical equipment. Provide documentation for each test within maintenance/commissioning manuals.

.6 Acceptance tests and commissioning shall be conducted for systems and/or equipment where indicated in the specifications and other standards referenced herein. Acceptance tests shall include, but not be limited to, the following Sections.

.1 26 09 24 – Lighting Control Devices - Low Voltage

.2 27 05 14 - Communication Cables Inside Buildings

.3 27 05 28 – Pathways for Communication Systems

.4 27 11 19 - Communications Termination Blocks and Patch Panels

.5 28 31 01 - Fire Alarm System

.7 Acceptance tests shall meet requirements as required by manufacturer, as outlined in ANSI – NETA 2007 and additional requirements described on drawings and specified herein. All tests shall be documented as per ANSI – NETA 2007 standards and shall include testing results, testing date, testing technician and representative present.

.8 Acceptance tests shall be made up of the following:

.1 Shop Drawing Information Sheets

.2 Static Review Check Sheets

.3 Performance Verifications Sheets

.4 Manufacturer Commissioning and Report

.5 Manufacturer Test Reports, Factory and On Site where required

.6 Test Results not forming part of the Static Review Checks Sheets

.7 Owner / Consultant Demonstration Sheets

.8 Training

.9 Certification of all acceptance tests and commissioning shall be submitted to the Consultant for approval. Tests not conducted to the satisfaction of the Consultant shall be repeated, and no further costs will be considered. Written documentation bearing name and signature of Contractor, Consultant and Owner's personnel present during acceptance tests shall be included in certification reports.

1.16 SHOP DRAWINGS

.1 Submit shop drawings, where specifically called for, or as requested. Shop drawings shall show detailed dimensional and technical information, and shall properly describe each piece

of equipment. Where applicable, shop drawings shall include complete schematics and wiring diagrams. These shop drawings shall be sufficiently detailed to permit the Owner's technicians to trouble-shoot and repair the equipment. Equipment shall not be ordered and/or fabricated until shop drawings have been reviewed by the Consultant. Shop Drawings shall include, but not be limited to the following Sections on systems and equipment:

.1 26 05 36 - Cable Trays
.2 26 09 51 - Car Parking Control
.3 26 23 00 – Low Voltage Switchboards
.4 26 24 17 - Panelboards Breaker Type
.5 26 27 26 - Wiring Devices
.6 26 28 14 - Fuses - Low Voltage
.7 26 28 21 - Moulded Case Circuit Breakers
.8 26 28 23 - Disconnect Switches - Fused and Non-Fused
.9 26 29 10 - Motor Starters
.10 26 50 00 – Lighting
.11 26 52 00 - Emergency Lighting
.12 26 53 00 - Exit Signs
.13 27 00 00 - Communication Requirements
.14 27 05 14 - Communications Cables Inside Buildings
.15 27 05 28 - Pathways for Communication Systems
.16 27 11 19 - Communications Termination Blocks and Patch Panels
.17 28 31 01 - Fire Alarm System

.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. Refer to each section for further shop drawing information.

.3 Refer to General Conditions of the Contract.

.4 Provide nine (9) printed copies and one PDF copy for each Section. Each shop drawing shall be complete with a cover page with the following information:

.1 Specification Section and name
.2 Project name, Owner's name and address
.3 Number of pages in submittal
.4 Contractor and Supplier's name and contact information
.5 Approval stamps with room for Consultant's stamp

.5 Shop drawings for complementary systems and/or equipment shall be submitted at the same time. Partial submittals of related equipment will be rejected or held until all other related shop drawing information has been submitted (i.e. submit all shop drawings for power

equipment at the same time). Submittals of shop drawings that are incomplete will be rejected.

1.17 CHANGES

.1 Refer to General and Supplemental Conditions.

.2 Submit complete itemized breakdowns of all extras, deletions, and changes to the Consultant. Breakdown shall include quantities, unit costs and extensions. If requested, support claim by certified copies of supplier's invoices.

.3 The right is reserved to move equipment 3000 mm from location shown without further charge or consideration, provided that such re-location is requested prior to finish being applied.

1.18 CONSULTANT PRICES

.1 Electrical progress claims shall be made on Contractor Progress Report #ES110 provided by the Consultant. A copy of this Progress Report is attached for reference. The Electrical contract price shall be broken down into thirteen (13) parts to facilitate assessment of work done and material supplied. This progress claim shall be submitted simultaneously to the General Contractor and the Consultant, the latter case in duplicate. Refer to General Conditions.

.2 The breakdown shall indicate labour and material to the nearest dollar. Overhead, profit and job expense shall be apportioned to all parts. The breakdown shall be as follows:

.1 Main services
.2 Distribution/Panels
.3 Conduit and boxes
.4 Wire and cable
.5 Motor control
.6 Wiring devices
.7 Lighting fixtures and lamps
.8 Communications systems
.9 Security Systems
.10 Fire Alarm System
.11 Specials
.12 Miscellaneous - 8% maximum
.13 Extras and credits. (Extras in excess of $1,000 shall be broken down into the above points on a separate ES110 sheet)

1.19 OPERATING INSTRUCTIONS AND SERVICE MANUALS

.1 Upon completion of the installation, provide complete and comprehensive identical sets of operating and maintenance manuals.

.2 The Consultant shall review the operating and maintenance manuals and approve same prior to the manuals being sent to the Owner.

.3 The operating and maintenance manuals shall include but not be limited to the following information when applicable in the project:

.1 Certification reports.
.2 Documentation indicating Owner's receipt of operating instructions.
.3 Complete list of all materials turned over to the Owner c/w receipts for same.
.4 Shop drawings properly indexed and contained in suitably sized binders.
.5 Schematic drawings for all systems indexed and contained in suitably sized envelopes or attached efficiently in the above binders.
.6 Catalogue brochures for light fixtures, panelboards, switches, receptacles, fuses, etc.
.7 All final settings of equipment that has user adjustable settings.
.8 Overcurrent coordination and arc fault study and documentation of associated tests.
.9 Phase rotation confirmation by the Contractor.
.10 Certificate of Owner's training.
.11 Acceptance Testing and Commissioning reports.
.12 Listing of any spare devices turned over to Owner

The above information shall be bound in binders as noted in specifications. Incomplete or poorly reproduced manuals will be rejected.

.4 Maintain, on a daily basis, a complete set of marked-up prints as as-built drawings that show in complete detail the final arrangement and location of all electrical components and the interconnecting wiring.

.5 All riser conduits (size and routing), panel feeds (size and routing), conduit runs (size and routing) and main communications (size and routing) shall be marked on plans. These are to be maintained in a neat and substantial manner, so as to properly and fully illustrate the way in which the installation has been completed.

.6 All equipment locations such as fire alarm signal boosters, cable termination boxes, signal amplifiers, network switches, door controllers, etc shall be identified on the drawings as to their location and quantity (if more than one exists at that particular location).

.7 The Owner's personnel shall be instructed in the operation and maintenance of the following equipment to the satisfaction of the Owner as per the standards referenced herein.

Section No.	Description	Hours
26 29 10	Motor Starters	1
26 50 00	Lighting	1
26 09 51	Car Parking Control	1
26 29 10	Motor Starters	1
26 52 00	Emergency Lighting	1
27 00 00	Communication Requirements	1
27 11 19	Communications Termination Blocks and Patch Panels	2
28 31 01	Fire Alarm System	4

.8 The above instructions shall be given by personnel experienced in the operation of the particular system or equipment. Each item or type of equipment, and all controls, shall be operated in the presence of the Owner's personnel to ensure their understanding of equipment

function and individual working parts. The Owner reserves the right to set the period or periods during which the instruction shall be given. The contractor shall submit a program of instruction for approval by the Owner.

.9 Operating and maintenance manuals shall include written documentation bearing name and signature of Owner's personnel who received the above instructions. Contractor shall allow for all training to be completed in a minimum of two sessions. One session at substantial completion, and one session within three months of turning over the system.

.10 Operating and maintenance manuals, as well as all Owner instructions, shall be complete before substantial completion (as outlined by the Builders' Lien Act) will be considered. Also, preliminary maintenance manuals must be submitted prior to 70% completion. No further progress payments will be permitted until these preliminary maintenance manuals have been submitted and approved.

1.20 STORAGE AND PROTECTION

.1 Maintain and protect all work provided under this Division. Store all materials within a protected enclosure to prevent exposure to weather or construction dirt.

.2 Protect all finished and unfinished work of this and other divisions from damage during the course of construction. Cover floors and other surfaces, if necessary. Any damaged work or finishes shall be repaired or replaced without further charge to the Owner.

1.21 WARRANTY

.1 All materials and workmanship shall be guaranteed for a period of one year from date of substantial completion.

.2 Properly repair and replace all defective work and other work which becomes defective during the term of warranty.

.3 Service on equipment or systems critical to the Owner's operation shall be provided on an emergency basis which may necessitate overtime and service outside of normal working hours. The contractor shall ensure that all suppliers comply with this requirement.

1.22 ELECTRIC MOTORS, EQUIPMENT AND CONTROLS

.1 Supplier and installer responsibility is indicated in Motor, Control and Equipment Schedule on electrical drawings and related mechanical responsibility is indicated on Mechanical Equipment Schedule on mechanical drawings.

.2 Control wiring and conduit is provided by the Electrical Contractor except for conduit, wiring and connections below 50 V which are related to control systems specified in Division 15 and shown on mechanical drawings.

1.23 FINISHES

.1 Shop finish metal enclosure surfaces by application of rust resistant primer inside and outside, and at least two coats of finish enamel.

.1 Paint indoor switchboards and distribution enclosures light grey ASA 61.

.2 Clean and touch up surfaces of shop-painted equipment scratched or marred during shipment or installation, to match original paint.

.3 Clean and prime exposed non-galvanized hangers, racks and fastenings to prevent rusting.

1.24 ABBREVIATIONS

.1 Abbreviations used in this specification are common to and in general use within the related trades.

1.25 EQUIPMENT IDENTIFICATION

.1 Nameplates shall be provided on each new piece of electrical equipment, including, power panels, distribution panels, lighting panels, transformers, disconnect switches, contactors, telephone panels, miscellaneous systems and panels.

.2 Nameplates for each new electrical panel shall indicate panel designation, mains voltage and panel and circuit number from which this panel is fed.

.3 Nameplates for new disconnects and contactors shall indicate equipment being controlled, and voltage.

.4 Nameplates for new terminal cabinets shall indicate system and voltage and load of area served.

.5 Nameplates for Normal Power Equipment shall be made from black-white-black Lamecoid with bevelled edges and white engraved letters. Nameplates shall be fastened with self tapping metal screws to equipment in a conspicuous location. Flush mounted panels shall have nameplate located on front of panel behind hinged door.

.6 Typical identification standards shall be used for new equipment throughout the project as follows:

.1 Lighting, receptacle and power panels shall each be identified with an engraved Lamecoid plate secured to top interior trim as:

Panel 202	10 mm high lettering
120/208 volts	6 mm high lettering
Fed from	6 mm high lettering

.2 Each panel shall be supplied with a directory card holder welded to inside of door, complete with a neatly typewritten list showing information as follows:

Panelboard name	202
Panel voltage	120/208 volts

Circuit Number	Description	Load
1	Lighting Room 200 (Main Area)	1200W
2	Receptacles Room 200 (Main Area)	6-15A

3	Room 220	1/3 H.P. Fan

Spaces and spares shall be left blank so as to facilitate future description. Also, existing panels where adjustments have been made in the circuitry shall be field checked in their entirety and new directory cards shall be provided.

.3 List shall be covered with a 1 mm thick clear plastic sheet to protect it.

.4 Other cabinets and plywood back boards for low voltage systems, such as signals and communications, shall be identified as panelboards with a directory showing circuit numbers and room locations, plus a blank for "Remarks", as well as a Lamecoid plate designation panel name.

EXAMPLE: if cabinet is for telephone

.....TP - 2nd floor

.5 Equipment not listed above, such as incoming service cables, communicating cables, switchgear, transformers, disconnects, motors, instruments, fire alarm and control panels, shall be identified in a similar manner, showing name and number of the equipment, voltage and load information.

.7 Feeder pull boxes and junction boxes shall be identified with waterproof ink, showing feeder or system concerned. Conduit entering junction boxes for communications systems shall be identified with the room number that each conduit serves.

.8 A small dab of paint shall be applied to inside of each outlet box, pull box and panel as it is installed, using colour code as follows:

Red	-	Fire Alarm System
Yellow	-	Security, Alarm Systems, Card Access
Green	-	Telephone/IT Computer Systems

The outside of the box shall also be identified in this way so as to readily determine the system within the conduit system. The cover of each junction box for branch circuits shall describe the voltage being used by means of a waterproof ink.

.9 No colour code is required for regular lighting and power circuits, but voltage class shall be displayed on all pull boxes and panels.

.10 Junction boxes in furred ceilings shall be colour identified on both inside and outside.

.11 Connections in equipment shall be made Phase 'A', 'B', 'C', from left to right when viewing wiring from front or accessible direction.

.12 Colour coding shall be carried through from incoming utility supply down to and including panels, and shall be as follows:

.1 Incoming utility service lines shall be identified by Red - Phase 'A'; Black - Phase 'B'; Blue - Phase 'C'; with colour coded PVC tape.

.2 Switchgear buswork in each switchboard and unit substation cubicle shall be banded with 3M tape identified in accordance with service lines colour coding. In addition, where neutral bus is introduced, it shall be banded white. Ground bus shall be banded green.

.3 Feeder and sub-feeder bus or conductors shall be banded as above.

.4 Lighting and power panels shall conform to the Canadian Electrical Code, and shall have main bus banded with tape as follows:

Red	-	Phase 'A'
Black	-	Phase 'B'
Blue	-	Phase 'C'
White	-	Neutral
Green	-	Ground

.13 All plug-in type receptacles on all levels shall be identified by means of a self laminated, self adhesive label. Each cover plate shall be engraved with a label approximately 8 mm x 30 mm, and contain the panel and circuit number in 4 mm high lettering. The cover plates for all receptacles designated on the drawings for housekeeping purposes shall also contain the wording “Housekeeping”. The cover plates for all receptacles fed from the ground fault interrupters shall also contain the wording “G.F.I.”

.14 The circuits controlled by all light switches shall be neatly printed with waterproof ink on the side of the switch outlet box so that the panel and circuit number are clearly legible when the coverplate is removed. It shall not be necessary to remove the switch from the outlet box in order to read the panel or circuit number.

1.26 WIRING IDENTIFICATION

.1 Identify wiring with permanent indelible identifying markings, either numbered or coloured plastic tapes, on both ends of phase conductors of feeders and branch circuit wiring.

.2 Maintain phase sequence and colour coding throughout.

.3 Colour code: to CSA C22.1.

.4 Use colour coded wires in communication cables, matched throughout system.

.5 All data cables and data jumper cables (minimum 23 gauge), jacks and connector boots installed as part of this project used for Security Systems, whether CAT 6A or fibre optic, shall be BRIGHT GREEN in colour.

.6 All patch cables are to be stranded cable with RJ45 connectors. RJ45 connectors shall not be attached to solid conductor cable.

.7 All installed runs of CAT6A cable are to be terminated into patch panels in equipment racks or faceplates in other locations.

.8 An installed cable is any cable that is run through a conduit, run from one area in a building to another area or any cable that travels farther than the adjacent equipment cabinet in a series of cabinets. Note: Equipment cabinets must be abutting without side panels to open connection to be considered adjacent.

1.27 CONDUIT AND CABLE IDENTIFICATION

.1 Colour code conduits, boxes and metallic sheathed cables.

1.28 WIRING TERMINATIONS

.1 Lugs, terminals, screws used for termination of wiring to be suitable for either copper or aluminum conductors.

1.29 MANUFACTURERS AND CSA LABELS

.1 Visible and legible, after equipment is installed.

1.30 WARNING SIGNS

.1 As specified and to meet requirements of Electrical Inspection Department and Owner.

.2 Decal signs, minimum size 175 x 250 mm.

1.31 LOCATION OF OUTLETS

.1 Locate outlets in accordance with drawings and specifications.

.2 Do not install outlets back-to-back in wall; allow minimum 150 mm horizontal clearance between boxes.

.3 Change location of outlets at no extra cost or credit, providing distance does not exceed 3000 mm, and information is given before installation.

.4 Locate light switches on latch side of doors. Locate disconnect devices in mechanical and electrical on latch side of door.

1.32 MOUNTING HEIGHTS

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

.2 If mounting height of equipment is not specified or indicated, verify before proceeding with installation.

.3 Install electrical equipment at following heights unless indicated otherwise or as noted on drawings.

.1 Local switches: 1200 mm.

.2 Wall receptacles:

.1 General: 450 mm.

.2 Above top of counters or counter splash backs: 150 mm.

.3 In mechanical rooms: 1400 mm.

.3 Fire alarm stations: 1200 mm.

.4 Fire alarm horn/strobe: 2100 mm.

1.33 LOAD BALANCE

.1 All lighting panels, distribution centres, motor control centres and main switchboards shall be load balanced such that the maximum variation between the two worst phases does not exceed 5%.

.2 Measure phase current to panelboards with normal loads (lighting) operating at time of acceptance. Adjust branch circuit connections as required to obtain best balance of current between phases and record changes.

.3 Measure phase voltages at loads and adjust transformer taps to within 2% of rated voltage of equipment.

.4 Submit, at completion of work, report listing phase and neutral currents on panelboards, dry-core transformers and motor control centres, operating under normal load. State hour and date on which each load was measured, and voltage at time of test.

1.34 CONDUIT AND CABLE INSTALLATION

.1 Install conduit and sleeves prior to pouring of concrete. Sleeves through concrete: plastic, sized for free passage of conduit, and protruding 50 mm.

.2 If plastic sleeves are used in fire rated walls or floors, remove before conduit installation.

.3 Install cables, conduits and fittings to be embedded or plastered over, neatly and close to building structure so furring can be kept to minimum.

.4 All conduit and tray sealing shall be the responsibility of the Electrical Contractor.

1.35 TEMPORARY AND TRIAL USAGE

.1 Temporary and trial usage by the Owner, or the Contractor, of any of the electrical apparatus or equipment, or any work or materials supplied under this Division before final completion and written acceptance, is not to be construed as evidence of acceptance of same by the Owner.

.2 Temporary and trial usage may be made as soon as this Division deems the work sufficiently advanced for making a complete and thorough test of same, and that no claim may be made for the injury to or the breaking of any part of such work which may be so used, whether caused by weakness or inaccuracy of structural parts, or by defective material or workmanship of any kind.

.3 Lighting shall not be used for temporary or trial usage without prior approval of the owner and consultant sign off. If temporary lighting is required for the duration of the project, only construction lamps marked with a permanent ink on the lamp may be used. Evidence of marking will be requested by the consultant. Any fixtures used for temporary or trail usage shall be relamped and cleaned. Evidence of cleaning and relamping will be required by the consultant.

1.36 EXCAVATION AND BACKFILL

.1 Any excavation and backfilling work that is necessary to accommodate the work under this Division shall be the responsibility of Divisions 26, 27, and 28, in accordance with the requirements of Division 31.

1.37 TEMPORARY LIGHT AND POWER

.1 The General Contractor shall be responsible for all temporary light and power provisions. Refer to General Conditions.

1.38 MATERIAL TO BE TURNED OVER TO THE OWNER

.1 All equipment that is being removed or replaced shall be stockpiled as per Owner's request. The owner may deem that the equipment shall be disposed. All disposal and removal is the responsibility of the contractor.

.2 Materials as indicated in various sections of this specification shall be turned over to the Owner. These materials shall include, but not be limited to the following:

.1 Obtain a signed receipt for each item turned over to the Owner. Include receipts in the operating and maintenance manuals.

.2 One set of three fuses for each fuse type and size for each switchboard distribution centre and motor control centre.

.3 One set of contacts and one holding coil for each size and type of FVNR motor starter.

.4 Spare lighting fixtures.

.5 Spare Fire Alarm Devices.

.6 Data patch cables.

1.39 SITE WORK

.1 The electrical contractor shall be responsible for all necessary trenching and backfilling for all exterior work in connection with underground feeders. All trenches shall be a minimum 900 mm deep. Care must be exercised to ensure a proper grade line is used, and that suitable drainage has been provided.

.2 All excavated material shall be removed from the site.

.3 Trenches shall be filled with granular fill and compacted to 95% proctor. Prior to backfilling, all trenches must be inspected by the Consultant.

.4 Supply and install all cable and conduit in trenches, as described herein or detailed on the drawings.

.5 Electrical contractor shall be responsible for all concrete and reinforcing in connection with site lighting and car parking pedestals. All concrete and reinforcing on the project shall be in accordance with the quality required for reinforced concrete and reinforcing as specified under Division 3, and as detailed on the drawings.

1.40 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.

1.41 PAINTING

.1 All iron or steel structures fabricated and installed by Divisions 26, 27, and 28 for supporting panels, starters, conduit or other equipment, shall be wire brushed and given one coat of lead chromate paint primer before being set into place. After all equipment is installed and piping complete, this iron work shall be given two coats of ASA #61 enamel to match the panel or structure being supported or in the colour specified for the product.

.2 All pull boxes, wireways, gutters, etc., fabricated for Divisions 26, 27, and 28, shall be given a coat of lead chromate primer and two coats of ASA #61 enamel before installation to match equipment finish.

.3 All panels and pull boxes that are set in finished walls or ceilings shall have approved flush covers that shall be prime coated with lead chromate paint, and left for the painting division to paint in with the surrounding wall or ceiling finishes. Panel trims and pull box covers to be painted with the cover removed from the wall so that it can be easily installed or removed without damaging the surrounding paint finish.

.4 All electrical equipment shall be finished with an ASA #61 enamel, the colour of which shall be grey, unless otherwise specified.

.5 When installation is complete, all scratches and defects to the paint finishes shall be properly touched up, and where necessary, entire paint surfaces shall be re-done.

1.42 MATERIAL SAFETY DATA AND HAZARDOUS MATERIALS

.1 The Contractor shall provide material safety data sheets on all materials prior to shipping materials to site. These data sheets shall be submitted in triplicate to the Owner.

.2 The Contractor shall coordinate and provide necessary information for the Owner’s "Work Place Hazardous Material Information System".

1.43 SCHEDULING OF WORK AND DEMOLITION

.1 Refer to Division 1 specifications.

.2 Refer to the overall project schedule for further scheduling requirements.

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 GENERAL REQUIREMENTS

.1 The General Conditions of Contract, Division 01 General Requirements and all Addenda thereto form an integral part of and must be read in conjunction with the requirements of this Section.

.2 Cooperate and coordinate with the requirements of other units of work specified in other Sections.

1.2 REFERENCES

.1 The Electrical Contractor shall be bound by industry standards, as interpreted by the Consultant, whether or not specifically referenced in this document. Comply with Electrical Protection Act and rules and regulations made pursuant thereto, including the Canadian Electrical Code. Also, comply with applicable standards of the following:

.1 CSA C22.1-2012, Canadian Electrical Code, Part 1.

.2 Electrical and Electronic Manufacturers Association of Canada (EEMAC).

.3 National Electrical Manufacturers Association (NEMA).

.4 National Building Code 2010 (NBC 2010)

.5 National Fire Protection Association (NFPA)

.6 Institute of Electrical and Electronic Engineers (IEEE).

.7 Audio Engineering Society (AES).

.8 Other Applicable CSA and UL approvals.

1.3 SHOP DRAWINGS AND PRODUCT DATA

.1 Submit shop drawings in accordance with:

.1 Section 01 33 00 - Submittal Procedures

.2 26 05 01 – Common Work Results

.2 Shop drawings shall include but not be limited to device types, cable types, and special mounting details.

Part 2 Products

2.1 MATERIALS

.1 Pressure type wire connectors: with current carrying parts of copper sized to fit copper conductors as required.

.2 Fixture type splicing connectors: with current carrying parts of copper sized to fit copper conductors #10 AWG or less.

.3 Bushing stud connectors: to EEMAC 1Y-2 to consist of:

.1 Connector body and stud clamp for round copper conductors.

.2 Clamp for round copper conductors.

.3 Stud clamp bolts.

.4 Sized for conductors as indicated.

.4 Clamps or connectors for armoured cable, aluminum sheathed cable, mineral insulated cable, flexible conduit, non-metallic sheathed cable as required.

Part 3 Execution

3.1 INSTALLATION

.1 Remove insulation carefully from ends of conductors and:

.1 Apply coat of zinc joint compound on aluminum conductors prior to installation of connectors.

.2 Install mechanical pressure type connectors and tighten screws with appropriate compression tool recommended by manufacturer. Installation shall meet secureness tests in accordance with CSA C22.2No.65.

.3 Install fixture type connectors and tighten. Replace insulating cap.

.4 Install bushing stud connectors in accordance with NEMA.

END OF SECTION

Part 1 General

1.1 GENERAL REQUIREMENTS

.1 The General Conditions of Contract, Division 01 General Requirements and all Addenda thereto form an integral part of and must be read in conjunction with the requirements of this Section.

.2 Cooperate and coordinate with the requirements of other units of work specified in other Sections.

1.2 REFERENCES

.1 The Electrical Contractor shall be bound by industry standards, as interpreted by the Consultant, whether or not specifically referenced in this document. Comply with Electrical Protection Act and rules and regulations made pursuant thereto, including the Canadian Electrical Code. Also, comply with applicable standards of the following:

.1 CSA C22.1-2012, Canadian Electrical Code, Part 1.

.2 Electrical and Electronic Manufacturers Association of Canada (EEMAC).

.3 National Electrical Manufacturers Association (NEMA).

.4 National Building Code 2010 (NBC 2010)

.5 National Fire Protection Association (NFPA)

.6 Institute of Electrical and Electronic Engineers (IEEE).

.7 Audio Engineering Society (AES).

.8 Other Applicable CSA and UL approvals.

1.3 SHOP DRAWINGS AND PRODUCT DATA

.1 Submit shop drawings in accordance with:

.1 Section 01 33 00 - Submittal Procedures

.2 26 05 01 – Common Work Results

.2 Shop drawings shall include but not be limited to speakers, riser diagram, cable types, and special mounting details.

1.4 PRODUCT APPROVALS

.1 Manufacturers' and model numbers named in these specifications indicate an acceptable technical standard of performance and are not intended to be exclusive. Products submitted as alternates must result in a control system that meets or exceeds all technical performance criteria as described.

.2 Products proposed as alternatives to those specified, shall only be considered if submitted for approval no later than 15 working days before tender close. Submit alternates, for approval, as one complete listing. Provide complete product specification sheets with request for approval.

□

.3 The Bidder must provide a complete list of primary system products offered with their bid.

Part 2 Products

2.1 BUILDING WIRES

.1 All conductors shall be copper, minimum No. 12 gauge, unless specifically noted otherwise.

.2 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 1000V 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.

.3 Wiring for major feeders may be NUAL aluminum and may be installed only where specifically noted on the drawings.

.4 Conductor utilized in conduit run under slab on grade or in conduit underground shall be Type 'RWU-90'.

.5 Wire shall be as manufactured by Nexans, Alcan, Pirelli, BICC General Wire or Superior Essex.

2.2 TECK CABLE

.1 Cable: to CAN/CSA-C22.2 No. 131.

.2 Conductors:

.1 Grounding conductor: copper.

.2 Circuit conductors: copper, size as indicated.

.3 Insulation:

.1 Chemically cross-linked thermosetting polyethylene rated type RW90, 600V to 1000V as noted above.

.4 Fastenings:

.1 One hole steel straps to secure surface cables 50 mm and smaller. Two hole steel straps for cables larger than 50 mm.

.2 Channel type supports for two or more cables.

.3 Threaded rods: 6 mm dia. to support suspended channels.

.5 Connectors:

.1 Watertight approved for TECK cable.

□

Part 3 Execution

3.1 CLOSEOUT SUBMITTALS

.1 Provide operation and maintenance information for the Intercom system for incorporation into manual specified in:

.1 Section 01 78 00 - Closeout Submittals

.2 Include:

.1 Manufacture description sheet on each cable type

3.2 INSTALLATION OF BUILDING WIRES

.1 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.

.2 Conductor splices shall be made in accordance with specifications. Provide sufficient length for joint remake, and no less than 200 mm spare length. On through wiring, leave 300 mm loop.

.3 Wiring in cabinets, pull boxes, panels and junction boxes shall be neatly trained and held with nylon cable ties.

.4 Conductors shall be tag identified where passing through junction boxes.

3.3 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 terminated and spliced with suitable compression type connectors, as recommended by the cable manufacturer. The connectors shall satisfy the bonding and grounding requirements at the supply end.

.4 All cables shall be single conductor and copper, unless otherwise specified.

.5 All cable shall be rated for 1000 volts, insulated with cross-linked polyethylene and rated for operation at 90 degrees C. Cable shall have a FT4 rated outer jacket.

.6 All cable shall meet the CSA requirements for cold bend and impact testing at minus 40 degrees C.

.7 All cable shall be protected by a corrugated aluminum sheath or by interlocked aluminum armour.PVC jackets shall be required on all metallic sheathed cables.

.8 The jackets shall meet the FT4 flame spread requirements and be identified on the P.V.C. jacket.

□

.9 All cables shall be installed in accordance with the manufacturers recommendations, in suitable cable tray as specified within the specifications.

.10 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.

.11 All cable installed in cable tray shall be installed at one diameter spacing.

.12 When single conductor cables are direct earth buried they shall be spaced 150 mm apart.

.13 Cables shall be manufactured by Nexans, Alcan, Superior Essex, General Wire or Pirelli.

3.4 INSTALLATION OF ARMOURED CABLES

.1 Group cables wherever possible.

.2 Terminate cables in accordance with Section 26 05 20 - Wire and Box Connectors 0-1000 V.

.3 Conductors: insulated, copper, size as indicated.

.4 Type: AC90 - Armour: interlocking type fabricated from aluminum strip. Use of this cable shall be kept to a minimum and used only when required from junction box to light fixture, connection to mechanical equipment, etc. Maximum length allowed shall be 1500mm.

.5 Type: ACWU90 - jacket over armour meeting requirements of Vertical Tray Fire Test of CSA C22.2 No. 0.3 with maximum flame travel of 1.2 m.

.6 Connectors: as required.

.7 Multi conductor cables shall be color coded during manufacture. Single conductor cables shall be color coded with adhesive colour coding tape. The tape shall be applied for a minimum of 75 mm at all terminations. Cables shall not be painted under any condition. Color coding shall be as follows:

Phase 'A' - Red	Neutral - White
Phase 'B' - Black	Ground - Green or Bare
Phase 'C' – Blue	

END OF SECTION

□

Part 1 General

1.1 GENERAL REQUIREMENTS

.1 The General Conditions of Contract, Division 01 General Requirements and all Addenda thereto form an integral part of and must be read in conjunction with the requirements of this Section.

.2 Cooperate and coordinate with the requirements of other units of work specified in other Sections.

1.2 REFERENCES

.1 The Electrical Contractor shall be bound by industry standards, as interpreted by the Consultant, whether or not specifically referenced in this document. Comply with Electrical Protection Act and rules and regulations made pursuant thereto, including the 2012 Canadian Electrical Code. Also, comply with applicable standards of the following:

.1 CSA C22.1-2012, Canadian Electrical Code, Part 1.
.2 Electrical and Electronic Manufacturers Association of Canada (EEMAC).
.3 National Electrical Manufacturers Association (NEMA).
.4 National Building Code 2010 (NBC 2010)
.5 National Fire Protection Association (NFPA)
.6 Institute of Electrical and Electronic Engineers (IEEE).
.7 Audio Engineering Society (AES).
.8 Other Applicable CSA and UL approvals.

1.3 SHOP DRAWINGS AND PRODUCT DATA

.1 Submit shop drawings in accordance with:

.1 Section 01 33 00 - Submittal Procedures
.2 Section 26 05 01 – Common Work Results

.2 Shop drawings shall include but not be limited to connectors used, specialty ground bars, etc.

1.4 PRODUCT APPROVALS

.1 Manufacturers' and model numbers named in these specifications indicate an acceptable technical standard of performance and are not intended to be exclusive. Products submitted as alternates must result in a control system that meets or exceeds all technical performance criteria as described.

.2 Products proposed as alternatives to those specified, shall only be considered if submitted for approval no later than 15 working days before tender close. Submit alternates, for approval, as one complete listing. Provide complete product specification sheets with request for approval.

.3 The Bidder must provide a complete list of primary system products offered with their bid.

□

Part 2 Products

2.1 EQUIPMENT

.1 Clamps for grounding of conductor: size as required to electrically conductive underground water pipe.

.2 All ground rods shall be 20 mm diameter by 3000 mm long, copper clad.

.3 Grounding conductors: bare stranded copper.

.4 Insulated grounding conductors: green

.5 Ground bus: copper, complete with insulated supports, fastenings, connectors.

.6 Non-corroding accessories necessary for grounding system, type, size, material as indicated, including but not necessarily limited to:

- .1 Grounding and bonding bushings.
- .2 Protective type clamps.
- .3 Bolted type conductor connectors.
- .4 Thermit welded type conductor connectors.
- .5 Bonding jumpers, straps.
- .6 Pressure wire connectors.

.7 All ground conductors shall be bare or insulated, stranded, medium hard drawn copper wire. All insulated ground wires shall be green.

.8 Exposed copper shall be cleaned to a bright surface, and shall be finished with two coats of clean, insulating varnish.

.9 Connect ground conductor to copper water pipe at least twice (minimum 40 mm diameter), utilizing a Burndy Type GAR pipe clamp. Provide jumper across water meter.

.10 All connections to the ground bus or risers shall be thermowelded, or shall utilize the Burndy Hy-Ground compression connections. Clamp type connections shall only be allowed to individual pieces of equipment.

.11 Where bonds are covered with soil, the conductors are to be coated with anti-corrosion compound "Kopr-Shield" (Thomas & Betts Co.) before compression connector is applied. All bonding shall be done with 'C' tap and lug compression connectors.

Part 3 Execution

3.1 INSTALLATION GENERAL

.1 Electrical equipment and wiring shall be grounded in accordance with the Canadian Electrical Code, and local inspection authority's rules and regulations.

.2 All metallic raceways and conduits for communications, cable and conductors shall be grounded.

□

.3 All motors with flexible connections shall have separate ground wire run bridging the flexible connections. This ground wire shall be run from the motor back to the nearest junction box or motor control centre where the termination can be readily inspected. Insulation for this wire shall be green.

.4 Lay-in trays and feeder conduits shall be connected to the ground bus.

.5 All panel feeds at 208 volt shall include a building network ground conductor.

.6 All grounding conductors outside the electrical rooms and closets shall be insulated and installed in conduits, unless otherwise noted.

.7 Install connectors in accordance with manufacturer's instructions.

.8 Protect exposed grounding conductors from mechanical injury.

.9 Use mechanical connectors for grounding connections to equipment provided with lugs.

.10 Install bonding wire for flexible conduit, connected at both ends to grounding bushing, solderless lug, clamp or cup washer and screw. Neatly cleat bonding wire to exterior of flexible conduit.

.11 Install flexible ground straps for bus duct enclosure joints, where such bonding is not inherently provided with equipment.

.12 Structural steel and metal siding to ground by welding copper to steel.

.13 Make grounding connections in radial configuration only, with connections terminating at single grounding point. Avoid loop connections unless indicated otherwise.

.14 Use mechanical connectors for grounding connections to equipment provided with lugs.

.15 Soldered joints not permitted.

.16 Install separate ground conductor to outdoor lighting standards.

.17 Make grounding connections in radial configuration only. Avoid loop connections.

.18 Bond single conductor, metallic armoured cables to cabinet at supply end, and provide non-metallic entry plate at load end.

3.2 SYSTEM AND CIRCUIT GROUNDING

.1 Install system and circuit grounding connections to neutral of secondary systems.

3.3 EQUIPMENT GROUNDING

.1 Install grounding connections to typical equipment included in, but not necessarily limited to following list. Service equipment, duct systems, frames of motors, starters, control panels, structure steel work, and distribution panels.

□

3.4 COMMUNICATION SYSTEMS

.1 Install grounding connections for all communication and security systems as per manufacturer's recommendations

3.5 FIELD QUALITY CONTROL

.1 Perform tests in accordance with Section 26 05 01 - Common Work Results - Electrical.

.2 Perform tests before energizing electrical system.

.3 Disconnect ground fault indicator during tests.

.4 All grounding conductors outside the electrical rooms and closets shall be insulated and installed in conduits, unless otherwise noted.

.5 Connections to equipment shall be made with, bronze or copper bolts and connectors.

.6 Equipment grounds shall be connected to the building grounding network. All non-current carrying metallic parts of equipment shall be connected to the ground network.

END OF SECTION

□

Part 1 General

1.1 GENERAL REQUIREMENTS

.1 The General Conditions of Contract, Division 01 General Requirements and all Addenda thereto form an integral part of and must be read in conjunction with the requirements of this Section.

.2 Cooperate and coordinate with the requirements of other units of work specified in other Sections.

1.2 REFERENCES

.1 The Electrical Contractor shall be bound by industry standards, as interpreted by the Consultant, whether or not specifically referenced in this document. Comply with Electrical Protection Act and rules and regulations made pursuant thereto, including the 2012 Canadian Electrical Code. Also, comply with applicable standards of the following:

.1 CSA C22.1-2012, Canadian Electrical Code, Part 1.

.2 Electrical and Electronic Manufacturers Association of Canada (EEMAC).

.3 National Electrical Manufacturers Association (NEMA).

.4 National Building Code 2010 (NBC 2010)

.5 National Fire Protection Association (NFPA)

.6 Institute of Electrical and Electronic Engineers (IEEE).

.7 Audio Engineering Society (AES).

.8 Other Applicable CSA and UL approvals.

.2 Submit shop drawings in accordance with:

.1 Section 01 33 00 - Submittal Procedures

.2 Section 26 05 01 – Common Work Results

.3 Shop drawings shall include but not be limited to speakers, riser diagram, cable types, and special mounting details.

1.3 PRODUCT APPROVALS

.1 Manufacturers' and model numbers named in these specifications indicate an acceptable technical standard of performance and are not intended to be exclusive. Products submitted as alternates must result in a control system that meets or exceeds all technical performance criteria as described.

.2 Products proposed as alternatives to those specified, shall only be considered if submitted for approval no later than 15 working days before tender close. Submit alternates, for approval, as one complete listing. Provide complete product specification sheets with request for approval.

.3 The Bidder must provide a complete list of primary system products offered with their bid.

□

Part 2 Products

2.1 SUPPORT CHANNELS

.1 U shape, size 41 x 41 mm, 2.5 mm thick, surface mounted suspended or set in poured concrete walls and ceilings.

Part 3 Execution

3.1 INSTALLATION

.1 Secure equipment to poured concrete with expandable inserts.

.2 Secure equipment to hollow masonry walls or suspended ceilings with toggle bolts.

.3 Secure surface mounted equipment with twist clip fasteners to inverted T bar ceilings. Ensure that T bars are adequately supported to carry weight of equipment specified before installation.

.4 Support equipment, conduit or cables using clips, spring loaded bolts, cable clamps designed as accessories to basic channel members.

.5 Fasten exposed conduit or cables to building construction or support system using straps.

- .1 One-hole steel straps to secure surface conduits and cables 50 mm and smaller.
- .2 Two-hole steel straps for conduits and cables larger than 50 mm.
- .3 Beam clamps to secure conduit to exposed steel work.

.6 Suspended support systems.

- .1 Support individual cable or conduit runs with 6 mm dia threaded rods and spring clips.
- .2 Support 2 or more cables or conduits on channels supported by 6 mm dia threaded rod hangers where direct fastening to building construction is impractical.

.7 For surface mounting of two or more conduits, use channels spaced as required by C22.1.

.8 Provide metal brackets, frames, hangers, clamps and related types of support structures where indicated or as required to support conduit and cable runs.

.9 Ensure adequate support for raceways and cables dropped vertically to equipment where there is no wall support.

.10 Do not use wire lashing or perforated strap to support or secure raceways or cables.

.11 Do not use supports or equipment installed for other trades for conduit or cable support except with permission of other trade and approval of Engineer.

.12 Install fastenings and supports as required for each type of equipment cables and conduits, and in accordance with manufacturer's installation recommendations.

□

3.2 CLOSEOUT SUBMITTALS

.1 Provide operation and maintenance information for the Intercom system for incorporation into manual specified in:

.1 Section 01 78 00 - Closeout Submittals

.2 Include:

.1 Operation instructions

.2 Description of system operation

.3 Description of each subsystem operation

.4 List specifying each piece of equipment in system or subsystem by its original manufacturer name and model number.

.5 Parts list specifying parts used in equipment by identification numbers that are standard to electronic industry.

3.3 WARRANTY

.1 The contractor must make available to the Owner a local service department of a duly authorized distributor of the equipment manufacturer, which shall stock the manufacturer's standard parts. The service department shall have at least one factory trained repair technician available to the Owner on 24 hours' notice.

.2 Provide warranty of installation of equipment installed by this contractor to be free of defects for a period of (1) one year from date of Substantial Completion.

.3 Provide during the warranty period, all service, maintenance, parts, etc., required for normal operation of the systems, such that Owner needs not purchase additional maintenance agreement or contracts. Upon request, the manufacturer and his agent shall provide direct to the Owner the following proposals:

.1 Continuation, after the warranty period, of full maintenance, including all service, labour, parts, etc. required to maintain the systems in a fully operational condition.

END OF SECTION

□

Part 1 General

1.1 GENERAL REQUIREMENTS

.1 The General Conditions of Contract, Division 01 General Requirements and all Addenda thereto form an integral part of and must be read in conjunction with the requirements of this Section.

.2 Cooperate and coordinate with the requirements of other units of work specified in other Sections.

1.2 REFERENCES

.1 The Electrical Contractor shall be bound by industry standards, as interpreted by the Consultant, whether or not specifically referenced in this document. Comply with Electrical Protection Act and rules and regulations made pursuant thereto, including the 2012 Canadian Electrical Code. Also, comply with applicable standards of the following:

.1 CSA C22.1-2012, Canadian Electrical Code, Part 1.
.2 Electrical and Electronic Manufacturers Association of Canada (EEMAC).
.3 National Electrical Manufacturers Association (NEMA).
.4 National Building Code 2010 (NBC 2010)
.5 National Fire Protection Association (NFPA)
.6 Institute of Electrical and Electronic Engineers (IEEE).
.7 Audio Engineering Society (AES).
.8 Other Applicable CSA and UL approvals.

1.3 SHOP DRAWINGS AND PRODUCT DATA

.1 Submit shop drawings in accordance with:

.1 Section 01 33 00 - Submittal Procedures
.2 Section 26 05 01 – Common Work Results

1.4 PRODUCT APPROVALS

.1 Manufacturers' and model numbers named in these specifications indicate an acceptable technical standard of performance and are not intended to be exclusive. Products submitted as alternates must result in a control system that meets or exceeds all technical performance criteria as described.

.2 Products proposed as alternatives to those specified, shall only be considered if submitted for approval no later than 15 working days before tender close. Submit alternates, for approval, as one complete listing. Provide complete product specification sheets with request for approval.

.3 The Bidder must provide a complete list of primary system products offered with their bid.

□

Part 2 Products

2.1 SPLITTERS

.1 Sheet metal enclosure, welded corners and formed hinged cover suitable for locking in closed position.

.2 Main and branch lugs to match required size and number of incoming and outgoing conductors as indicated.

.3 At least three spare terminals on each set of lugs in splitters.

2.2 JUNCTION AND PULL BOXES

.1 Welded steel construction with screw-on flat covers for surface mounting.

.2 Covers with 25 mm minimum extension all around, for flush-mounted pull and junction boxes.

2.3 CABINETS

.1 Sheet steel, hinged door and return flange overlapping sides, handle, lock and catch, for surface mounting.

Part 3 Execution

3.1 CLOSEOUT SUBMITTALS

.1 Provide operation and maintenance information for incorporation into manual specified in:

.1 Section 01 78 00 - Closeout Submittals

.2 Include:

.1 List specifying each piece of equipment in system or subsystem by its original manufacturer name and model number.

.2 Parts list specifying parts used in equipment by identification numbers that are standard to electronic industry.

3.2 SPLITTER INSTALLATION

.1 Install splitters and mount plumb, true and square to the building lines.

.2 Extend splitters full length of equipment arrangement except where indicated otherwise.

3.3 JUNCTION, PULL BOXES AND CABINETS INSTALLATION

.1 Install pull boxes in inconspicuous but accessible locations.

.2 Mount cabinets with top not higher than 2 m above finished floor.

.3 Install terminal / bix block where indicated in cabinets.

□

.4 Only main junction and pull boxes are indicated. Provide others as required by code. Install pull boxes so as not to exceed 30m of conduit run between pull boxes.

3.4 IDENTIFICATION

.1 Provide equipment identification in accordance with Section 26 05 01 - Common Work Results - Electrical.

.2 Install size 2 identification labels indicating system name, voltage and phase, Emergency, or Normal power.

3.5 WARRANTY

.1 The contractor must make available to the Owner a local service department of a duly authorized distributor of the equipment manufacturer, which shall stock the manufacturer's standard parts. The service department shall have at least one factory trained repair technician available to the Owner on 24 hours' notice.

.2 Provide warranty of installation of equipment installed by this contractor to be free of defects for a period of (1) one year from date of Substantial Completion.

.3 Provide during the warranty period, all service, maintenance, parts, etc., required for normal operation of the systems, such that Owner needs not purchase additional maintenance agreement or contracts. Upon request, the manufacturer and his agent shall provide direct to the Owner the following proposals:

.1 Continuation, after the warranty period, of full maintenance, including all service, labour, parts, etc. required to maintain the systems in a fully operational condition.

END OF SECTION

□

Part 1 General

1.1 GENERAL REQUIREMENTS

.1 The General Conditions of Contract, Division 01 General Requirements and all Addenda thereto form an integral part of and must be read in conjunction with the requirements of this Section.

.2 Cooperate and coordinate with the requirements of other units of work specified in other Sections.

1.2 REFERENCES

.1 The Electrical Contractor shall be bound by industry standards, as interpreted by the Consultant, whether or not specifically referenced in this document. Comply with Electrical Protection Act and rules and regulations made pursuant thereto, including the 2012 Canadian Electrical Code. Also, comply with applicable standards of the following:

.1 CSA C22.1-2012, Canadian Electrical Code, Part 1.
.2 Electrical and Electronic Manufacturers Association of Canada (EEMAC).
.3 National Electrical Manufacturers Association (NEMA).
.4 National Building Code 2010 (NBC 2010)
.5 National Fire Protection Association (NFPA)
.6 Institute of Electrical and Electronic Engineers (IEEE).
.7 Audio Engineering Society (AES).
.8 Other Applicable CSA and UL approvals.

1.3 SHOP DRAWINGS AND PRODUCT DATA

.1 Submit shop drawings in accordance with:

.1 Section 01 33 00 - Submittal Procedures
.2 Section 26 05 01 – Common Work Results

.2 Shop drawings shall include but not be limited to speakers, riser diagram, cable types, and special mounting details.

1.4 PRODUCT APPROVALS

.1 Manufacturers' and model numbers named in these specifications indicate an acceptable technical standard of performance and are not intended to be exclusive. Products submitted as alternates must result in a control system that meets or exceeds all technical performance criteria as described.

.2 Products proposed as alternatives to those specified, shall only be considered if submitted for approval no later than 15 working days before tender close. Submit alternates, for approval, as one complete listing. Provide complete product specification sheets with request for approval.

□

.3 The Bidder must provide a complete list of primary system products offered with their bid.

Part 2 Products

2.1 OUTLET AND CONDUIT BOXES GENERAL

.1 Size boxes in accordance with CSA C22.1.

.2 102 mm square or larger outlet boxes as required for special devices.

.3 Gang boxes where wiring devices are grouped.

.4 Provide blank cover plates for boxes without wiring devices.

.5 Provide combination boxes with barriers where outlets for more than one system are grouped.

.6 Each outlet box installed in steel stud and gyproc walls shall be mounted on Caddy #BHA, series SGB or TSGB screw gun brackets. Wood strapping with steel studs shall not be utilized for supporting outlet boxes

.7 Use condulets where 90° turn required on wall mounted conduit. They shall be of the type where cover screws do not enter the wire chamber and covers are left accessible.

.8 Each outlet box installed in acoustic tile ceilings shall be mounted on double Caddy "Tee Bar Hanger" #512 in such a manner that the outlet box will not twist in any direction.

.9 Where boxes are surface mounted in unfinished areas, such as furnace or boiler rooms, stamped galvanized steel 100 mm square box to accept #8300 series raised covers shall be used.

.10 Where surface wiring methods are allowed and approved in finished areas, use Hubbell or Wiremold boxes as per drawings c/w suitable adapter for wireway entrance.

.11 Outdoors or damp locations, boxes shall be cast Feraloy or aluminum type 'FS', with threaded hubs and vapourproof covers.

.12 Indoors, stamped zinc cadmium plated steel boxes shall be provided and set for each fixture, switch, wall receptacle or other types of outlets, adapted to suit its respective location and designed to accept its particular components.

.13 Standard octagon boxes shall be 100 mm diameter, 53 mm deep minimum. Increase depth where area fill requires. Equip each box used for fixture hanging with a fixture stud.

.14 Two gang or larger shall be solid type with raised cover for tile, block or gyproc finish.

.15 Wood strapping with steel studs shall not be utilized for supporting outlet boxes.

.16 Set boxes plumb and level within 6 mm of finished surface. Mats not permitted.

.17 Where required, provide voltage separation barriers.

□

2.2 SHEET STEEL OUTLET BOXES

.1 Electro-galvanized steel multi-gang flush device boxes for flush installation, minimum size 76 x 50 x 38 mm or as indicated. 102 mm square outlet boxes when more than one conduit enters one side with extension and plaster rings as required.

.2 Standard octagon boxes shall be 100 mm diameter, 53 mm deep minimum. Increase depth where area fill requires. Equip each box used for fixture hanging with a fixture stud.

.3 102 mm square outlet boxes with extension and plaster rings for flush mounting devices in finished walls.

.4 102 mm square or octagonal outlet boxes for lighting fixture outlets.

.5 102 mm square outlet boxes with extension and plaster rings for flush mounting devices in finished plaster walls.

2.3 MASONRY BOXES

.1 Electro-galvanized steel masonry single and multi-gang boxes for devices flush mounted in exposed block walls.

2.4 CONCRETE BOXES

.1 Electro-glavanized sheet steel concrete type boxes for flush mount in concrete with matching extension and plaster rings as required.

2.5 CONDUIT BOXES

.1 Outdoors or damp locations, boxes shall be cast Feraloy or aluminum type 'FS', with threaded hubs and vapourproof covers.

.2 Indoors, stamped zinc cadmium plated steel boxes shall be provided and set for each fixture, switch, wall receptacle or other types of outlets, adapted to suit its respective location and designed to accept its particular components.

.3 Standard octagon boxes shall be 100 mm diameter, 53 mm deep minimum. Increase depth where area fill requires. Equip each box used for fixture hanging with a fixture stud.

.4 Two gang or larger shall be solid type with raised cover for tile, block or gyproc finish.

.5 Wood strapping with steel studs shall not be utilized for supporting outlet boxes.

.6 Set boxes plumb and level within 6 mm of finished surface. Mats not permitted.

.7 Where required, provide voltage separation barriers.

2.6 FITTINGS - GENERAL

.1 Bushing and connectors with nylon insulated throats.

.2 Knock-out fillers to prevent entry of debris.

□

.3 Conduit outlet bodies for conduit up to 32 mm and pull boxes for larger conduits.

.4 Double locknuts and insulated bushings on sheet metal boxes.

Part 3 Execution

3.1 INSTALLATION

.1 Support boxes independently of connecting conduits.

.2 Fill boxes with paper, sponges or foam or similar approved material to prevent entry of debris during construction. Remove upon completion of work.

.3 For flush installations mount outlets flush with finished wall using plaster rings to permit wall finish to come within 6 mm of opening.

.4 Provide correct size of openings in boxes for conduit, mineral insulated and armoured cable connections. Reducing washers are not allowed.

.5 Outlet boxes shall be supported independently of conduit capable of supporting weight of fixture or other device. Conduit entering the back of a box shall not enter the centre knockout.

.6 For recessed fixtures in suspended ceilings, outlet box shall be accessible when fixture is removed.

.7 Flexible conduit to fixture shall be minimum 12 mm diameter, and shall not emanate from outlet box cover. Maximum length of flexible conduit from outlet box to fixture shall be 3000 mm. Outlet box for fixture shall not be located above ducts, pipes, etc. Outlet box shall be within 750 mm (vertically) of the fixture.

.8 Provide and set all special communications type back boxes associated with systems specified under Electrical Divisions.

.9 In placing outlets, allow for overhead pipes, ducts, etc., and for variation in wall and ceiling finishes, door and window trim, panelling, etc.

.10 Location of receptacle outlets in equipment rooms shall be finalized during construction to give optimum arrangement. Consultant to approve locations before installation.

.11 Multigang boxes shall have each gang fully barriered from the next, or multiple single gang boxes may be used, provided they are installed in a neat, orderly fashion. Barriers shall be steel and shall be firmly held in place.

Attention is directed to special outlet box locations for switches requiring wider mount spacing rejection feature.

3.2 CLOSEOUT SUBMITTALS

.1 Provide operation and maintenance information for incorporation into manual specified in:

.1 Section 01 78 00 - Closeout Submittals

.2 Include:

.1 Operation instructions

.2 Description of system operation

.3 Description of each subsystem operation

.4 List specifying each piece of equipment in system or subsystem by its original manufacturer name and model number.

.5 Parts list specifying parts used in equipment by identification numbers that are standard to electronic industry.

3.3 WARRANTY

.1 The contractor must make available to the Owner a local service department of a duly authorized distributor of the equipment manufacturer, which shall stock the manufacturer's standard parts. The service department shall have at least one factory trained repair technician available to the Owner on 24 hours' notice.

.2 Provide warranty of installation of equipment installed by this contractor to be free of defects for a period of (1) one year from date of Substantial Completion.

.3 Provide during the warranty period, all service, maintenance, parts, etc., required for normal operation of the systems, such that Owner needs not purchase additional maintenance agreement or contracts. Upon request, the manufacturer and his agent shall provide direct to the Owner the following proposals:

.1 Continuation, after the warranty period, of full maintenance, including all service, labour, parts, etc. required to maintain the systems in a fully operational condition.

END OF SECTION

□

Part 1 General

1.1 GENERAL REQUIREMENTS

.1 The General Conditions of Contract, Division 01 General Requirements and all Addenda thereto form an integral part of and must be read in conjunction with the requirements of this Section.

.2 Cooperate and coordinate with the requirements of other units of work specified in other Sections.

1.2 REFERENCES

.1 The Electrical Contractor shall be bound by industry standards, as interpreted by the Consultant, whether or not specifically referenced in this document. Comply with Electrical Protection Act and rules and regulations made pursuant thereto, including the 2012 Canadian Electrical Code. Also, comply with applicable standards of the following:

.1 CSA C22.1-2012, Canadian Electrical Code, Part 1.
.2 Electrical and Electronic Manufacturers Association of Canada (EEMAC).
.3 National Electrical Manufacturers Association (NEMA).
.4 National Building Code 2010 (NBC 2010)
.5 National Fire Protection Association (NFPA)
.6 Institute of Electrical and Electronic Engineers (IEEE).
.7 Audio Engineering Society (AES).
.8 Other Applicable CSA and UL approvals.

1.3 SHOP DRAWINGS AND PRODUCT DATA

.1 Submit shop drawings in accordance with:

.1 Section 01 33 00 - Submittal Procedures
.2 Section 26 05 01 – Common Work Results

.2 Shop drawings shall include but not be limited to speakers, riser diagram, cable types, and special mounting details.

1.4 PRODUCT APPROVALS

.1 Manufacturers' and model numbers named in these specifications indicate an acceptable technical standard of performance and are not intended to be exclusive. Products submitted as alternates must result in a control system that meets or exceeds all technical performance criteria as described.

.2 Products proposed as alternatives to those specified, shall only be considered if submitted for approval no later than 15 working days before tender close. Submit alternates, for approval, as one complete listing. Provide complete product specification sheets with request for approval.

□

.3 The Bidder must provide a complete list of primary system products offered with their bid.

Part 2 Products

2.1 CONDUITS

.1 Electrical metallic tubing (EMT): to CSA C22.2 No. 83, with couplings.

.2 Rigid PVC conduit: to CSA C22.2 No. 211.2.

.3 Flexible metal conduit: to CSA C22.2 No. 56, liquid-tight flexible metal.

.4 Flexible PVC conduit: to CAN/CSA-C22.2 No. 227.3

.5 Conduit for use in corrosive atmospheres shall be rigid PVC or rigid steel with extruded PVC jacketed. Refer to drawings for areas requiring PVC.

.6 Condulets shall be of a type wherein cover screws do not enter the wire chamber.

.7 Flexible conduit connections to all mechanical equipment shall be of 'Sealtite' manufacture.

.8 Flexible conduit connectors shall be of the insulated throat type.

.9 Condulets with suitable covers shall be used where condulets are exposed. Each conduit fitting shall be of a type suitable to its particular use, and of a type which will allow installation of future conduits without blocking covers of existing condulets.

.10 Expansion joints shall be installed with ground jumper.

.11 All conduits shall be terminated with a suitable bushing.

.12 Flexible conduit and Rigid conduit entering boxes or enclosures shall be terminated with nylon insulated steel threaded bushings, grounded type.

2.2 CONDUIT FASTENINGS

.1 One hole steel straps to secure surface conduits 50 mm and smaller. Two hole steel straps for conduits larger than 50 mm.

.2 Beam clamps to secure conduits to exposed steel work.

.3 Channel type supports for two or more conduits at 1.5 m oc.

.4 Threaded rods, 6 mm dia., to support suspended channels.

2.3 CONDUIT FITTINGS

.1 Fittings: manufactured for use with conduit / raceway specified. Coating: same as conduit / raceway.

.2 Factory "ells" where 90º bends are required for 25 mm and larger conduits / raceways.

□

2.4 EXPANSION FITTINGS FOR RIGID CONDUIT

.1 Weatherproof expansion fittings with internal bonding assembly suitable for 100 mm linear expansion.

.2 Watertight expansion fittings with integral bonding jumper suitable for linear expansion and 19 mm deflection in all directions.

.3 Weatherproof expansion fittings for linear expansion at entry to panel.

2.5 FISH CORD

.1 Polypropylene.

Part 3 Execution

3.1 INSTALLATION

.1 Install conduits to conserve headroom in exposed locations and cause minimum interference in spaces through which they pass.

.2 Conduits and cables shall be supported, at regular intervals, with corrosion resisting clamps. Lead anchors or expansion bolts shall be used to attach clamps to masonry walls.

.3 Conduit and cables shall be installed to avoid proximity to water and heating pipes. They shall not run within 150 mm of such pipes, except where crossings are unavoidable, in which case they shall be kept at least 25 mm from covering of pipe crossed.

.4 Cap ends of all conduits to prevent entrance of foreign matter during construction. Manufactured caps shall be employed.

.5 Conduit shall be installed as close to building structure as possible so that where concealed, necessary furring can be kept to a minimum.

.6 Empty conduits, installed under this Division but in which wiring will be installed by others, shall be swabbed out with "Jet Line" foam packs, and be c/w Polypropylene pull wire or polytwine.

.7 Conduits shall be installed at right angles or parallel to building lines, accurate in line and level.

.8 Conduit shall not be bent over sharp objects. Improperly formed bends and running threads will not be accepted. Bends and fittings shall not be used together. Proper supports of manufactured channels shall be provided where exposed conduits and cable runs are grouped.

.9 Under no condition will EMT be allowed exposed within 1200 mm of floor, outdoors, or in areas where explosive, corrosive or moist atmosphere exists.

.10 Not more than four (4) 90 degree bends or equivalent offsets will be permitted between pull boxes. When maximum number of bends are used, the total run between pull boxes shall not exceed 18000 mm.

□

.11 PVC conduit shall not pass through a fire partition or floor separation. Where it is necessary for PVC conduits to pass through a fire barrier, a transition to rigid steel conduit shall be provided for 2000 mm on either side of the fire barrier.

.12 Surface mount conduits except where noted otherwise.

.13 Use rigid PVC conduit in corrosive areas or as indicated on plans.

.14 Use flexible metal conduit or Teck90 for connection to motors.

.15 Use liquid tight flexible metal conduit or Teck90 for connection to motors or vibrating equipment in damp, wet or corrosive locations.

.16 Use explosion proof flexible connection for connection to explosion proof motors.

.17 Minimum conduit size for lighting and power circuits: 19 mm.

.18 Bend conduit cold. Replace conduit if kinked or flattened more than 1/10th of its original diameter. Mechanically bend steel conduit over 19 mm dia.

.19 Field threads on rigid conduit must be of sufficient length to draw conduits up tight.

.20 Install pulltwine in all empty conduits / raceways and conduits / raceways that are less than 40% filled.

.21 Remove and replace blocked conduit sections. Do not use liquids to clean out conduits.

.22 Dry conduits out before installing wire.

.23 Conduits/Cabling/raceways are not to be run within concrete floors/ceilings. Any conduits/cabling/raceways required to be run along the concrete slabs shall be surface run and not recessed into the concrete. Any instances where cabling is required to be run vertically within concrete poured walls, coreline may be used as the raceway but it shall be transitioned to EMT or Rigid Steel (where required) with interfacing connectors or junction boxes being provided as required. This specification contains references to cast in place conduits. This is only applicable where specifically called for in certain locations within the documents.

.24 No exposed conduit or electrical boxes are allowed within the Provost area walls or ceilings. In the Center block area, the only allowed exposed conduit is on the ceiling area due to that area's ceiling construction.

3.2 SURFACE CONDUITS

.1 Run parallel or perpendicular to building lines.

.2 Locate conduits behind infrared or gas fired heaters with 1.5 m clearance.

.3 Run conduits in flanged portion of structural steel.

.4 Group conduits wherever possible on surface channels.

.5 Do not pass conduits through structural members except as indicated.

□

.6 Do not locate conduits less than 75 mm parallel to steam or hot water lines with minimum of 25 mm at crossovers.

3.3 CONCEALED CONDUITS

.1 Run parallel or perpendicular to building lines.

.2 Do not install horizontal runs in masonry walls.

.3 Do not install conduits in terrazzo or concrete toppings.

3.4 CONDUITS UNDERGROUND

.1 Slope conduits to provide drainage.

.2 Waterproof joints (pvc excepted) with heavy coat of bituminous paint.

3.5 CLOSEOUT SUBMITTALS

.1 Provide operation and maintenance information for incorporation into manual specified in:

.1 Section 01 78 00 - Closeout Submittals

.2 Include:

.1 List specifying each piece of equipment in system or subsystem by its original manufacturer name and model number.

.2 Parts list specifying parts used in equipment by identification numbers that are standard to electronic industry.

3.6 WARRANTY

.1 The contractor must make available to the Owner a local service department of a duly authorized distributor of the equipment manufacturer, which shall stock the manufacturer's standard parts. The service department shall have at least one factory trained repair technician available to the Owner on 24 hours' notice.

.2 Provide warranty of installation of equipment installed by this contractor to be free of defects for a period of (1) one year from date of Substantial Completion.

Provide during the warranty period, all service, maintenance, parts, etc., required for normal operation of the systems, such that Owner needs not purchase additional maintenance agreement or contracts.

END OF SECTION

□

Part 1 General

1.1 GENERAL REQUIREMENTS

.1 The General Conditions of Contract, Division 01 General Requirements and all Addenda thereto form an integral part of and must be read in conjunction with the requirements of this Section.

.2 Cooperate and coordinate with the requirements of other units of work specified in other Sections.

.3 Section 01 33 00 - Submittal Procedures.

1.2 REFERENCES

.1 Canadian Standards Association (CSA International)

.1 CAN/CSA C22.2No.126-M91(R1997), Cable Tray Systems.

.2 National Electrical Manufacturers Association (NEMA) standards

.1 NEMA FG 1-1993, Fibreglass and Cable Tray Systems.

.2 NEMA VE 1-1998, Metal Cable Tray Systems.

1.3 SHOP DRAWINGS AND PRODUCT DATA

.1 Submit shop drawings and product data in accordance with section 01 33 00 - Submittal Procedures.

.2 Identify types of cabletroughs used.

.3 Show actual cabletrough installation details and suspension system.

Part 2 Products

2.1 CABLETROUGH

.1 Cable trays shall be complete with necessary factory elbows, fittings, joiner plates, radius turns, supports, etc., as necessary for the total installation.

.2 Cable tray shall be provided for communications conductors where shown on the drawings. The cable tray shall be used for the running of data/voice communications cables, coax cable.

.3 The cable tray shall not be used for the running of low-voltage Class 2 control wiring.

.4 Cable tray indicated on the drawings for the purpose of running base building Data / communications conductors shall be a basket tray cable support system, electroplated welded wire-mesh, minimum of 50 x 100mm mesh size, 105mm deep, in standard 3048mm lengths. Tray width shall be 300mm unless otherwise noted on the drawings.

.5 Increase try size if necessary to accommodate cables and spacing specified on the drawings AND to meet the maximum fill requirements of 60% (the cable tray fill shall not be more than 60% at project completion).

.6 Where required, provide framed cable or conduit drops.

.7 Provide cable clamps or ties at 1000 mm intervals to maintain alignment of cable in tray.

.8 All hanger rods and supports shall be galvanized.

.9 Cable tray shall be manufactured by Cooper B-Line Systems, Cablofil, Canstrut, Code Manufacturing Ltd., or Thomas and Betts 'Express' Tray.

2.2 SUPPORTS

.1 Provide supports as required.

Part 3 Execution

3.1 INSTALLATION

.1 Install complete cabletrough system. The basket tray shall be run suspended from the LAN room's ceiling around the perimeter of the room in a 'U' or 'J' shape from where the cabling enters the room to directly above the equipment racks.

.2 The trays shall be installed at a minimum height of 2300mm A.F.F and a maximum of 2740mm A.F.F (measured from the bottom of the tray).

.3 Do not run tray within 300 mm of steam or hot water lines. Cable tray shall not be in contact of any sprinkler piping or laboratory gas lines.

.4 Cuts shall be filed smooth and treated with a galvanizing compound where cutting of certain sections is required.

.5 Cable tray shall be supported on 1500 mm centres, and shall be adequately braced to withstand loads due to pulling in of cables.

.6 Check routing and field dimensions to ensure there is absolutely no interference with work and equipment of other divisions.

.7 Cable tray shall be grounded every 15 meters with AWG #3/0 bare copper unless otherwise noted.

.8 Remove sharp burrs or projections to prevent damage to cables or injury to personnel.

END OF SECTION

Part 1 General

1.1 GENERAL REQUIREMENTS

.1 The General Conditions of Contract, Division 01 General Requirements and all Addenda thereto form an integral part of and must be read in conjunction with the requirements of this Section.

.2 Cooperate and coordinate with the requirements of other units of work specified in other Sections.

1.2 REFERENCES

.1 The Electrical Contractor shall be bound by industry standards, as interpreted by the Consultant, whether or not specifically referenced in this document. Comply with Electrical Protection Act and rules and regulations made pursuant thereto, including the 2012 Canadian Electrical Code. Also, comply with applicable standards of the following:

.1 CSA C22.1-2012, Canadian Electrical Code, Part 1.

.2 CSAC22.2No.26, Construction and Test of Wireways, Auxiliary Gutters and Associated Fittings.

.3 Electrical and Electronic Manufacturers Association of Canada (EEMAC).

.4 National Electrical Manufacturers Association (NEMA).

.5 National Building Code 2010 (NBC 2010)

.6 National Fire Protection Association (NFPA)

.7 Institute of Electrical and Electronic Engineers (IEEE).

.8 Audio Engineering Society (AES).

.9 Other Applicable CSA and UL approvals.

1.3 SHOP DRAWINGS AND PRODUCT DATA

.1 Submit shop drawings in accordance with:

.1 Section 01 33 00 - Submittal Procedures

.2 Section 26 05 01 – Common Work Results

1.4 PRODUCT APPROVALS

.1 Manufacturers' and model numbers named in these specifications indicate an acceptable technical standard of performance and are not intended to be exclusive. Products submitted as alternates must result in a control system that meets or exceeds all technical performance criteria as described.

.2 Products proposed as alternatives to those specified, shall only be considered if submitted for approval no later than 15 working days before tender close. Submit alternates, for approval, as one complete listing. Provide complete product specification sheets with request for approval.

□

.3 The Bidder must provide a complete list of primary system products offered with their bid.

Part 2 Products

2.1 WIREWAYS

.1 Wireways and fittings: to CSA C22No.26.

.2 Sheet steel with hinged cover to give uninterrupted access.

.3 Finish: baked grey enamel.

.4 Elbows, tees, couplings and hanger fittings manufactured as accessories to wireway supplied.

Part 3 Execution

3.1 INSTALLATION

.1 Install wireways and auxiliary gutters.

.2 Keep number of elbows, offsets, connections to minimum.

.3 Install supports, elbows, tees, connectors, fittings.

.4 Install barriers where required.

.5 Install gutter to full length of equipment.

3.2 CLOSEOUT SUBMITTALS

.1 Provide operation and maintenance information for incorporation into manual specified in:

.1 Section 01 78 00 - Closeout Submittals

.2 Include:

.1 List specifying each piece of equipment in system or subsystem by its original manufacturer name and model number.

.2 Parts list specifying parts used in equipment by identification numbers that are standard to electronic industry.

3.3 WARRANTY

.1 The contractor must make available to the Owner a local service department of a duly authorized distributor of the equipment manufacturer, which shall stock the manufacturer's standard parts. The service department shall have at least one factory trained repair technician available to the Owner on 24 hours' notice.

.2 Provide warranty of installation of equipment installed by this contractor to be free of defects for a period of (1) one year from date of Substantial Completion.

□

.3 Provide during the warranty period, all service, maintenance, parts, etc., required for normal operation of the systems, such that Owner needs not purchase additional maintenance agreement or contracts.

END OF SECTION

□

Part 1 General

1.1 RELATED SECTIONS

.1 Section 01 23 00 – Alternates.

.2 Section 26 05 01 - Common Work Results - Electrical.

.3 Section 26 27 26 - Wiring Devices.

.4 Section 26 50 00 - Lighting.

1.2 SYSTEM DESCRIPTION

.1 Provide occupancy sensors and photocell control as shown on the drawings and as described herein.

.2 Stand alone control system designed to provide switching of lighting by use of:

.1 Line voltage wall switches
.2 Low voltage occupancy sensors
.3 Low voltage exterior discrete photocells
.4 Low voltage interior discrete photocells

.3 Individual rooms lighting shall be controlled only by sensors and line voltage switches located in that room.

.4 Photocell sensors and occupancy sensors shall operate in a “slave” mode unless noted otherwise. Wall switches shall operate in “master” mode unless noted otherwise. Refer to drawings.

1.3 PRODUCT DATA AND SHOP DRAWINGS

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

.2 Shop drawings shall include a fully detailed description of the system, control schematics, wiring diagrams, component equipment and operating instructions. Component equipment shall include relay or contactor control panel, transformers and power supplies, rectifiers, override switches, occupancy and photo-sensors, etc. Each component shall be identified as to the manufacturer, type, description and catalogue number.

.3 Provide labeling of system components with shop drawings.

1.4 CLOSEOUT SUBMITTALS

.1 Submit maintenance data in accordance with Section 01 78 00 - Closeout Submittals.

Part 2 Products

2.1 MATERIALS

.1 Low voltage class 2 wiring shall be #18 gauge copper with 30 volt insulation, type LVT, installed within conduit systems unless otherwise noted.

.2 All catalogue numbers shown are approximate and are intended to assist in providing the current features. Coordinate all catalogue numbers with the manufacturer to ensure a fully operable system. The catalogue numbers shown shall not reduce or amend the requirements of the specifications.

.3 All equipment shall be manufactured by Hubbell, Douglas Lighting Controls, Watt Stopper, Leviton or Sensor Switch.

2.2 DEVICES

.1 Wall Switch/Occupancy Sensors: shall be specification grade passive infrared (PIR) or Dual Technology, wall sensor switch, ivory finish. Manual ON/OFF switch with automatic time delay off operation (adjustable from 30 seconds to 30 minutes) set at 5 minutes after momentary occupancy. Adjustable PIR unit sensitivity from 20% to 100%. Coverage limited to 180° field of view, 900 square feet, rated for minimum 800 watt for fluorescent ballast load at 120-volt. Wall occupancy sensor switch shall be compatible with all electronic fluorescent non-dimming ballasts and shall mount in a standard 120-volt single gang switch box.

.2 Occupancy Sensors: Provide where indicated and as described on lighting plans. The sensor shall be easy to adjust with a 5-minute time delay setting (adjustable from 30 seconds to 20 minutes), LED status indicator and push button programmable. Occupancy sensors shall be white in finish. See drawings for type of occupancy sensors required.

- OC – wall switch decorator sensor, line voltage, dual technology.
- OC1 – passive dual technology, 360 degree sensor, standard range, ceiling mounted, low voltage.

.3 Interior Photocell (Discrete): Provide where indicated on the lighting plans, indoor day-light sensors for applications that harvest daylight by 50/100% control of the designated lighting circuit or designated lighting fixtures. The sensor shall switch the ballast to 100% when natural light is insufficient and step down to 50% when the sufficient. The sensors shall be integral mounted in the fixture and shall measure light reflected upward from the surface below. The sensor shall be easy to adjust with a range setting and a set-point at the device. The day-light sensor shall have an adjustable dead-band and 5-minute time delay setting so that cycling effects can be eliminated, adjustable setpoints 100 – 2000 lux, and adjustable time delay 3 seconds to 5 minutes, LED status indicator.

.4 Outdoor photocells: Surface exterior wall mounted with weatherproof plate, range between 10 – 160 lux. Photocells may be installed with one exterior fixture to control the remained of that zone.

Part 3 Execution

3.1 INSTALLATION

.1 All low voltage wiring shall be installed in conduit. Confirm with the manufacturer of this system all wiring and cable requirements.

.2 Switches shall be ganged where more than one occurs in the same location.

.3 All devices shall be tested after installation to confirm proper operation, and all connected loads shall be recorded on the relay schedule for each panel.

.4 Refer to manufacturer's literature for typical methods of installation and connection of components. The contractor shall be responsible for coordinating the actual components and equipment utilized so as to provide a fully operational and reliable system.

.5 Locate and install equipment in accordance with manufacturer's recommendations and as indicated.

3.2 IDENTIFICATION AND DOCUMENTATION

.1 Provide unique identification for all low voltage control devices and power supplies.

.2 Each low voltage wire shall be labelled clearly indicating which device the cable is connected to. Use only proper colour coded, stranded #18 AWG, or as recommended by the manufacturer.

.3 Labelling shall be applied to ganged switches to identify the areas the switches control.

.4 Include in the Electrical Operating Manuals, the system installation and operating manuals for the lighting control system, including the installation and operation of each unique configuration.

3.3 SYSTEM START-UP AND TRAINING

.1 Provide trained factory authorized technician to confirm proper installation, programming and operation of the system.

.2 Perform tests described herein and in accordance with Section 26 05 01 – Common Work Results – Electrical and Electrical Commissioning Specifications.

.3 The Owner’s operating and maintenance personnel shall be instructed in the operation and maintenance of the lighting control system by a trained factory authorized technician. The minimum training period shall be (2) two hours of instruction. Written documentation bearing name and signature of Owner’s personnel who received the above instruction shall be included in the operating Electrical Operating and Maintenance manuals.

END OF SECTION

Part 1 General

1.1 RELATED SECTIONS

.1 Section 26 05 01 – Common Work Results - Electrical.

.2 Section 26 27 26 – Wiring Devices.

.3 Section 26 24 17 – Panelboards Breaker Type

.4 Section 26 28 21 – Moulded Case Circuit Breakers.

1.2 SYSTEM DESCRIPTION

.1 Supply and install a fully operational car parking control system designed to limit the use of the car parking receptacles. The car parking control system components shall be as shown on the drawings and as described herein:

.2 Car parking control system shall include the following components:

.1 System controller
.2 Contactors
.3 Distribution centre
.4 Transformers
.5 Temperature Sensor
.6 Time of Day Clock

.3 The car parking control system shall be mounted in an outdoor enclosure that houses site lighting and power panels, dry type transformers up to 600-volt primary, and other control devices independent of the car parking control system.

.4 The car parking control system shall be fully assembled, factory programmed, pre-wired CSA certified and factory built. All components shall be CSA approved.

1.3 PRODUCT DATA AND SHOP DRAWINGS

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

.2 Shop drawings shall include a fully detailed description of the system, control schematics, wiring diagrams, component equipment and operating instructions. Component equipment shall include relay or contactor control panel, transformers and power supplies, rectifiers, override switches, temperature sensors, etc. Each component shall be identified as to the manufacturer, type, description and catalogue number.

.3 Provide labeling of system components with shop drawings.

1.4 CLOSEOUT SUBMITTALS

.1 Submit maintenance data in accordance with Section 01 78 00 - Closeout Submittals.

Part 2 Products

2.1 MATERIALS

.1 **System Controller:** The system shall be rated for 120-volt AC operation with a three phase distribution centre at the voltage and capacities noted on the drawings.

.2 The system controller shall be capable of optional operation and controlling multiple independent banks of load contactors and branch circuit panels. The actual control of the contactors shall be provided through separate control relays; each relay equipped with 120-volt contacts with minimum 5 ampere rating to operating the independent load contactor holding coils. The controller logic shall be provided separate fuse protection and shall be equipped with Form 'C' relay between the logic and contactor coils.

.3 Load contactors shall have 120-volt AC coil and contacts with minimum 35 ampere rating, 3-pole style for operation of 120/208-volt branch circuit plans unless otherwise noted on the drawings.

.4 System controller shall be capable of operating in ambient conditions of -40°C to 40°C and 0% to 90% relative humidity.

.5 The system shall provide duty cycles, time shifted, based on outside air temperatures, fully individually adjustable and factory set to 50/50 load shed logic. The system shall be factory set to the following load shed option unless otherwise specified on drawings:

Temperture Range	On Time %	Actual Time On 'A' Cycle / ' B' Cycle	Load On
0°C and Warmer	0%	Continual OFF / Continual OFF	None
0°C to -12°C	25%	1 ½ minutes ON / 1 ½ minutes ON	50/50
		10.5 minutes OFF / 10.5 minutes OFF	
-12°C to -16°C	50%	3 minutes ON / 3 minutes ON	50/50
		9 minutes OFF / 9 minutes OFF	
-16°C to -22°C	75%	4.5 minutes ON / 4.5 minutes ON	50/50
		7.5 minutes OFF / 7.5 minutes OFF	
-22°C and Colder	100%	6 minutes ON / 6 minutes ON	50/50
		6 minutes OFF / 6 minutes OFF	

.6 The 50/50 load share option with the times noted above shall allow each load contactor to operate at ½ the ON times noted above, and shall cycle continually, and operate at the temperatures noted. The temperature set points shall be field adjustable. Total cycle time will be a 12-minute cycle in 3-minute increments per temperature range.

.7 As each temperature range is reached, the load shall be switched ON and OFF. The loads shall also be managed such that all load contactors will be energized at the same time.

.8 The controller shall have a hand-off-auto 'HOA' selector switch mounted on the dead front inner door of the controller assembly. The HOA switch shall allow the option to bypass the system controller's energy saving feature including time clock and outdoor air sensor, and activate the load contactors manually. Hand meaning 100% ON.

.9 For temperatures 0°C and warmer, the controller shall go into a 100% OFF mode, which is non-adjustable and activated when the temperature reaches 0°C. This locks the controller off at high temperatures.

.10 **Temperature Sensor:** The temperature sensor shall be supplied and installed by the manufacturer of the car parking control system. The temperature sensor shall be mounted on the side of the exterior wall of the cabinet assembly and shall be protected from snow build up or vandalism by a stainless steel removable cover.

.11 **Time of Day Clock:** Include a 7-day time clock, pre-wired and interconnected to the controller by the car parking control system manufacturer. The time clock shall permit the controller to go into 100% OFF mode regardless of temperature at periods of the day as determined by the Owner.

.12 The time clock shall be initially set by the factory so that the controller is operable or "ON" between 0600 – 2300 hours daily. The time settings shall be adjusted on site as determined by the Owner.

.13 The controller shall have a battery back-up to retain time clock and scheduling for 8 hours during power outages.

.14 **Outdoor Enclosure:** The distribution equipment, transformers and car parking control system shall be mounted in a rain proof and sleet resistant outdoor enclosure, EEMAC 3R Enclosure. The outdoor enclosure shall include the following:

.1 Steel welded construction – code gauge

.2 Free standing pad mount assembly with raised bottom

.3 Open bottom for cable entry with 53mm inner flange

.4 Oversized drip hood on top of cabinet to overhang all doors

.5 All sections shall be barried with dead front doors

.6 Safety 'Corner formed' edges

.7 ASA 61 Grey powder coat finish

.8 Hinged exterior door(s) with oil resistant gasket material inside door(s), 100mm snow kick on all doors

.9 3-Point pad lockable handle – stainless steel

.10 Flush mount GFCI duplex receptacle with weatherproof cover

.11 Copper ground bus bar. Include bond connection of enclosure and door(s).

.15 Branch circuit panelboards, dry-type transformers and lighting contactors inside the enclosure as shown on the drawings shall be supplied, installed and pre-wired by the manufacturer of the car parking control system.

.16 The car parking control system and outdoor enclosure shall be manufactured:

.1 A.C. Dandy Products Ltd, ‘Cartrol’ series CRT5 series ; which shall include panelboards and transformers manufactured by Siemens for installation in the car parking outdoor enclosure.

.2 Or Approved Equal

Part 3 Execution

3.1 INSTALLATION

.1 Provide conduit and wiring as shown on the drawings, and as specified in Section 26 05 34 – Conduits, Fastening & Fittings.

.2 Install the entire system c/w terminations and start up.

.3 All cable shall be clearly identified by labeling both ends with adhesive markers, such as Brady wire markers. These markings shall correspond to 'as-built' drawings to be supplied by this Division.

.4 All wiring shall be neatly harnessed or laced, or secured with Panduit Type SNT or SSC cable ties or clamps, or the equivalent. Excessive loose lengths shall be avoided.

.5 All termination points within the system shall be labeled in a logical numbering sequence using decal marking devices. Corresponding numbers shall appear on the circuit diagrams in the instruction manual. Multi-conductor cables shall be given an overall identification. Individual conductors shall have individual labels matching the terminal label.

.6 All wiring shall be terminated in terminal panels, junction boxes, or on suitable terminal strips or blocks.

.7 The manufacturer shall provide a single line block drawing illustrating system operation.

.8 Refer to manufacturer's literature for typical methods of installation and connection of components. The contractor shall be responsible for coordinating the actual components and equipment utilized so as to provide a fully operational and reliable system.

.9 Locate and install equipment in accordance with manufacturer's recommendations and as indicated.

3.2 IDENTIFICATION AND DOCUMENTATION

.1 Provide lamecoid identification to the control panel named on the panel schematics.

.2 Provide lamecoid identification of circuit and panel at each car parking pedestal.

3.3 SYSTEM START-UP AND TRAINING

.1 Provide trained factory authorized technician to confirm proper installation, programming and operation of the system.

.2 Provide (3) three copies of installation manuals complete with time and temperature adjustment information for insertion into the Owner Operating and Maintenance manuals.

.3 Perform tests described herein and in accordance with Section 26 05 01 – Common Work Results – Electrical and Electrical Commissioning Specifications.

.4 Actuate control units in the presence of Engineer to demonstrate lighting circuits are controlled as designated.

.5 The equipment shall be guaranteed for one year from date of acceptance.

.6 The Owner's operating and maintenance personnel shall be instructed in the operation and maintenance of the car parking control system by a trained factory authorized technician. The minimum training period shall be two (2) hours of instruction. Training shall be completed in two parts. The first training shall be one hour and shall be completed prior to substantial completion. The second training session shall be two months following completion to ensure owner understands system and requirements. Written documentation bearing name and signature of Owner's personnel who received the above instruction shall be included in the operating Electrical Operating and Maintenance manuals.

END OF SECTION

Part 1 General

1.1 GENERAL REQUIREMENTS

.1 The General Conditions of Contract, Division 01 General Requirements and all Addenda thereto form an integral part of and must be read in conjunction with the requirements of this Section.

.2 Cooperate and coordinate with the requirements of other units of work specified in other Sections.

1.2 REFERENCES

.1 The Electrical Contractor shall be bound by industry standards, as interpreted by the Consultant, whether or not specifically referenced in this document. Comply with Electrical Protection Act and rules and regulations made pursuant thereto, including the Canadian Electrical Code. Also, comply with applicable standards of the following:

.1 CSA C22.1-2012, Canadian Electrical Code, Part 1.

.2 CAN/CSA-C22.2 No.31-M89(R2000), Switchboard Assemblies.

.3 Electrical and Electronic Manufacturers Association of Canada (EEMAC).

.4 National Electrical Manufacturers Association (NEMA).

.5 National Building Code 2010 (NBC 2010)

.6 National Fire Protection Association (NFPA)

.7 Institute of Electrical and Electronic Engineers (IEEE).

.8 Audio Engineering Society (AES).

.9 Other Applicable CSA and UL approvals.

1.3 SHOP DRAWINGS AND PRODUCT DATA

.1 Submit shop drawings in accordance with:

.1 Section 01 33 00 - Submittal Procedures

.2 26 05 01 – Common Work Results

.2 Shop drawings shall include but not be limited to layout, devices installed, withstand ratings, lug and torque tables, Time-current characteristic curves for circuit breakers and fuses, and special mounting details.

.3 Submit shop drawings for review prior to fabrication of equipment. The following drawings of the switchboard shall be provided prior to commencing manufacture:

.1 Channel base plan

.2 Single line diagrams showing necessary details of electrical components and connections.

.3 Elevation plan and section views with dimensions and all component details.

.4 Weight of complete structure, size and weight of each shipping section, and manufacturer's data sheets of all major components.

□

.5 Complete wiring schematics.

.4 Include schematic, wiring and interconnection diagrams, which shall include component identification.

.5 Each component shall be identified as to manufacturer, type, description, and catalogue number.

.6 Drawing details show all stations, control modules, cabling and field terminations.

.7 Include a statement of warranty hardware from the manufacturer.

1.4 PRODUCT APPROVALS

.1 Manufacturers' and model numbers named in these specifications indicate an acceptable technical standard of performance and are not intended to be exclusive. Products submitted as alternates must result in a control system that meets or exceeds all technical performance criteria as described.

.2 Products proposed as alternatives to those specified, shall only be considered if submitted for approval no later than 15 working days before tender close. Submit alternates, for approval, as one complete listing. Provide complete product specification sheets with request for approval.

.3 The Bidder must provide a complete list of primary system products offered with their bid.

1.7 CLOSEOUT SUBMITTALS

.1 Provide maintenance data for secondary switchboard for incorporation into manual in accordance with Section 01 78 00 - Closeout Submittals.

.2 3 copies maintenance data for complete switchboard assembly including components.

1.8 STORAGE AND PROTECTION

.1 Store switchboard on site in protected, dry location. Cover with plastic to keep off dust.

1.9 EXTRA MATERIALS

.1 Provide maintenance materials in accordance with Section 01 78 00 - Closeout Submittals.

Part 2 Products

2.1 MATERIALS

.1 Switchboard assembly: to CAN/CSA-C22.2 No.31.

.2 Size, arrangement and extent of equipment shall be as shown on the drawings.

.3 Switchboard construction shall consist of a 3 mm sheet steel enclosure dead front, self-supporting unit.

□

.4 Phasing shall conform to CSA and CEMA standards. Colour code all three phases on main bus and on the load terminals of all feeders.

.5 Re-arrangement of components will not be permitted. Equipment shall be constructed to fit space allocated and shall be mounted on a concrete pad. Arrangement and space allocation as shown on drawings shall be maintained, unless an alternate method, suggested by the contractor under this Division and the successful manufacturer, is approved in writing by the Consultant.

.6 Equipment shall be designed, factory assembled and tested in accordance with latest applicable CEMA and CSA standards.

.7 Equipment shall be complete with required Arc Flash warning labels as required by CEC and this specification.

.8 All switchboard enclosures including covers and lids shall be made with 3mm. (#12 gauge) steel.

2.2 RATING

.1 Secondary switchboard: indoor, voltage as shown on drawing, ampacity as shown on drawings, 3 phase, 4 wire, 60 hz, minimum short circuit capacity 42 ka (rms symmetrical) for 120/208v.

2.3 ENCLOSURE

.1 Distribution sections to contain:

.2 Fusible disconnects sized as indicated.

.3 Main bus work, extending through every section, shall be tin plated copper rated as shown on the drawings, and shall be full size throughout length of switchboard.

.4 Copper ground bus 6 mm x 50 mm, bolted to the structure and extending the full length of the switchboards. Cable clamps shall be provided at convenient locations for making the station ground connection.

.5 Blanked off spaces for future units.

.6 Switchboard shall be fitted with two permanent channels, minimum 100 mm across the bottom of each section, to permit rolling or jacking of board. A permanent channel or angle shall also be provided across top of each section substantial enough to carry weight of section for hoisting purposes. Two other channels, minimum 150 mm width, shall be provided by switchboard manufacturer along with floor plan, and shall be grouted into floor for levelling purposes. Floor channels shall run full length of board, and shall line up with 100 mm channel on switchboard.

.7 All panelboard enclosures shall be 2300 mm high. All unused panel spaces shall be made available for future switch fuse units.

□

.8 Provide sprinkler guards on top of all switchboards. All conduit entering top of switchboards shall be c/w water tight connectors. Seal all conduit connectors with silicone based caulking to provide a degree of water tightness in the event of a sprinkler system failure.

.9 The entire enclosure shall be cleaned and phosphated, then painted with one coat of alkyd type primer, and one coat of low gloss light grey (ASA 61) baked on polyester powder coat.

.10 Before leaving the factory, switchboards shall be touched up to present a smooth, even, clean finish inside and outside. Interiors shall be cleaned of debris and dirt. Before shipment, movable components shall be carefully blocked.

.11 The switchboard shall be completely assembled, wired, adjusted and tested at the factory. After assembly, the complete switchboard will be tested for operation under simulated service conditions to ensure the accuracy of the wiring and the functioning of the equipment.

.12 All switchboards shall be manufactured by General Electric, Eaton or Schneider Electric

2.4 BUSBARS

.1 Three phase and full capacity neutral, insulated busbars, continuous current rating as noted on drawing, self-cooled, extending full width of cubicle(s), suitably supported on insulators.

.2 Main connections between bus and major switching components to have continuous current rating to match major switching components.

.3 Busbars and main connections: Tin Plated Copper

.4 Provision for extension of bus on both sides of unit without need for further drilling or preparation in field.

.5 Tin plated joints, secured with non-corrosive bolts and Belleville washers.

.6 Identify phases of busbars by suitable marking.

.7 Busbar connectors, when switchboard shipped in more than one section.

.8 Bus section shall house interconnecting bus, instrument transformers, connections to incoming feeders and control wiring.

.9 Main bus work, extending through every section, shall be rated as shown on drawings, and shall be full size throughout length of switchboard.

.10 Where space has been provided for future switches on the drawings, bus and stationary elements shall be provided to facilitate future additions.

2.5 GROUNDING

.1 Lugs at each end for size #3/0 AWG grounding cable.

.2 Copper ground bus 6 mm x 50 mm shall be provided at bottom, bolted to the structure and extending the full length of the switchboards.

□

.3 Cable clamps shall be provided at convenient locations for making the station ground connection.

2.6 FUSIBLE DISCONNECTS AND FUSES

.1 As per Specification Section 26 28 23 Disconnect Switches – Fused and Non Fused

2.7 INSTRUMENTS

.1 Refer to Section 26 09 02 – Metering and Switchboard Instruments.

2.8 FINISHES

.1 The entire enclosure shall be cleaned and phosphated, then painted with one coat of alkyd type primer, and one coat of low gloss light grey (ASA 61) baked on polyester powder coat.

2.9 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. Also, a 150 mm x 50 mm nameplate shall be provided on top portion of switchboard for identification.

.3 Lamecoid nameplates shall be Black with white lettering for Normal Power switchboards.

Part 3 Execution

3.1 INSTALLATION

.1 Locate switchboard assembly as indicated and bolt to floor.

.2 Check factory made connections for mechanical security and electrical continuity.

.3 size and weight of the sections into which the assembly shall be divided for shipment to ensure that they can easily be moved into or out of the electrical room, as shown on the drawings.

.4 The ground bus shall be connected to the ground network. Refer to specifications and the drawings for full grounding requirements.

.5 All switchboards shall carry the required arc flash warning labels.

.6 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.

.7 Set on 100 mm high concrete housekeeping pad.

□

3.2 WARRANTY

.1 The contractor must make available to the Owner a local service department of a duly authorized distributor of the equipment manufacturer, which shall stock the manufacturer's standard parts. The service department shall have at least one factory trained repair technician available to the Owner on 24 hours' notice.

.2 Provide warranty of installation of equipment installed by this contractor to be free of defects for a period of (1) one year from date of Substantial Completion.

.3 Provide during the warranty period, all service, maintenance, parts, etc., required for normal operation of the systems, such that Owner needs not purchase additional maintenance agreement or contracts. Upon request, the manufacturer and his agent shall provide direct to the Owner the following proposals:

.1 Continuation, after the warranty period, of full maintenance, including all service, labour, parts, etc. required to maintain the systems in a fully operational condition.

END OF SECTION

□

Part 1 General

1.1 GENERAL REQUIREMENTS

.1 The General Conditions of Contract, Division 01 General Requirements and all Addenda thereto form an integral part of and must be read in conjunction with the requirements of this Section.

.2 Cooperate and coordinate with the requirements of other units of work specified in other Sections.

1.2 REFERENCES

.1 The Electrical Contractor shall be bound by industry standards, as interpreted by the Consultant, whether or not specifically referenced in this document. Comply with Electrical Protection Act and rules and regulations made pursuant thereto, including the 2012 Canadian Electrical Code. Also, comply with applicable standards of the following:

.1 CSA C22.1-2012, Canadian Electrical Code, Part 1.
.2 Electrical and Electronic Manufacturers Association of Canada (EEMAC).
.3 National Electrical Manufacturers Association (NEMA).
.4 National Building Code 2010 (NBC 2010)
.5 National Fire Protection Association (NFPA)
.6 Institute of Electrical and Electronic Engineers (IEEE).
.7 CSA C22.2No.29-M1989(R2000), Panelboards and enclosed Panelboards.
.8 Other Applicable CSA and UL approvals.

1.3 SHOP DRAWINGS AND PRODUCT DATA

.1 Submit shop drawings in accordance with:

.1 Section 01 33 00 - Submittal Procedures
.2 Section 26 05 01 – Common Work Results

.2 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 or with interrupting capacity of 18,000 A symmetrical (rms) or greater.

1.4 PRODUCT APPROVALS

.1 Manufacturers' and model numbers named in these specifications indicate an acceptable technical standard of performance and are not intended to be exclusive. Products submitted as alternates must result in a control system that meets or exceeds all technical performance criteria as described.

.2 Products proposed as alternatives to those specified, shall only be considered if submitted for approval no later than 15 working days before tender close. Submit alternates, for approval,

as one complete listing. Provide complete product specification sheets with request for approval.

.3 The Bidder must provide a complete list of primary system products offered with their bid.

Part 2 Products

2.1 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 All panels shall be specification grade and of the same manufacture. Load centres are not acceptable.

.15 All branch circuit spaces shall be fitted with filler plates.

.16 All panels serving bedrooms shall be equipped with arc fault circuit interrupters where shown on the drawings.

.17 Each panel shall be equipped with a ground bus suitable for terminating one ground conductor per load circuit.

.18 Panels shall be General Electric, Eaton or Schneider Electric.

.19 Refer to attached breaker panel schematic detail sheets attached at the end of this specification section.

2.2 BREAKERS

.1 Breakers: to Section 26 28 21 - Moulded Case Circuit Breakers.

.2 Lock-on devices for fire alarm circuits.

2.3 EQUIPMENT IDENTIFICATION

.1 Provide equipment identification in accordance with 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 3 Execution

3.1 INSTALLATION

.1 Locate panelboards as indicated and mount securely, plumb, true and square, to adjoining surfaces.

.2 Install surface mounted panelboards on painted 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 Connect neutral conductors to common neutral bus.

3.2 WARRANTY

.1 The contractor must make available to the Owner a local service department of a duly authorized distributor of the equipment manufacturer, which shall stock the manufacturer's standard parts. The service department shall have at least one factory trained repair technician available to the Owner on 24 hours' notice.

.2 Provide warranty of installation of equipment installed by this contractor to be free of defects for a period of (1) one year from date of Substantial Completion.

.3 Provide during the warranty period, all service, maintenance, parts, etc., required for normal operation of the systems, such that Owner needs not purchase additional maintenance agreement or contracts. Upon request, the manufacturer and his agent shall provide direct to the Owner the following proposals:

.1 Continuation, after the warranty period, of full maintenance, including all service, labour, parts, etc. required to maintain the systems in a fully operational condition.

END OF SECTION

□

Part 1 General

1.1 GENERAL REQUIREMENTS

.1 The General Conditions of Contract, Division 01 General Requirements and all Addenda thereto form an integral part of and must be read in conjunction with the requirements of this Section.

.2 Cooperate and coordinate with the requirements of other units of work specified in other Sections.

1.2 REFERENCES

.1 The Electrical Contractor shall be bound by industry standards, as interpreted by the Consultant, whether or not specifically referenced in this document. Comply with Electrical Protection Act and rules and regulations made pursuant thereto, including the 2012 Canadian Electrical Code. Also, comply with applicable standards of the following:

.1 CSA C22.1-2012, Canadian Electrical Code, Part 1.

.2 Electrical and Electronic Manufacturers Association of Canada (EEMAC).

.3 National Electrical Manufacturers Association (NEMA).

.4 National Building Code 2010 (NBC 2010)

.5 National Fire Protection Association (NFPA)

.6 Institute of Electrical and Electronic Engineers (IEEE).

.7 CSA-C22.2 No.42, General Use Receptacles, Attachment Plugs and Similar Devices.

.8 CSA-C22.2 No.42.1, Cover Plates for Flush-Mounted Wiring Devices (Bi-national standard, with UL 514D).

.9 CSA-C22.2 No.55, Special Use Switches.

.10 CSA-C22.2 No.111, General-Use Snap Switches (Bi-national standard, with UL 20, twelfth edition).

1.3 SHOP DRAWINGS AND PRODUCT DATA

.1 Submit shop drawings in accordance with:

.1 Section 01 33 00 - Submittal Procedures

.2 Section 26 05 01 – Common Work Results

1.4 PRODUCT APPROVALS

.1 Manufacturers' and model numbers named in these specifications indicate an acceptable technical standard of performance and are not intended to be exclusive. Products submitted as alternates must result in a control system that meets or exceeds all technical performance criteria as described.

.2 Products proposed as alternatives to those specified, shall only be considered if submitted for approval no later than 15 working days before tender close. Submit alternates, for approval,

as one complete listing. Provide complete product specification sheets with request for approval.

.3 The Bidder must provide a complete list of primary system products offered with their bid.

Part 2 Products

2.1 SWITCHES

.1 15 A, 120 V, single pole, three-way switches where required on drawings.

.2 Manually-operated general purpose ac switches with following features:

.1 Terminal holes approved for No. 10 AWG wire.
.2 Silver alloy contacts.
.3 Urea or melamine molding for parts subject to carbon tracking.
.4 Suitable for back and side wiring.
.5 Ivory toggle.

.3 Toggle operated fully rated for tungsten filament and fluorescent lamps.

.4 All wiring devices specified shall be of the same manufacture throughout the project.

.5 Switches controlling motors shall be K.W. (H.P.) rated and approved for motor control service.

.6 Set switches flush in all finished areas, or in surface box where conduit or wireway is exposed.

.7 Refer to drawing symbol schedule for further requirements.

.8 Switches and receptacles shall comply with requirements of CSA and NEMA Standards.

.9 Switches shall be specification grade from one of the following manufacturers: Cooper, Leviton, Hubbell or Pass & Seymour.

2.2 RECEPTACLES

.1 Duplex receptacles, CSA type 5-15 R, 125 V, 15 A, U ground, with following features:

.1 Ivory high impact chemical resistant molded nylon or polycarbonate face.
.2 Suitable for No. 10 AWG for back and side wiring.
.3 Break-off links for use as split receptacles.
.4 Eight back wired entrances, four side wiring screws.
.5 Triple wipe contacts and rivetted grounding contacts.
.6 Specification grade from one of the following manufacturers: Cooper, Leviton, Hubbell or Pass & Seymour.

.2 Single receptacles CSA type 5-15 R, 125 V, 15 A, U ground with following features:

.1 Ivory high impact chemical resistant molded nylon or polycarbonate face.

.2 Suitable for No. 10 AWG for back and side wiring.

.3 Four back wired entrances, 2 side wiring screws.

.4 Specification grade from one of the following manufacturers: Cooper, Leviton, Hubbell or Pass & Seymour.

.3 Other receptacles with ampacity and voltage as indicated.

.4 Receptacles of one manufacturer throughout project.

.5 Set receptacles flush in all finished areas, or in surface box where conduit or wireway is exposed

.6 Provide five (5) 20 amp and five (5) 15 amp specification grade receptacles c/w installation, 10 meters of wire and required raceway, etc for each of these receptacles so that they may be installed where required during the construction and commissioning stages of this project. .

2.3 SPECIAL WIRING DEVICES

.1 **Ground Fault Circuit Interrupter** - shall have a nylon face and a thermoplastic backbody. They must have a feed-through capability for protecting receptacles downstream on the same circuit. They must be Class A rated with a 5 milliampere ground fault trip level and a 20 ampere feed through rating. GFCI receptacles shall have 'Safe Lock' protection such if critical components are damaged and ground fault protection is lost, power to the receptacle is disconnected. GFCI receptacles shall be equipped with LED trip indicator light, NEMA configuration 5-15R, side wired and one of the following manufacturers: Cooper #XGF15-V, Leviton #8599-I or Pass & Seymour #1594-I, Hubbell 'Autoguard' GFR Series

.2 **Pilot Light Switches** - shall be quiet specification grade and rated 15A, 120 volts, back and side wiring with toggle lit red in the "ON" position, accepting up to #10 copper conductor and of one of the following manufacturers: Cooper, Leviton, Hubbell or Pass & Seymour.

.3 **Fractional HP/KW Manual Starters** - to be non-reversing, toggle operated, suitable for mounting in a surface or flush box, single or two pole to suit 120 or 208 volt application, c/w pilot light and thermal overload to adequately protect motor. Flush mount to have stainless steel or ivory cover plates to match other flush mount wiring devices. To be of one of the following manufacturers: Cooper, Leviton, Hubbell or Pass & Seymour.

.4 **Illuminated Switches** - shall be quiet specification grade, 120 volts, back and side wiring with toggle lit in the "OFF" position, accepting up to #10 copper conductor and of one of the following: Cooper, Leviton, Hubbell or Pass & Seymour.

.5 **Wall Occupancy Sensors, 120-Volt:** Wall occupancy sensors shall be specification grade passive infrared (PIR) or dual technology (PIR/Microphonics) wall sensor switch, white finish. Manual ON/OFF switch with automatic time delay off operation (adjustable from 30 seconds to 30 minutes) after momentary occupancy. Adjustable PIR unit sensitivity from 20% to 100%. Coverage limited to 180° field of view, 900 square feet, rated for minimum 800 watt for ballast load at 347-volt. Wall occupancy sensor switch shall be compatible with all electronic fluorescent non-dimming ballasts and shall mount in a standard single 120-volt

single gang switch box. Set delay off to 5 minutes after momentary occupancy. Wall occupancy sensors shall be of one of the following manufacturers:

Hubbell, Leviton, Sensorswitch, Wattstopper, Cooper

.6 **Ceiling Occupancy Sensors, 120-Volt:** Designated as 'OC1' on drawings - Ceiling occupancy sensors for controlling the room lighting shall be multi-technology occupancy sensor switch, passive infrared (PIR/Microphonics) and ultrasonic sensor (40kHz ultrasonic frequency), 360° coverage within a 92.9 square meter area. Automatic ON/OFF control, with delay off set at 5 minutes after momentary occupancy.

Hubbell, Leviton, Sensorswitch, Wattstopper, Cooper

2.4 COVER PLATES

.1 Cover plates for wiring devices shall be from one manufacturer throughout project.

.2 Wall plates shall be designed and manufactured in accordance with performance and dimensional requirements of the following industry standards:

CSA Standard C22-2 No. 42

U.S. Federal Specification WP455

NEMA Standard WD-1

.3 Wall plates shall be manufactured by one of the following:

Cooper, Arrow Hart, Eagle, Hubbell, Leviton or Pass & Seymour.

.4 Blank cover plates in finished ceiling areas shall be Columbia Electric #9002 baked white enamel for white ceilings, or painted to match colored finishes.

.5 Stainless Steel wall plates shall be provided for all switches, receptacles, blanks, telephone and special purpose outlets. The wall plates shall be of suitable configuration for the device for which it is to cover with color matched mounting screws. Use ganged plate where more than one device occur at one location. Any specific locations calling for Metal wall plates are referring to stainless steel.

.6 Where surface wiring methods need to be employed in a high finish area because of renovations to existing structure, wall plates shall be used in conjunction with Wiremold surface box to suit the device.

.7 Where outlets occur in an unfinished area such as boiler or furnace room and surface conduit and boxes are specified, stamped galvanized steel wall plates shall be used to suit configuration.

.8 Exterior outlets shall be fitted with weatherproof die cast aluminum cover plates to suit wiring device, c/w rubber gasket to provide positive seal. Duplex cover plates shall have two independent flaps. Weatherproof covers shall provide protection in wet and damp locations.

□

Part 3 Execution

3.1 INSTALLATION

.1 Switches:

.1 Install single throw switches with handle in "UP" position when switch closed.

.2 Install switches in gang type outlet box when more than one switch is required in one location.

.3 Switches shall be as located on the drawings, mounted up 1200 mm, and ganged where more than one occurs in the same location.

.2 Receptacles:

.1 Install receptacles in gang type outlet box when more than one receptacle is required in one location.

.2 Convenience outlets shall be as located on the drawings, and mounted up 450 mm, unless otherwise noted.

.3 Where split receptacle has one portion switched, mount vertically and switch upper portion.

.4 Outlets over counter tops shall be mounted 150 mm above counter, or immediately above backsplash. Co-ordinate with architectural drawings for location of all counter tops, millwork and feature walls, to ensure proper location and mounting height.

.5 Coordinate with the location of all mechanical convectors and mount convenience outlets up 100 mm above heating convectors.

.6 All convenience outlets shall meet tension tests as per CSA requirements, and will be subjected to 'on site' tests during final inspection.

.3 All plug-in type receptacles shall be identified by means of a Lamecoid label fixed with self tapping screws on the cover plate. Each cover plate shall contain the panel and circuit number. Those receptacles fed from ground fault interrupters shall have 'GFI' labeled adjacent to the panel and circuit number. Those receptacles designated for housekeeping purposes shall have ‘HOUSEKEEPING’ labeled adjacent to the panel and circuit number.

.4 The circuits controlled by all switches on all levels, shall be neatly printed with waterproof ink on the side of the switch outlet box so that the panel and circuit number are clearly legible when the cover plate is removed. It shall not be necessary to remove the switch from the outlet box in order to read the panel or circuit number.

.5 Cover plates:

.1 Protect cover plate finish with paper or plastic film until painting and other work is finished.

.2 Install suitable common cover plates where wiring devices are grouped.

.3 Do not use cover plates meant for flush outlet boxes on surface-mounted boxes.

3.2 WARRANTY

.1 The contractor must make available to the Owner a local service department of a duly authorized distributor of the equipment manufacturer, which shall stock the manufacturer’s

standard parts. The service department shall have at least one factory trained repair technician available to the Owner on 24 hours' notice.

.2 Provide warranty of installation of equipment installed by this contractor to be free of defects for a period of (1) one year from date of Substantial Completion.

.3 Provide during the warranty period, all service, maintenance, parts, etc., required for normal operation of the systems, such that Owner needs not purchase additional maintenance agreement or contracts. Upon request, the manufacturer and his agent shall provide direct to the Owner the following proposals:

.1 Continuation, after the warranty period, of full maintenance, including all service, labour, parts, etc. required to maintain the systems in a fully operational condition.

END OF SECTION

□

Part 1 General

1.1 GENERAL REQUIREMENTS

.1 The General Conditions of Contract, Division 01 General Requirements and all Addenda thereto form an integral part of and must be read in conjunction with the requirements of this Section.

.2 Cooperate and coordinate with the requirements of other units of work specified in other Sections.

1.2 REFERENCES

.1 The Electrical Contractor shall be bound by industry standards, as interpreted by the Consultant, whether or not specifically referenced in this document. Comply with Electrical Protection Act and rules and regulations made pursuant thereto, including the 2012 Canadian Electrical Code. Also, comply with applicable standards of the following:

.1 CSA C22.1-2012, Canadian Electrical Code, Part 1.

.2 Electrical and Electronic Manufacturers Association of Canada (EEMAC).

.3 National Electrical Manufacturers Association (NEMA).

.4 National Building Code 2010 (NBC 2010)

.5 National Fire Protection Association (NFPA)

.6 Institute of Electrical and Electronic Engineers (IEEE).

.7 Other Applicable CSA and UL approvals.

1.3 SHOP DRAWINGS AND PRODUCT DATA

.1 Submit shop drawings in accordance with:

.1 Section 01 33 00 - Submittal Procedures

.2 Section 26 05 01 – Common Work Results

.2 Submit fuse performance data characteristics for each fuse type and size above 50 A. Performance data to include: average melting time-current characteristics.

1.4 DELIVERY AND STORAGE

.1 Ship fuses in original containers.

.2 Do not ship fuses installed in switchboard.

.3 Provide a typed list of all spare fuses

.4 Provide three (3) spare fuses of each type and size installed.

□

Part 2 Products

2.1 FUSES GENERAL

.1 Fuses: product of one manufacturer for entire project.

.2 Fuse interrupting rating shall be 200,000 amperes RMS symmetrical, unless otherwise noted.

.3 Time delay fuses shall carry 500% of rated current for a minimum of 10 seconds and shall be labeled "Time Delay" by the manufacturer.

2.2 FUSE TYPES

.1 HRC fuses rated 600 amperes and smaller shall be CSA certified HRC1-J time delay and shall be in accordance with CSA Specification C22-2 No. 106-M92. HRC-1 fuse dimensions and current limiting performance shall be in accordance with the UL Standard 198C

Part 3 Execution

3.1 INSTALLATION

.1 Install fuses in mounting devices immediately before energizing circuit.

.2 Ensure correct fuses fitted to physically matched mounting devices.

.3 Ensure correct fuses fitted to assigned electrical circuit.

.4 Application of all fuses shall comply with the Canadian Electrical Code - Part 1 and local inspection authority regulations.

.5 Unless otherwise noted on the drawings, Time Delay fuses for overcurrent protection of motor circuits shall be rated at 150% of full-load current and

.6 Time Delay fuses for overcurrent protection of transformer circuits shall be rated at 125% of full-load current.

.7 All fuses shall be manufactured by Littlefuse, Buss, Ferraz Shawmut**,** or Edison.

3.2 WARRANTY

.1 The contractor must make available to the Owner a local service department of a duly authorized distributor of the equipment manufacturer, which shall stock the manufacturer's standard parts. The service department shall have at least one factory trained repair technician available to the Owner on 24 hours' notice.

.2 Provide warranty of installation of equipment installed by this contractor to be free of defects for a period of (1) one year from date of Substantial Completion.

.3 Provide during the warranty period, all service, maintenance, parts, etc., required for normal operation of the systems, such that Owner needs not purchase additional maintenance agreement or contracts. Upon request, the manufacturer and his agent shall provide direct to the Owner the following proposals:

□

.1 Continuation, after the warranty period, of full maintenance, including all service, labour, parts, etc. required to maintain the systems in a fully operational condition.

END OF SECTION

□

Part 1 General

1.1 GENERAL REQUIREMENTS

.1 The General Conditions of Contract, Division 01 General Requirements and all Addenda thereto form an integral part of and must be read in conjunction with the requirements of this Section.

.2 Cooperate and coordinate with the requirements of other units of work specified in other Sections.

1.2 REFERENCES

.1 The Electrical Contractor shall be bound by industry standards, as interpreted by the Consultant, whether or not specifically referenced in this document. Comply with Electrical Protection Act and rules and regulations made pursuant thereto, including the 2012 Canadian Electrical Code. Also, comply with applicable standards of the following:

.1 CSA C22.1-2012, Canadian Electrical Code, Part 1.

.2 Electrical and Electronic Manufacturers Association of Canada (EEMAC).

.3 National Electrical Manufacturers Association (NEMA).

.4 National Building Code 2010 (NBC 2010)

.5 National Fire Protection Association (NFPA)

.6 Institute of Electrical and Electronic Engineers (IEEE).

.7 CSA-C22.2 No. 5-02, Moulded-Case Circuit Breakers, Moulded-Case Switches and Circuit-Breaker Enclosures (Tri-national standard with UL 489, tenth edition, and the second edition of NMX-J-266-ANCE).

.8 Other Applicable CSA and UL approvals.

1.3 SHOP DRAWINGS AND PRODUCT DATA

.1 Submit shop drawings in accordance with:

.1 Section 01 33 00 - Submittal Procedures

.2 Section 26 05 01 – Common Work Results

.2 Include time-current characteristic curves for breakers with ampacity of 50 A and over or with interrupting capacity of 18,000 A symmetrical (rms) and over at system voltage.

1.4 PRODUCT APPROVALS

.1 Manufacturers' and model numbers named in these specifications indicate an acceptable technical standard of performance and are not intended to be exclusive. Products submitted as alternates must result in a control system that meets or exceeds all technical performance criteria as described.

.2 Products proposed as alternatives to those specified, shall only be considered if submitted for approval no later than 15 working days before tender close. Submit alternates, for approval, as one complete listing. Provide complete product specification sheets with request for approval.

.3 The Bidder must provide a complete list of primary system products offered with their bid.

Part 2 Products

2.1 BREAKERS GENERAL

.1 Bolt-on moulded case circuit breaker: quick- make, quick-break type, for manual and automatic operation with temperature compensation for 40 deg C ambient.

.2 Common-trip breakers: with single handle for multi-pole applications.

.3 Magnetic instantaneous trip elements in circuit breakers to operate only when value of current reaches setting. Trip settings on breakers with adjustable trips.

.4 Circuit breakers with interchangeable trips as indicated.

.5 Circuit breakers to have minimum of 10,000 A symmetrical rms interrupting capacity rating in breaker panelboards.

.6 Magnetic instantaneous trip elements in circuit breakers to operate only when value of current reaches setting.

.1 Trip settings on breakers to have adjustable trips.

2.2 THERMAL MAGNETIC BREAKERS

.1 Moulded case circuit breaker to operate automatically by means of thermal and magnetic tripping devices to provide inverse time current tripping and instantaneous tripping for short circuit protection.

2.3 SOLID STATE TRIP BREAKERS

.1 Moulded case circuit breaker to operate by means of solid-state trip unit with associated current monitors and self-powered shunt trip to provide inverse time current trip under overload condition, and long time, short time, instantaneous, tripping for ground fault short circuit protection.

.2 The main service breaker for the building main service shall have solid state trip unit. All other breakers shown shall be thermal magnetic breakers.

Part 3 Execution

3.1 INSTALLATION

.1 Install circuit breakers as indicated.

3.2 WARRANTY

.1 The contractor must make available to the Owner a local service department of a duly authorized distributor of the equipment manufacturer, which shall stock the manufacturer's standard parts. The service department shall have at least one factory trained repair technician

available to the Owner on 24 hours' notice.

.2 Provide warranty of installation of equipment installed by this contractor to be free of defects for a period of (1) one year from date of Substantial Completion.

.3 Provide during the warranty period, all service, maintenance, parts, etc., required for normal operation of the systems, such that Owner needs not purchase additional maintenance agreement or contracts. Upon request, the manufacturer and his agent shall provide direct to the Owner the following proposals:

.1 Continuation, after the warranty period, of full maintenance, including all service, labour, parts, etc. required to maintain the systems in a fully operational condition.

END OF SECTION

Part 1 General

1.1 GENERAL REQUIREMENTS

.1 The General Conditions of Contract, Division 01 General Requirements and all Addenda thereto form an integral part of and must be read in conjunction with the requirements of this Section.

.2 Cooperate and coordinate with the requirements of other units of work specified in other Sections.

1.2 REFERENCES

.1 The Electrical Contractor shall be bound by industry standards, as interpreted by the Consultant, whether or not specifically referenced in this document. Comply with Electrical Protection Act and rules and regulations made pursuant thereto, including the 2012 Canadian Electrical Code. Also, comply with applicable standards of the following:

.1 CSA C22.1-2012, Canadian Electrical Code, Part 1.
.2 Electrical and Electronic Manufacturers Association of Canada (EEMAC).
.3 National Electrical Manufacturers Association (NEMA).
.4 National Building Code 2010 (NBC 2010)
.5 National Fire Protection Association (NFPA)
.6 Institute of Electrical and Electronic Engineers (IEEE).
.7 CAN/CSA C22.2 No.4-M89 (R2000), Enclosed Switches.
.8 CSA C22.2 No.39-M89 (R2003), Fuseholder Assemblies.
.9 Other Applicable CSA and UL approvals.

1.3 SHOP DRAWINGS AND PRODUCT DATA

.1 Submit shop drawings in accordance with:

.1 Section 01 33 00 - Submittal Procedures
.2 Section 26 05 01 – Common Work Results

.2 Shop drawings shall include but not be limited to speakers, riser diagram, cable types, and special mounting details.

1.4 PRODUCT APPROVALS

.1 Manufacturers' and model numbers named in these specifications indicate an acceptable technical standard of performance and are not intended to be exclusive. Products submitted as alternates must result in a control system that meets or exceeds all technical performance criteria as described.

.2 Products proposed as alternatives to those specified, shall only be considered if submitted for approval no later than 15 working days before tender close. Submit alternates, for approval, as one complete listing. Provide complete product specification sheets with request for approval.

□

.3 The Bidder must provide a complete list of primary system products offered with their bid.

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, in accordance with Section 26 28 14 - Fuses - Low Voltage. 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.

.11 All switches shall be manufactured by General Electric, Eaton, Siemens, or Schneider Electric.

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.

3.2 WARRANTY

.1 The contractor must make available to the Owner a local service department of a duly

authorized distributor of the equipment manufacturer, which shall stock the manufacturer's standard parts. The service department shall have at least one factory trained repair technician available to the Owner on 24 hours' notice.

.2 Provide warranty of installation of equipment installed by this contractor to be free of defects for a period of (1) one year from date of Substantial Completion.

.3 Provide during the warranty period, all service, maintenance, parts, etc., required for normal operation of the systems, such that Owner needs not purchase additional maintenance agreement or contracts. Upon request, the manufacturer and his agent shall provide direct to the Owner the following proposals:

.1 Continuation, after the warranty period, of full maintenance, including all service, labour, parts, etc. required to maintain the systems in a fully operational condition.

END OF SECTION

□

Part 1 General

1.1 GENERAL REQUIREMENTS

.1 The General Conditions of Contract, Division 01 General Requirements and all Addenda thereto form an integral part of and must be read in conjunction with the requirements of this Section.

.2 Cooperate and coordinate with the requirements of other units of work specified in other Sections.

.3 Coordinate all control requirements prior to ordering equipment.

.4 All motor control and ancillary components shall be supplied by one manufacturer in order to assure an integrated system and one point of contact for service. Each manufacturer shall have a local Saskatchewan service capability. All motor control equipment shall be of the same manufacture, and shall be manufactured by one of the following:

Eaton, Schneider Electric, General Electric

1.2 REFERENCES

.1 The Electrical Contractor shall be bound by industry standards, as interpreted by the Consultant, whether or not specifically referenced in this document. Comply with Electrical Protection Act and rules and regulations made pursuant thereto, including the 2012 Canadian Electrical Code. Also, comply with applicable standards of the following:

.1 CSA C22.1-2012, Canadian Electrical Code, Part 1.
.2 Electrical and Electronic Manufacturers Association of Canada (EEMAC).
.3 National Electrical Manufacturers Association (NEMA).
.4 National Building Code 2010 (NBC 2010)
.5 National Fire Protection Association (NFPA)
.6 Institute of Electrical and Electronic Engineers (IEEE).
.7 Other Applicable CSA and UL approvals.

1.3 SHOP DRAWINGS AND PRODUCT DATA

.1 Submit shop drawings in accordance with:

.1 Section 01 33 00 - Submittal Procedures
.2 Section 26 05 01 – Common Work Results

.2 Indicate:

.1 Mounting method and dimensions.
.2 Starter size and type.
.3 Layout of identified internal and front panel components.
.4 Enclosure types.
.5 Wiring diagram for each type of starter.

.6 Interconnection diagrams.

.7 All Fuse types for all starters

1.4 PRODUCT APPROVALS

.1 Manufacturers' and model numbers named in these specifications indicate an acceptable technical standard of performance and are not intended to be exclusive. Products submitted as alternates must result in a control system that meets or exceeds all technical performance criteria as described.

.2 Products proposed as alternatives to those specified, shall only be considered if submitted for approval no later than 15 working days before tender close. Submit alternates, for approval, as one complete listing. Provide complete product specification sheets with request for approval.

.3 The Bidder must provide a complete list of primary system products offered with their bid.

1.5 EXTRA MATERIALS

.1 Provide maintenance materials in accordance with Section 01 78 00 - Closeout Submittals.

.2 Provide listed spare parts for each different size and type of starter:

.1 2 contacts, auxiliary.

.2 1 operating coil.

.3 2 fuses.

Part 2 Products

2.1 MATERIALS

.1 For all motors, provide circuit and thermal protection on all lines except neutral.

.2 For all pumps not controlled by VFD's, provide hour meters for each visible on the motor control centre doors. All magnetic starters located outside of motor control centres shall contain hour meters.

.3 All contactors shall be NEMA rated contactors.

2.2 MANUAL MOTOR STARTERS

.1 Single or Three phase manual motor starters as shown of size, type, rating, and enclosure type as indicated, with components as follows:

.1 Switching mechanism, quick make and break.

.2 Overload heater(s) for each phase, manual reset, trip indicating handle.

.3 Thermal switches for small fractional KW motors shall be single or 2 pole as required.

.4 In all cases, locate within 9000 mm and in sight of motor

.2 Accessories:

.1 Toggle switch: industrial standard type labelled as indicated.

.2 Indicating light: standard neon type and colour as indicated.

.3 Locking tab to permit padlocking in "ON" or "OFF" position.

.4 thermal relay

2.3 FULL VOLTAGE MAGNETIC STARTERS

.1 Combination magnetic starters of size, type, rating and enclosure type as indicated with components as follows:

.1 Contactor solenoid operated, rapid action type.

.2 Motor overload protective device in each phase, manually reset from outside enclosure.

.3 Wiring and schematic diagram inside starter enclosure in visible location.

.4 Identify each wire and terminal for external connections, within starter, with permanent number marking identical to diagram.

.5 All starters shall be combination starters c/w quick-make, quick-break, switch, fuse and magnetic starter c/w red and green indicator lights

.6 H.O.A. switch operator controls

.7 Provide primary fuse for control transformer.

.8 Starters shall not be equipped with an automatic thermal overload reset.

.9 Tin plated stab on connectors are acceptable.

.2 Combination type starters to include fused disconnect switch with operating lever on outside of enclosure to control disconnect, and provision for:

.1 Locking in "OFF" position with up to 3 padlocks.

.2 Independent locking of enclosure door.

.3 Provision for preventing switching to "ON" position while enclosure door open.

.4 Fusing shall be Form I, NEMA "J", HRC, 200,000 amps current limiting type.

.3 Accessories:

.1 Pushbuttons and Selector switches: standard labelled as indicated.

.2 Indicating lights: standard type and color as indicated.

.3 1-N/O and 1-N/C spare auxiliary contacts unless otherwise indicated.

.4 The overload relays shall be the ambient temperature compensated type, and the trip rating of a specific heater element shall be field adjustable over a range of approximately 85% + 115% of its respective rating.

2.4 FULL VOLTAGE REVERSING MAGNETIC STARTERS

.1 Full voltage reversing magnetic starters of size, type, rating and enclosure type as indicated with components as follows:

.1 Contactor solenoid operated, rapid action type.

.2 Motor overload protective device in each phase, manually reset from outside enclosure.

.3 Wiring and schematic diagram inside starter enclosure in visible location.

.4 Identify each wire and terminal for external connections, within starter, with permanent number marking identical to diagram.

.5 All combination starters shall be quick-make, quick-break, switch, fuse and magnetic starter c/w red and green indicator lights

.6 H.O.A. switch operator controls

.7 Provide primary fuse for control transformer.

.8 Starters shall not be equipped with an automatic thermal overload reset.

.2 Combination type starters to include fused disconnect switch with operating lever on outside of enclosure to control disconnect, and provision for:

.1 Locking in "OFF" position with up to 3 padlocks.

.2 Independent locking of enclosure door.

.3 Provision for preventing switching to "ON" position while enclosure door open.

.4 Fusing shall be Form I, NEMA "J", HRC, 200,000 amps current limiting type.

.3 Accessories:

.1 Pushbuttons and Selector switches: standard labelled as indicated.

.2 Indicating lights: standard type and color as indicated.

.3 1-N/O and 1-N/C spare auxiliary contacts unless otherwise indicated.

.4 The overload relays shall be the ambient temperature compensated type, and the trip rating of a specific heater element shall be field adjustable over a range of approximately 85% + 115% of its respective rating.

2.5 CONTROL TRANSFORMER

.1 Single phase, dry type, control transformer with primary voltage as indicated and 120V secondary, complete with secondary fuse, installed in with starter as indicated.

2.6 FINISHES

.1 Apply finishes to enclosure in accordance with Section 26 05 01 - Common Work Results - Electrical.

2.7 EQUIPMENT IDENTIFICATION

.1 Provide equipment identification in accordance with Section 26 05 01 - Common Work Results - Electrical.

.2 Manual starter designation label, white plate, black letters, size 1, engraved as indicated.

.3 The plates shall be attached with two self-tapping metal screws.

Part 3 Execution

3.1 INSTALLATION

.1 Install starters, connect power and control as indicated.

.2 Ensure correct fuses and overload devices elements installed.

.3 Each manufacturer shall have a local Saskatchewan service capability.

.4 All motor control equipment shall be of the same manufacture.

.5 Install starters, connect power and control as indicated.

.6 Ensure correct fuses and overload devices elements installed.

.7 The motor starters shall be cleared of all ambient construction dust prior to commissioning or the energizing of the starters.

.8 Provide a disconnect for each motor within the room or area that the motor is located. All disconnects shall be sized in accordance with kilowatt ratings of the motor being isolated and shall be quick-make, quick-break type, equipped with lock-off feature.

.9 Within 900 mm of each motor, provide flexible Sealtite conduit. Provide a separate ground wire bridging the flexible connections.

.10 All conduit / cabling entering top of motor starter shall be c/w water tight connectors with silicone based caulking.

.11 Control wiring shall be stranded TEW 105°C (220°F) rise.

.12 Terminal blocks for remote interface shall be Weidmueller SAK6N or approved equal.

.13 Provide wire markers at both ends of all control wires, Electrovert Type Z or approved equal

.14 Provide isolation and voltage surge suppression for contacts used for external monitoring to limit inductive switching surges to less than 200 V peak. Provide DC coils with freewheeling diodes to limit inductive surges to 28V peak.

3.2 CLOSEOUT SUBMITTALS

.1 Provide operation and maintenance information for incorporation into manual specified in:

.1 Section 01 78 00 - Closeout Submittals

.2 Include:

.1 Operation instructions

.2 Description of system operation

.3 Description of each subsystem operation

.4 List specifying each piece of equipment in system or subsystem by its original manufacturer name and model number.

.5 Parts list specifying parts used in equipment by identification numbers that are standard to electronic industry.

.6 Include operation and maintenance data for each type and style of starter.

3.3 FIELD QUALITY CONTROL

.1 Perform tests in accordance with Section 26 05 01 - Common Work Results - Electrical and manufacturer's instructions.

.2 Provide factory certified copies of production test results to the Consultant prior to shipment of the equipment.

.3 Operate switches, contactors to verify correct functioning.

.4 Perform starting and stopping sequences of contactors and relays.

.5 Check that sequence controls, interlocking with other separate related starters, equipment, control devices, operate as indicated.

3.4 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.

3.5 VERIFICATION

.1 The entire installation shall be performed under the supervision of the manufacturer. Upon completion of the installation, the manufacturer shall check and test the entire system. Certification of all tests shall be submitted in writing to the Consultant and shall certify the following:

.1 That the system is complete in accordance with this specification

.2 That the system is installed in accordance with the manufacturer's best recommendations

.2 During the certification tests, the contractor shall provide one (1) electrician and (1) helper to assist the manufacturer's representative. The contractor shall also provide any required equipment such as ladders, scaffolding, etc.

3.6 TRAINING

.1 Written documentation bearing name and signature of Owner's personnel who received the above instructions shall be included in the operating instructions and service manuals.

END OF SECTION

Part 1 General

1.1 GENERAL REQUIREMENTS

.1 The General Conditions of Contract, Division 01 General Requirements and all Addenda thereto form an integral part of and must be read in conjunction with the requirements of this Section.

.2 Cooperate and coordinate with the requirements of other units of work specified in other Sections.

1.2 REFERENCES

.1 The Electrical Contractor shall be bound by industry standards, as interpreted by the Consultant, whether or not specifically referenced in this document. Comply with Electrical Protection Act and rules and regulations made pursuant thereto, including the 2012 Canadian Electrical Code. Also, comply with applicable standards of the following:

.1 CSA C22.1-2012, Canadian Electrical Code, Part 1.

.2 Electrical and Electronic Manufacturers Association of Canada (EEMAC).

.3 National Electrical Manufacturers Association (NEMA).

.4 National Building Code 2010 (NBC 2010)

.5 National Fire Protection Association (NFPA)

.6 Institute of Electrical and Electronic Engineers (IEEE).

.2 American National Standards Institute (ANSI)

.1 ANSI C82.1, Electric Lamp Ballasts-Line Frequency Fluorescent Lamp Ballast.

.2 ANSI C82.4, Ballasts for High-Intensity-Discharge and Low-Pressure Sodium Lamps.

.3 American National Standards Institute/Institute of Electrical and Electronics Engineers (ANSI/IEEE)

.4 ANSI/IEEE C62.41, Surge Voltages in Low-Voltage AC Power Circuits.

.5 American Society for Testing and Materials (ASTM)

.6 ASTM F1137, Specification for Phosphate/Oil and Phosphate/Organic Corrosion Protective Coatings for Fasteners.

.7 United States of America, Federal Communications Commission (FCC)

.8 FCC (CFR47) EM and RF Interference Suppression.

1.3 SHOP DRAWINGS AND PRODUCT DATA

.1 Submit shop drawings in accordance with:

.1 Section 01 33 00 - Submittal Procedures

.2 Section 26 05 01 – Common Work Results

.2 Shop drawings for each fixture shall include but not be limited to, lamps, ballasts, fixture cuts, custom colors, and special mounting details. All pertinent information for each fixture shall be stapled separately from other fixtures.

1.4 PRODUCT APPROVALS

.1 Manufacturers' and model numbers named in these specifications indicate an acceptable technical standard of performance and are not intended to be exclusive. Products submitted as alternates must result in a control system that meets or exceeds all technical performance criteria as described.

.2 Products proposed as alternatives to those specified, shall only be considered if submitted for approval no later than 10 working days before tender close. Submit alternates, for approval, as one complete listing. Provide complete product specification sheets with request for approval.

.3 The Bidder must provide detailed lighting calculation drawings for fixtures that are submitted for approval for classrooms, open office areas, training rooms or as requested by the consultant. These shall be submitted no later than 10 working days before tender close.

.4 The Bidder must provide a complete list of primary system products offered with their bid.

Part 2 Products

2.1 LAMPS

.1 Provide in wattages and types to properly suit the specified fixtures.

.2 T5 Linear Fluorescent Lamps:

.1 Miniature Bi-pin, slim 5/8" diameter for operating with high frequency electronic programmed start ballasts

.2 Colour Rendering Index (CRI) of 85

.3 Colour Temperature: 3500°K

.4 Nominal Life Rating: 20,000 hours

.3 Compact Fluorescent Lamps:

.1 4-pin lamp base for dimming and electronic ballast systems

.2 End-of-Life (EOL) shutdown protection

.3 Flicker free start on electronic ballast systems

.4 Colour Rendering Index (CRI) of 82

.5 Colour Temperature: 3500°K

.6 Nominal Life Rating: 12,000 hours

.4 Lamps for T5 linear fluorescent lighting fixtures shall be manufactured by Osram-Sylvania or Philips.

2.2 BALLASTS

.1 Ballasts for fluorescent fixtures shall be supplied with the fixtures, pre-wired for operation with the compatible lamps and quantity of lamps specified for the fixture. Provide ballasts in the voltage noted with the fixture specification.

.2 Fluorescent ballast systems shall include:

- .1 Operate lamps for maximum efficacy, high lumen output operation and operate for full lamp life
- .2 Eliminate lamp flicker
- .3 UL Listed Class P, Type 1 Outdoor
- .4 CSA Certified
- .5 70°C Maximum Case Temperature
- .6 FCC 47CFR Part 18 Non-Consumer for EMI and RFI filtering
- .7 Class A Sound Rating
- .8 ANSI C62.41 Category A Transient Protection
- .9 CFCI Compatible

.3 Ballasts for Linear T5 Lamps

- .1 Starting Method: Programmed Rapid Start
- .2 Stepped Switching Ballast System where indicated bi-level 100% and 50% stepped output
- .3 Ballast Factor (BF): 1.00
- .4 Circuit Type: Series
- .5 Lamp Frequency: >40kHz to reduce potential interference with infrared control systems
- .6 Lamp Current Crest Factor (CCF): less than 1.6
- .7 Total Harmonic Distortion: <10% THD
- .8 Power Factor: >98%
- .9 End of Lamp Life Sensing
- .10 Manufacturer:

  Sylvania ‘Quicktronic PROStart T5 Professional Series
  Advance ‘Optanium Step Dim EL’ series, available in 120-volt only

.4 Dimming Fluorescent Ballasts for T5, T5HO and Compact Fluorescent Lamps

- .1 Starting Method: Programmed Rapid Start System
- .2 Ballast Factor (BF): 1.00 – Normal Ballast Factor
- .3 Circuit Type: Series
- .4 Lamp Frequency: >40kHz to reduce potential interference with infrared control systems
- .5 Lamp Current Crest Factor (CCF): less than 1.7
- .6 Total Harmonic Distortion: <10% THD
- .7 Power Factor: >98%

.8 Dimming Range: 100 to 10%

.9 1 – 10 Volt Control

.10 Anti-Flash Circuitry turns on in dimmed mode

.11 End of Lamp Life Sensing for T4 and T5 lamps

.12 Compatible with 4-pin compact fluorescent lamp types

.13 Manufacturers (unless noted otherwise):

Lutron 'Hi-Lume' series
Sylvania 'Quicktronic – Powersense' series
Advance Mark 10

.5 Fluorescent ballasts shall have inrush current limiting capability to assure compatibility with all lighting systems controls.

.6 Ballast Warranty: All fluorescent ballasts shall include a written manufacturer's warranty against defects in materials and workmanship for 60 months from date of substantial completion and include a nominal replacement labour allowance.

2.3 LED LIGHTING – LAMP MODULES AND DRIVERS

.1 Solid-State Lighting (LED luminaires) shall comply with ENERGY STAR® SSL test standards for the following qualification requirements:

.1 Testing: SSL testing standards including IES LM-79-2008 and LM-80-2008 as performed by an independent test lab.

.2 Efficacy: The luminaire test data and submitted report shall demonstrate a minimum of 35 lumens per watt and 575 lumens for the least efficient LED for apertures ≥ 4.5" (345 lumens for apertures ≤ 4.5"), lowest efficient optic, and hottest luminaire configuration for the product group submitted for qualification.

.3 Colour: LED luminaire shall demonstrate colour uniformity across the aperture.

.4 Power: The driver/power supply must have a power factor of > 0.90 for all non-residential products, meet FCC requirements, sound rating of A and provide transient protection.

.5 Reliability: The LED luminaire shall demonstrate 70% lumen maintenance at 35,000 hours for non-residential products, as calculated using the DOE's linear extrapolation model.

.2 Tight chromaticity specification and LED colour binning process shall ensure LED colour uniformity, sustainable Colour Rendering Index (CRI) and Correlated Colour Temperature (CCT) consistency over the useful life of the LED. Consistent colour uniformity and tight colour control shall be maintained even during dimming.

.3 LED modules shall be InGaN (Indium Gallium Nitride) semiconductor material, absent of UV and minimal IR wavelengths. The conglomeration of diodes covered with remote phosphor technology shall provide consistent colour uniformity and tight colour control.

.4 LED Light Engine (Driver)

.1 Over-voltage, over-current and short-circuit protected

.2 Thermal management of the LED system shall be designed to yield 70% lumen maintenance after 50,000 hours of operation

.3 Total Harmonic Distortion: < 20% THD

.5 LED fixtures where specified as dimmable, shall have a dimming range of 100% to 10% unless otherwise noted.

.6 Warranty: The light engine and power components of LED luminaires installed for indoor applications shall be free from defects in material and workmanship for a minimum period of three (3) years from date of original purchase. Warranty shall cover only product failure due to defective material or workmanship, and does not include labour to remove or install fixtures. Defective LED's shall be considered if a minimum of 5% of LEDs per luminaire are non-operative in the fixture or module.

2.4 LUMINAIRES

.1 Contractor is responsible for all required mounting details for all lighting fixtures. If mounting of fixture is uncertain, contractor shall confirm prior to finalising pricing.

.2 Lighting fixtures shall be of the makes indicated. Similar types of fixtures shall be by one manufacturer.

.3 Only clean luminaires and lamps will be accepted at time of final inspection.

.4 Recessed fixtures shall generally be supplied complete with trim, plaster frame or ring and mounting brackets where installed in plaster, or without plaster frame in acoustic ceilings.

.5 Fixtures shall bear appropriate CSA labels.

.6 Cooperate with all other trades for the proper installation of all lighting fixtures.

.7 Verify the quantity of fixtures before placing orders.

.8 Verify all ceiling types with architectural drawings and the General Contractor before ordering fixtures.

.9 Fluorescent lighting fixtures shall be so designed that the temperature on the ballast case shall not exceed a maximum of 70°C in an ambient temperature of 25°C.

.10 Co-ordinate with drawings to ensure that all fluorescent fixtures are equipped with ballasts of a suitable voltage to match branch circuitry.

.11 All fluorescent fixtures such as troffers, specified as being equipped with flat acrylic lens, shall be provided with lens not less than 3.175 mm thick, regardless of catalogue numbers specified.

.12 All fluorescent troffers specified as being installed in inverted T-bar ceilings shall be painted on bottom face of fixture to match the T-bar splines unless otherwise noted.

.13 A self adhesive small circular label coloured blue shall be placed on a T-bar spline adjacent to each fixture housing the ballast to facilitate its location.

.14 All fluorescent luminaires installed on branch circuits with voltages exceeding 150 volts-to-ground shall be provided with a disconnecting means integral with the luminaire that simultaneously opens all circuit conductors between the branch circuit conductors and the conductors supplying the ballast(s), and shall be marked in a conspicuous and permanent manner adjacent to the disconnecting means so as to identify the disconnect.

.15 The new light fixture lamps shall not be used during construction. The contractor may use their own temporary lamps during construction at their own expense with the Owner's approval. The contractor shall replace temporary lamps with new lamps upon completion of work. All fixtures shall be cleaned inside and outside prior to substantial completion.

.16 Provide lighting fixtures of type and quality as specified in the following schedule. Fixtures shall be complete with necessary accessories, lamps and ballasts. The contractor shall advise of any restrictions on providing luminaire, lamp and ballast as specified during tender period.

.17 The lighting fixtures shall be as specified in the following schedule, and the manufacturer's numbers shown shall not reduce or amend the requirements as outlined under the description of each fixture type.

2.5 LUMINAIRE SCHEDULE

.1 Fixture type 'AA'

.1 Luminaire: Recessed fluorescent volumetric fixture suitable for inverted t-bar ceiling or metal panel ceiling, 305 x 305mm, painted white steel frame and side reflectors, hinged center optic component, acrylic center diffuser with satin lens, with one ballast per fixture.

.2 Lamps: 3 – F28 watt, T5 lamps, 3500k color temperature

.3 Ballast: Programmed rapid start electronic ballast, **120-volt**.

.4 Manufacturer:
Axis Lighting 'DIA' series
Mark Lighting 'WHISPER' series
Zumtobel 'ML' series
Ledalite 'SHINE' series
Metalumen 'Carlisle TC4' series
Or approved equal.

.2 Fixture type 'BB'

.1 Luminaire: Surface mounted fluorescent , 1219mm length, die formed cold rolled steel housing and end plates in white finish, clear acrylic prismatic wrap-around lens. Where suspended, fixture shall be suspended by chain hanger to a minimum height of 2700 mm above finished floor.

.2 Lamps: 2 x F28 watt T5 lamps

.3 Ballast: Program Rapid start electronic ballast, **120-volt**

.4 Manufacturer:
Cooper Metalux # WN series
Philips Day-Brite #OW Narrow series
Columbia Lighting 'AWN' series
Or approved equal

.3 Fixture type ‘CC’

.1 Luminaire: Surface mounted fluorescent strip light, 1219mm length c/w wire guard. Closed top symmetric reflector. Where suspended to 4700mm A.F.F. strip light shall be suspended by conduit. Where suspended to 2700mm, provide chain hanger. Coordinate final mounting height and locations with mechanical equipment and ductwork on site.

.2 Lamps: 2 x F28 watt T5 lamp

.3 Ballast: Program Rapid start electronic ballast, **120-volt**

.4 Manufacturer:
Cooper Metalux #ICF series
Philips Day-Brite #SV series
Columbia Lighting #CN series
Or approved equal.

.4 Fixture type ‘DD’

.1 Luminaire: Suspended fluorescent fixture direct/indirect, three lamps for each 1220mm section length, 120 volt ballast, die-cast extruded aluminum housing with end caps and in-line joint components suitable for continuous row mounting as shown on plans. Fixture shall be provided with a specular interior reflector allowing 80% downlight – 20% uplight, VL Optic acrylic lens, and daylight sensor. Fixture shall be mounted up 4000mm A.F.F. by aircraft cable from structural joists. Confirm final mounting heights with consultant. Fixture finish shall be aluminum paint.

.2 Lamps: 3 x F28 watt T5 lamps

.3 Ballast: Instant rapid start (0-10V dimming ballast) electronic ballast, **120-volt.**

.4 Manufacturer:
Axis Lighting #Slim series
Alera Lighting #PLK series
Ledalite #Thrive series
Or approved equal.

.5 Fixture type ‘DD2’

.1 Luminaire: Wall mounted fluorescent fixture direct/indirect, three lamps for each 1220mm section length, 120 volt ballasts, die-cast extruded aluminum housing with end caps and in-line joint components suitable for continuous row mounting as shown on plans. Fixture shall be provided with a specular interior reflector allowing 80% downlight – 20% uplight. VL Optic acrylic lens, and daylight sensor. Fixture shall be mounted up 4000mm A.F.F. . Confirm final mounting heights with consultant. Fixture finish shall be aluminum paint.

.2 Lamps: 1 x F28 watt T5 lamp

.3 Ballast: Instant rapid start (0-10V dimming ballast) electronic ballast, **120-volt.**

.4 Manufacturer:
Axis Lighting #Slim series
Alera Lighting #PLK series
Ledalite #Thrive series
Or approved equal.

.6 Fixture type ‘EE’

.1 Luminaire: Surface mounted fluorescent fixture , 1220mm length, end plates and metal housing in white finish, wrap around prismatic acrylic lens, mechanical lens retainer to prevent accidental removal of lens. Fixture shall include radio interference suppressor option.

.2 Lamps: 2 x F28 watt T5 lamps

.3 Ballast: Programmed rapid start electronic ballast, **120-volt.**

.4 Manufacturer:
C&M #STN
Cooper Metalux #WE
Lithonia #LB series
Philips Day-Brite #SA Caravel series
Columbia Lighting #AWN series
Or approved equal.

.7 Fixture type ‘FF’

.1 Luminaire: Recessed fluorescent volumetric fixture suitable for inverted t-bar ceiling or metal panel ceiling, 305 x 1219mm, painted white steel frame and side reflectors, hinged center optic component, acrylic center diffuser with satin lens, with one ballast per fixture.

.2 Lamps: 2 x F28 watt, T5 lamps, 3500k color temperature

.3 Ballast: Programmed rapid start electronic ballast, **120-volt**.

.4 Manufacturer:

Axis Lighting ‘DIA’ series
Mark Lighting ‘WHISPER’ series
Zumtobel ‘ML’ series
Ledalite ‘SHINE’ series
Metalumen ‘Carlisle TC4’ series
Or approved equal.

.8 Fixture type ‘GG’

.1 Luminaire: Fluorescent wall mount , 1219mm length, fixture frame in white finish, smooth opalescent acrylic diffuser. Mount up 150mm above vanity mirror.

.2 Lamps: 1 x F28 watt T5 lamp

.3 Ballast: Program start electronic ballast, **120-volt.**

.4 Manufacturer:
Cooper Metalux #BC series
Lithonia #WC series
Philips Day-Brite #CSW series
Columbia Lighting #W series
Or approved equal.

.9 Fixture type ‘GG3’

.1 Luminaire: Fluorescent wall mount , 610mm length, fixture frame in white finish, smooth opalescent acrylic diffuser. Mount up 150mm above vanity mirror.

.2 Lamps: 1 x F28 watt T5 lamp

.3 Ballast: Program start electronic ballast, **120-volt.**

.4 Manufacturer:
Philips Day-Brite #CSW series
Cooper Metalux #BC series
Lithonia #WC series
Columbia Lighting #W series
Or approved equal.

.10 Fixture type 'HH'

.1 Luminaire: Vandal proof corner mounted fluorescent, 1220 length,14 gauge cold rolled steel construction, seam welded, smooth finish with one piece piano hinged door frame, 1/4" thick polycarbonate outer lens, K12 internal lens, two 28 watt T5 fluorescent lamps and one 9 or 13 watt compact fluorescent lamp for night lite, two ballasts one for T5 lamps and one for compact fluorescent lamp.

.2 Lamps: 2 x F28 watt T5 lamps, 2600 initial lumens per lamp @ 25°C and one PL 9 or PL13 compact fluorescent lamp.

.3 Ballasts: Programmed rapid start electronic ballasts, **120 volt**

.4 Manufacturer:

Lighting Dimensions #LTMS-3324-12-12-THP-FNL

Cooper Lighting #FMC Corner Luminair

Metalumen #SS2 series (5mm polycarbonate outer lens)

Kenall #Mighty Mac CD Series

Or approved equal.

.11 Fixture type 'A'

.1 Luminaire: Keyless ceramic socket c/w screw-in type 13 watt compact fluorescent lamp. Mount 150mm above door header.

.12 Fixture type 'C'

.1 Luminaire: Recessed LED fixture suitable for wet location, fully gasketed with lens, 150mm diameter aperture, aluminum reflector with white trim.

.2 Lamp: 20 watt, 1100 lumen LED module with remote phosphor technology, 4100K, 80 CR1, 50000 hours at 70% lumen maintenance,

.3 Driver: over-voltage, over-current and short-circuit protected, 120 volt, < 20% THD, dimmable.

.4 Manufacturers:

Prescolite "LF6LED" Series

Conventry "6VLED" Series

Maxilume "HV6 LED" Series

Or approved equal.

.13 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: minimum 1330 lumen LED module, 3,500K, 80 CRI, 50000 hours at 70% lumen maintenance.

.3 **Driver: over-voltage, over-current and short-circuit protected, 120-volt, <20% THD, dimmable. Cold start temperature -40 degrees.**
Manufacturers:

Cooper Lighting Halo # ML56 LED Series

Elite "B6 LED" Series

Prescolite "LC6LED' Series
Or approved equal.

.14 Fixture type 'F'

.1 Luminaire: Recessed LED downlight suitable for mounting in inverted T-bar or drywall ceiling, 127mm diameter aperture, specular reflector with white trim, soft focus diffused lens.

.2 Lamps: 1200 lumen LED module, 3,500K, 80 CRI, 50000 hours at 70% lumen maintenance.

.3 **Driver: over-voltage, over-current and short-circuit protected, 120-volt, <20% THD, dimmable.**

.4 Manufacturers:
Cooper Lighting Halo # ML56 LED Series

Elite "B5 LED" Series

Prescolite "LC6LED' Series
Or approved equal.

.15 Fixture type 'G'

.1 Luminaire: Exterior surface mounted LED suitable for wet locations, extruded aluminum driver enclosure, die cast aluminum housing in powder coat grey finish, vandal resistant one-piece injection molded clear polycarbonate lens. Type III cut-off lighting distribution pattern, 120 volt LED driver with 0-10V dimming, <20% total harmonic distortion, >0.9 power factor, start-up operation -40 degree C to 40 degree C, 90% lumen maintenance at 60,000 hours, 56 input watts, 5,374 delivered lumens, 4000°K, c/w c/w integral photocell control. Fixture shall be mounted up 4,200 A.F.G. c/w 178mm length wall bracket. Five year warranty. Refer to lighting plan drawings and details.

.2 Manufacturers:
Cooper Lighting # GLEON series
Philips Gardco # ECOFORM series
Beacon #Viper Small 22NB series
Or approved equal.

.16 Fixture type 'H'

.1 Luminaire: Surface fluorescent fixture suitable for wet location, 16 gauge CRS backplate, gasketed for wet locations, .156 UV stabilized injection molded polycarbonate tamper resistant gasketed prismatic refractor, stainless steel Torx Head security screws, 305mm x 305mm diameter aperture. Fixture shall be GFCI protected.

.2 Lamp: 2 - 26 watt, triple tube fluorescent , 3500K, 80 CR1, 40000 hours at 70% lumen maintenance,

.3 Ballasts: Rapid Start HPF electronic ballasts, <10% THD, **120 volt**

.4 Manufacturers:

Cooper Lighting #Fail-Safe FS Series
Or approved equal.

.17 Fixture type 'K'

.1 Luminaire: Recessed LED downlight suitable for mounting in inverted T-bar or drywall ceiling, 86mm diameter aperture, white reflector with die-cast aluminum white trim ring, diffuse dome polymer lens. Five year warranty.

.2 Lamps: 700 lumen LED module, 3,500K, 80 CRI, 50000 hours at 70% lumen maintenance.

.3 **Driver: over-voltage, over-current and short-circuit protected, 120-volt, <20% THD, dimmable.**

.4 Manufacturers:

Cooper Lighting # Halo H4 Series

Elite "LED2-4" Series

Intense "ICRLS4" Series

Or approved equal.

.18 Fixture type 'PL1' (single head) 'PL2' (dual head)

.1 Luminaire: Exterior pole mounted LED suitable for wet locations, extruded aluminum driver enclosure, die cast aluminum housing in powder coat grey finish, vandal resistant one-piece injection molded clear polycarbonate lens. Type III cut-off lighting distribution pattern, 120 volt LED driver with 0-10V dimming, <20% total harmonic distortion, >0.9 power factor, start-up operation -40 degree C to 40 degree C, 90% lumen maintenance at 60,000 hours. 157 input watts, 15,669 delivered lumens, 4000°K, c/w c/w integral photocell control. Luminaire shall have five year warranty. Poles shall be square steel, 9144 mm (30 foot) and shall include anchor bolts, full base cover, hand hole, ground lug, top cap and all necessary accessories as required. Post top luminaire and lamp pole standard shall be grey finish. Refer to site plan drawings and details.

.2 Manufacturers:
Cooper Lighting # GLEON series
Philips Gardco # ECOFORM series
Beacon #Viper Large 64NB series
Valmont Pole 'SSS4-20' series
Keene SR2 series
Or approved equal.

.19 Fixtures type 'PL3' bollard light.

.1 Luminaire: LED high performance bollard, heavy gauge spun aluminum top cap, one piece extruded aluminum shaft (.125") in powder coat platinum silver finish, one-piece injection molded 1/4" high temperature clear polycarbonate vandalproof

enclosure. Hydro formed optical louvers with specular Alzak finish. Silicone gasketed for weathertight operation. Driver rated for -40 degrees F, 873 lumens, 4200°K, 0-10V dimming, photocell control. Luminaire shall have five year warranty. Bollard shall include zink plated anchor bolts, stainless steel cone point mounting screws, top cap and all necessary accessories as required. Refer to site plan drawings and details.

.2 Manufacturers:
Kim Lighting # B308R series
Philips #Gardco series
Solera #SRB8 series
Bega Lighting #BSH series
Or approved equal.

ADDITIONAL MATERIALS

.20 In addition to the materials specified and the quantity of materials as determined on the plans, provide for the supply and installation of the following additional materials, which shall be turned over to the owner if not installed during construction:

Lamps:

28 watt T5 Fluorescent Lamps: 30 lamps
Ballasts:
Instant Start Electronic ballasts for T5 lamps, 120 volt: 3 x ballasts

Fixtures:
Fixture type ‘AA’: 3 x additional fixtures
Fixture type ‘BB’ : 2 x additional fixtures
Fixture type ‘CC’: 5 x additional fixtures

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 Exit signs shall be wired in a separate conduit system.

.6 Conduit installation shall conform to the specifications.

.7 Emergency battery lighting units shall be connected to the room's 120-volt lighting circuit, non-switched leg.

3.2 CLOSEOUT SUBMITTALS

.1 Provide operation and maintenance information

.1 Section 01 78 00 - Closeout Submittals

.2 Include:

.1 Operation instructions

.2 Description of system operation

.3 Description of each subsystem operation

.4 List specifying each piece of equipment in system or subsystem by its original manufacturer name and model number.

.5 Parts list specifying parts used in equipment by identification numbers that are standard to electronic industry.

3.3 WIRING

.1 Each fixture shall be fed with a separate flex or AC-90 drop. Looping between fixtures or wiring rows through ballast channel will not be accepted.

3.4 LUMINAIRE SUPPORTS

.1 Lighting fixtures shall be supported independent of plasterboard or acoustic tile. Support from structural 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 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 United States of America, Federal Communications Commission (FCC)

.5 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 15 working days before tender close. Submit alternates, for approval, as one complete listing. Provide complete product specification sheets with request for approval.

.3 The Bidder must provide a complete list of primary system products offered with their bid.

Part 2 Products

2.1 EMERGENCY BATTERY OPERATED LIGHTING

.1 Emergency lighting units shall be battery contained units 120 volt, with a combination of remote heads interconnected as indicated on drawings, including wiring to a DC terminal block in the exit light fixtures.

.2 All emergency lighting fixtures shall be surface mounted up 2100mm unless otherwise noted. Lighting heads shall be adjusted on site to provide optimum lighting within the area with an emphasis directed at illuminating means of egress towards the exits. Coordinate mounting heights with architectural elevation drawings prior to rough-in.

.3 Emergency lighting units and remote fixtures shall be as specified in the following schedule, and the manufacturer's numbers shown shall not reduce or amend the requirements as outlined under the description of each fixture type.

.4 Battery units shall be labeled with identification numbers to match the owner’s existing numbering system. Contractor shall coordinate with the owner.

Fixture type ‘MA’ Emergency lighting unit shall be a battery contained unit with two integral lighting heads equipped with 2 x 12 watt, **12-volt** MR16 LED lamps. The emergency battery unit shall have a minimum **108 watt** capacity for 60 minutes, sealed long life battery with 10 year life expectancy. Solid state charger and battery protection circuit. Include auto-test self-diagnostic option, 120 volt.
Emergi-Lite - #Survive-All NXM series
Ready-Lite - #LDX-NM series
Beghelli – Luna RLA series

Fixture type ‘R2’ – Emergency remote light fixture powered from fixture type ‘MA’, as indicated, 2 x 12 watt **12-volt** MR16 lamps, fully gasketed cast aluminium back plate in white finish, clear polycarbonate cover. Provide for the supply and installation of (1) additional fixtures not shown on plans.
Emergi-Lite – EF40 series
Ready-Lite – TUF NM series
Beghelli – Luna RLA series

2.2 ADDITIONAL MATERIALS

.1 In addition to the materials specified and the quantity of materials as determined on the plans, provide for the supply and installation of the following additional materials, which shall be turned over to the owner if not installed during construction:

Fixtures:

Fixture type 'R2': 3 x additional fixtures including supply and installation of wire/ conduit for each additional fixture, 10 meters of 2 #10 RW90 in 16mm conduit.

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 Lighting fixtures installed in any area that is not completely finished shall be cleaned at the end of the construction.

.4 Conduit installation shall conform to the specifications.

.5 Emergency battery lighting units shall be connected to the room's 120-volt lighting circuit, non-switched leg.

3.2 CLOSEOUT SUBMITTALS

.1 Provide operation and maintenance information

.1 Section 01 78 00 - Closeout Submittals

.2 Include:

.1 Operation instructions

.2 Description of system operation

.3 Description of each subsystem operation

.4 List specifying each piece of equipment in system or subsystem by its original manufacturer name and model number.

.5 Parts list specifying parts used in equipment by identification numbers that are standard to electronic industry.

3.3 WIRING

.1 Each fixture shall be fed with a separate flex or AC-90 drop.

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 Fixtures shall be installed accurately in line and level. Any fixtures which are not installed properly shall be taken down and re-installed at no change to the contract sum.

3.6 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.

3.7 TRAINING

.1 Perform training in accordance with:

.1 Section 26 05 01 - Common Works Results - Electrical

.2 Written documentation bearing name and signature of Owner's personnel who received the above instructions shall be included in the operating instructions and service manuals.

END OF SECTION

Part 1 General

1.1 GENERAL REQUIREMENTS

.1 The General Conditions of Contract, Division 01 General Requirements and all Addenda thereto form an integral part of and must be read in conjunction with the requirements of this Section.

.2 Cooperate and coordinate with the requirements of other units of work specified in other Sections.

1.2 REFERENCES

.1 The Electrical Contractor shall be bound by industry standards, as interpreted by the Consultant, whether or not specifically referenced in this document. Comply with Electrical Protection Act and rules and regulations made pursuant thereto, including the 2012 Canadian Electrical Code. Also, comply with applicable standards of the following:

.1 CSA C22.1-2012, Canadian Electrical Code, Part 1.

.2 Electrical and Electronic Manufacturers Association of Canada (EEMAC).

.3 National Electrical Manufacturers Association (NEMA).

.4 National Building Code 2010 (NBC 2010)

.5 National Fire Protection Association (NFPA)

.6 Institute of Electrical and Electronic Engineers (IEEE).

.2 American National Standards Institute (ANSI)

.1 ANSI C82.1, Electric Lamp Ballasts-Line Frequency Fluorescent Lamp Ballast.

.2 ANSI C82.4, Ballasts for High-Intensity-Discharge and Low-Pressure Sodium Lamps.

.3 American National Standards Institute/Institute of Electrical and Electronics Engineers (ANSI/IEEE)

.4 ANSI/IEEE C62.41, Surge Voltages in Low-Voltage AC Power Circuits.

.5 American Society for Testing and Materials (ASTM)

.6 ASTM F1137, Specification for Phosphate/Oil and Phosphate/Organic Corrosion Protective Coatings for Fasteners.

.7 United States of America, Federal Communications Commission (FCC)

.8 FCC (CFR47) EM and RF Interference Suppression.

1.3 SHOP DRAWINGS AND PRODUCT DATA

.1 Submit shop drawings in accordance with:

.1 Section 01 33 00 - Submittal Procedures

.2 Section 26 05 01 – Common Work Results

.2 Shop drawings for each fixture shall include but not be limited to, lamps, ballasts, fixture cuts, custom colors, and special mounting details. All pertinent information for each fixture shall be stapled separately from other fixtures.

1.4 PRODUCT APPROVALS

.1 Manufacturers' and model numbers named in these specifications indicate an acceptable technical standard of performance and are not intended to be exclusive. Products submitted as alternates must result in a control system that meets or exceeds all technical performance criteria as described.

.2 Products proposed as alternatives to those specified, shall only be considered if submitted for approval no later than 15 working days before tender close. Submit alternates, for approval, as one complete listing. Provide complete product specification sheets with request for approval.

.3 The Bidder must provide a complete list of primary system products offered with their bid.

Part 2 Products

2.1 STANDARD UNITS

.1 Exit signs: to CSA C22.2 No.141 and CSA C860, packaged in accordance with the Canadian Code for Preferred Packaging guidelines.

.2 Exit sign fixtures shall be LED (Lighting Emitting Diodes), solid state design with high output LED's for a maximum 2 watts per sign, 120 volt.

.3 Aluminum housing in white finish

.4 Acrylic barrier

.5 Three green "Running Man" pictograms for direction selection (straight, left and right)

.6 Universal mounting

.7 Minimum five year warranty.

.8 Exit signs shall be one of the following manufacturers:

Ready-Lite 'RA' Series, Beghelli 'Quadra' #RM series, Emergi-Lite #EA series,

2.2 Fixture Type 'X1'

Exit sign, ceiling mounted, single face, direction indicators as shown on drawings. In addition to those fixtures shown and noted on the drawings, supply and install two (2) additional light fixtures complete with 10 meters of 2 #12 conductors plus insulated ground and 10 meters of 12mm conduit. These fixtures shall be installed as directed on site. Fixtures from this list that have not been installed during construction shall be turned over to the owner.

2.3 Fixture Type 'X2'

Exit sign, ceiling mounted, double face, direction indicators as shown on drawings.

2.4 Fixture Type 'X3'

Exit sign, surface wall mounted, single face, bottom of fixture mounted 100mm above door, direction indicators as shown on drawings.

2.5 ADDITIONAL MATERIALS

.1 In addition to the materials specified and the quantity of materials as determined on the plans, supply and install the following additional exit sign fixtures:

Fixture type 'X2': 2 x additional exit fixtures
Fixture type 'X3': 2 x additional exit fixtures

.2 For each additional exit sign fixture noted, include supply and installation conduit/wire for connection of the additional exit fixtures:

.1 120V : 10 meters of 2 # 12 RW90 plus insulated ground wire in 10 meters of 16mm conduit per fixture

.2 DC Input: 10 meters of 2 # 10 RW90 in 10 meters of 16mm conduit per fixture

.3 Location of the additional exit sign fixtures to be confirmed on site with the Consultant.

Part 3 Execution

3.1 INSTALLATION

.1 The contractor under this Division shall be responsible for expediting the delivery and installation of the exit fixtures to suit the construction schedule and work of other trades.

.2 Install exit signs so as to be visible from the exit approach.

.3 Exit signs shall be wired in a separate conduit system.

.4 Interconnect exit fixtures to the emergency lighting battery unit emergency circuit.

.5 Ensure the exit sign circuit breaker is locked in the 'ON' position.

3.2 WARRANTY

.1 The contractor must make available to the Owner a local service department of a duly authorized distributor of the equipment manufacturer, which shall stock the manufacturer's standard parts. The service department shall have at least one factory trained repair technician available to the Owner on 24 hours' notice.

.2 Provide warranty of installation of equipment installed by this contractor to be free of defects for a period of (1) one year from date of Substantial Completion.

.3 Provide during the warranty period, all service, maintenance, parts, etc., required for normal operation of the systems, such that Owner needs not purchase additional maintenance

agreement or contracts. Upon request, the manufacturer and his agent shall provide direct to the Owner the following proposals:

.1 Continuation, after the warranty period, of full maintenance, including all service, labour, parts, etc. required to maintain the systems in a fully operational condition.

3.3 VERIFICATION

.1 Perform tests in accordance with:

.1 Section 26 05 01 - Common Works Results - Electrical

.2 The entire installation shall be performed under the supervision of the manufacturer. Upon completion of the installation, the manufacturer shall check and test the entire system. Certification of all tests shall be submitted in writing to the Consultant and shall certify the following:

.1 That the system is complete in accordance with this specification

.2 That the system is installed in accordance with the manufacturer’s best recommendations

.3 During the certification tests, the contractor shall provide one (1) electrician and (1) helper to assist the manufacturer’s representative. The contractor shall also provide any required equipment such as ladders, scaffolding, etc.

3.4 TRAINING

.1 Perform training in accordance with:

.1 Section 26 05 01 - Common Works Results - Electrical

.2 Written documentation bearing name and signature of Owner's personnel who received the above instructions shall be included in the operating instructions and service manuals.

END OF SECTION

Part 1 General

1.1 GENERAL REQUIREMENTS

.1 The General Conditions of Contract, Division 01 General Requirements and all Addenda thereto form an integral part of and must be read in conjunction with the requirements of this Section.

.2 Cooperate and coordinate with the requirements of other units of work specified in other Sections.

1.2 REFERENCES

.1 The Electrical Contractor shall be bound by industry standards, as interpreted by the Consultant, whether or not specifically referenced in this document. Comply with Electrical Protection Act and rules and regulations made pursuant thereto, including the 2012 Canadian Electrical Code. Also, comply with applicable standards of the following:

.1 CSA C22.1-2012, Canadian Electrical Code, Part 1.

.2 Electrical and Electronic Manufacturers Association of Canada (EEMAC).

.3 National Electrical Manufacturers Association (NEMA).

.4 National Building Code 2010 (NBC 2010)

.5 National Fire Protection Association (NFPA)

.6 Institute of Electrical and Electronic Engineers (IEEE).

.2 Canadian Standards Association, (CSA International)

.1 CSA-T529, Telecommunications Cabling Systems in Commercial Buildings (Adopted ANSI/EIA TIA 568A with modifications).

.2 CSA-C22.2 No. 214, Communications Cables (Bi-national Standard, with UL 444).

.3 CAN/CSA-C22.2 No. 182.4, Plugs, Receptacles, and Connectors for Communication Systems.

.3 Telecommunications Industry Association (TIA)

.1 TIA/EIA/ANSI – 568B.1/2/3 latest revision Commercial Building Telecommunications Cabling Standards for Telecommunications Pathways and Spaces;

.2 TIA/EIA/ANSI – 515000 Generic Specification for Optical Fibre and Cable Splices

.3 TIA-568-C.0 Generic Telecommunications Cabling for Customer Premises;

.4 TIA-568-C Series Commercial Building Telecommunications Cabling Standard;

.5 TIA/EIA-569 Commercial Building Standard for Telecommunications Pathway and Spaces;

.6 TIA/EIA-606 The Administration Standard for the Telecommunications Infrastructure of Commercial Building;

.7 TIA/EIA-607-A Commercial Building Ground (Earthing) and Bonding Requirements for Telecommunications;

□

.8 Category 6A system and testing as released by TIA/EIA/ANSI – latest revision

.9 TIA/EIA T568-A UTP wiring/pinout

.4 The structured communication wiring system shall comply with Treasury Boards Information Technology Standard for wiring as described in the TBITS 6.9 document. TBITS 6.9 – Profile for the Telecommunications Wiring System in Government Owned and Leased Buildings – Technical Specifications) shall be as per Information and Technology Standards:

http://www.tbs-sct.gc.ca/it-ti/itp-pti/its-nit-eng.asp

1.3 SHOP DRAWINGS AND PRODUCT DATA

.1 Submit shop drawings in accordance with:

.1 Section 01 33 00 - Submittal Procedures

.2 Section 26 05 01 – Common Work Results

1.4 PRODUCT APPROVALS

.1 Manufacturers' and model numbers named in these specifications indicate an acceptable technical standard of performance and are not intended to be exclusive. Products submitted as alternates must result in a control system that meets or exceeds all technical performance criteria as described.

.2 Products proposed as alternatives to those specified, shall only be considered if submitted for approval no later than 15 working days before tender close. Submit alternates, for approval, as one complete listing. Provide complete product specification sheets with request for approval.

.3 The Bidder must provide a complete list of primary system products offered with their bid.

1.5 SYSTEM DESCRIPTION

.1 The data and voice cable installation, shall include all cable, connectors, patch panels, patch cords, racks, bix blocks, etc., as specified and shown on the drawings

.2 The cabling system shall meet or exceed the minimum characteristics as outlined TIA Standards Category 6. In addition, the testing method and parameters shall be as per the TIA recommendations.

.3 The cabling installer shall be a Belden Certified System Vender installing Belden components. Once completed, the installation must be a Belden Certified System. The data system and components shall be guaranteed for a period of twenty (20) years from the date of installation against defects in materials and workmanship.

1.6 SUBMITTALS

.1 Submit product data in accordance with Section 01 33 00 - Submittal Procedures and 26 05 01 – Common Work Results, Electrical.

□

.2 Submit shop drawings for review prior to ordering equipment. Shop drawings shall include but not be limited to, photocopies of accredited installers, cabling, hardware and components, patch cords, tester information, and labeling.

.3 Submit manufacturer's certification documentation that guarantees installation techniques, cable and cabling components and carry a minimum 20 year certification from the manufacturer for the capability to support gigabit applications such as 1000 Base-T, 622MB/s and 2.4 Gb/s ATM and work case channel performance based on the values indicated. The term channel performance incorporates manufacturer certified patch cords.

.4 Upon request and at no cost, the contractor shall provide a manufacturer's technical representative to conduct an onsite visit to ensure complete technical compliance.

.5 The manufacturer's certification must guarantee that design or installation negligence on the part of the certified contractor will not negate or void any portion of the certified system. The manufacturer must guarantee that all material, components and labour are covered for the full certification period. It must also guarantee that in the event a contractor is no longer in business, the full certification remains valid.

1.7 CONTRACTOR QUALIFICATIONS

.1 The Installer (Firm and Employees) conducting the installation shall have full working knowledge of cabling low voltage applications such as, but not limited to data/voice communications cabling systems. The Installer shall have at least five years of continuous recent experience on similar projects. The Installer shall hold recent, up-to-date licenses, certifications and training certificates in the area the project is located and for the equipment to be installed. The Installer shall:

.1 Provide references of the type of installation provided for this specification;

.2 Be a Belden Certified System Vendor.

.3 Have a knowledge of all applicable Telecommunication standards such as but not limited to CSA, TIA/EIA, IEEEE and ANSI;

.4 Have a experience in the installation of pathways and support for horizontal and backbone cabling;

.5 Be experienced in the installation and testing of telecommunication network cabling system, including the use of light meter and OTDR.

.6 Provide proof of being a manufacturer certified installer for all cable network components being installed such as but not limited to cables, connectors and end termination equipment. The use of non-manufacture certified installer is not permitted.

1.8 PROJECT CLOSEOUT

.1 Submit product data in accordance with Section 01 33 00 - Submittal Procedures and 26 05 01 – Common Work Results, Electrical.

.2 Operating and Maintenance Manuals at project closeout shall include

.1 List of cables, hardware and components;

.2 Copies of approved shop drawings;

□

.3 Record drawings.

.4 Warranty certification from the Manufacturer

.5 Receipts that include the listing of spare parts, materials and supplies, including patch cables and equipment cords.

.6 Test and verification reports (may be submitted on CD Disk inserted in an appropriate envelope page in the manual).

Part 2 Products

2.1 COMMUNICATION CABLES, PATHWAYS AND TERMINATION BLOCKS

.1 Refer to Section 27 05 14 - Communication Cables Inside Buildings

.2 Refer to Section 27 05 28 – Pathways for Communications Systems

.3 Refer to Section 27 11 19 – Communications Termination Blocks

Part 3 Execution

3.1 FIELD QUALITY CONTROL

.1 Perform tests in accordance with Section 26 05 01 - Common Work Results - Electrical.

.2 The communications cabling system and testing shall comply with the following standards. All standards shall be as per the latest revision at the time of tendering this project.

.1 TIA/EIA/ANSI – 568B.1/2/3 latest revision

.2 Category 6A system and testing as released by TIA/EIA/ANSI – latest revision

.3 TIA/EIA T568-A UTP wiring/pinout

.4 BICSI, TDMM Telecommunications Distribution Methods Manual (latest edition)

.5 CAN/CSA-T529-M91

.6 CAN/CSA-T530-M90

.7 CAN/CSA-T527-94, EIA/TIA-607

.8 CAN/CSA-T528-93, EIA/TIA-606

.9 EIA/TIA-TSB 40-A

.10 EIA/TIA-TSB 67

.11 EIA/TIA-569

.12 EIA/TIA-606

.3 The total installation shall be completed by the cable Installer who is certified by the manufacturer for Category 6A and fibre optic cable installations. The Installer shall submit photocopies of accreditation certificates with the shop drawings. Submit testing method and tester with shop drawings.

.4 The contractor shall submit the verified test result on each cable, connector, and connection for the total installation, including back-bone and horizontal cabling. The model number and

manufacturer of the Category 6A cable and fibre cable shall be documented. The type of tester used for testing the Category 6A cabling and fibre cabling must also be documented.

.5 Test results shall be evaluated by the test equipment using the most up-to-date criteria from the TIA/EIA Standard. This information shall be supplied in electronic format.

.1 Room number of installation

.2 Wall plate ID

.3 Test Results with an identification of type of test used and whether the result was PASS or FAIL

.6 Category 6A cable tests shall provide results for the following tests:

.1 Near End Crosstalk (NEXT)

.2 Attenuation

.3 Ambient Noise

.4 Attenuation to Crosstalk Ration (ACR)

.5 Far End Crosstalk (FEXT)

.7 Fibre Optic Testing:

.1 Single mode/multimode fibre cable shall be tested at both 850nm and 1300nm, and 1310nm and 1500nm in both directions.

.2 Testing of single mode fibre cabling shall meet the requirements of ANSI/TIA/EIA-526-7.

.3 Test set-up and performance shall be conducted in accordance with ANSI/TIA/EIA-526-14-A for multimode fibre. The light source shall meet the launch requirements of ANSI-TIA/EIA-455-50B, Method A. This launch condition may be achieved either within the test equipment or by use of an external mandrel wrap (as described in clause 11 of ANSI/TIA-EIA-568-C) with a Category 1 light source.

.4 Attenuation testing shall be performed with a stable launch condition using two-meter jumpers to attach the test equipment to the cable plat. The light source shall be left in place after calibration and the power meter moved to the far end to take measurements. Maximum attenuation for installed cables shall be evaluated basted on the following formula:

.8 Provide with maintenance manuals, a marked set of prints illustrating the network drop name for each drop location. No other as-built information shall be provided on these prints unless it relates to the data or voice network.

.9 The consultant will spot test this testing following test completion. Contractor shall provide the testing technician for (2) hours, and the completed test charts, for spot check verifications.

3.2 GROUNDING AND BONDING FOR COMMUNICATION SYSTEM

.1 Bonding Backbone shall consist of green jacketed stranded copper conductors and insulated ground bars.

□

.2 Install a #6 AWG insulated bond to ground connection directly to each equipment rack in LAN Rooms. Each ground connection shall be terminated at the existing building ground system.

.3 Bus bars shall be an insulated pre-drilled, electro tin plated copper busbar, minimum 6mm thigh x 100mm wide x 305mm long (or length that is determined by the number of required connections including space for additional bond connections). Mount up 300mm above finished floor near the equipment rack location.

.4 Aluminum wires, clamps or terminal connectors will not be accepted for grounding and bonding.

.5 Terminations to the telecommunication ground bus bars shall be installed without splices where possible. If splices are necessary, they shall be as few as possible. Use irreversible compression-type connectors, exothermic welding, or equivalent. The connection to the ground bus bar shall be done using 2-hole compression connectors.

3.3 WARRANTY

.1 Testing and certification of the building network distribution cable installation shall be by the Installer and shall include the provision of a full Manufacturer's and Vendor's Warranty covering performance, products and installation. The Warranties shall cover the full repair and/or replacement of any component failing or failure to meet the design requirements within one (1) year. Warranties shall be delivered to the Project Manager with the Testing and Certification documentation.

.2 Within ten (10) days after testing, the Installer shall submit the cable test results, and a marked up record drawing(s) of the as-built cable network. The record drawing(s) shall include the cable/jack identification at the outlet locations.

.3 The contractor must make available to the Owner a local service department of a duly authorized distributor of the equipment manufacturer, which shall stock the manufacturer's standard parts. The service department shall have at least one factory trained repair technician available to the Owner on 24 hours' notice.

.4 Provide during the warranty period, all service, maintenance, parts, etc., required for normal operation of the systems, such that Owner needs not purchase additional maintenance agreement or contracts

3.4 VERIFICATION

.1 Perform tests in accordance with:

.1 Section 26 05 01 - Common Works Results - Electrical

.2 The entire installation shall be performed under the supervision of the manufacturer. Upon completion of the installation, the manufacturer shall check and test the entire system. Certification of all tests shall be submitted in writing to the Consultant and shall certify the following:

.1 That the system is complete in accordance with this specification

□

.2 That the system is installed in accordance with the manufacturer's best recommendations

.3 During the certification tests, the contractor shall provide one (1) electrician and (1) helper to assist the manufacturer's representative. The contractor shall also provide any required equipment such as ladders, scaffolding, etc.

3.5 TRAINING

.1 Perform training in accordance with:

.1 Section 26 05 01 - Common Works Results - Electrical

.2 Written documentation bearing name and signature of Owner's personnel who received the above instructions shall be included in the operating instructions and service manuals.

END OF SECTION

□

Part 1 General

1.1 GENERAL REQUIREMENTS

.1 The General Conditions of Contract, Division 01 General Requirements and all Addenda thereto form an integral part of and must be read in conjunction with the requirements of this Section.

.2 Cooperate and coordinate with the requirements of other units of work specified in other Sections.

1.2 REFERENCES

.1 The Electrical Contractor shall be bound by industry standards, as interpreted by the Consultant, whether or not specifically referenced in this document. Comply with Electrical Protection Act and rules and regulations made pursuant thereto, including the 2012 Canadian Electrical Code. Also, comply with applicable standards of the following:

.1 CSA C22.1-2012, Canadian Electrical Code, Part 1.

.2 Electrical and Electronic Manufacturers Association of Canada (EEMAC).

.3 National Electrical Manufacturers Association (NEMA).

.4 National Building Code 2010 (NBC 2010)

.5 National Fire Protection Association (NFPA)

.6 Institute of Electrical and Electronic Engineers (IEEE).

.7 Audio Engineering Society (AES).

.8 Other Applicable CSA and UL approvals.

.2 Telecommunications Industry Association (TIA)

.1 TIA/EIA/ANSI – 568B.1/2/3 latest revision Commercial Building Telecommunications Cabling Standards for Telecommunications Pathways and Spaces;

.2 TIA/EIA/ANSI – 515000 Generic Specification for Optical Fibre and Cable Splices

.3 TIA-568-C.0 Generic Telecommunications Cabling for Customer Premises;

.4 TIA-568-C Series Commercial Building Telecommunications Cabling Standard;

.5 TIA/EIA-569 Commercial Building Standard for Telecommunications Pathway and Spaces;

.6 TIA/EIA-606 The Administration Standard for the Telecommunications Infrastructure of Commercial Building;

.7 TIA/EIA-607-A Commercial Building Ground (Earthing) and Bonding Requirements for Telecommunications;

.8 Category 6 system and testing as released by TIA/EIA/ANSI – latest revision

.9 TIA/EIA T568-A UTP wiring/pinout

1.3 SHOP DRAWINGS AND PRODUCT DATA

.1 Submit shop drawings in accordance with:

□

.1 Section 01 33 00 - Submittal Procedures

.2 Section 26 05 01 – Common Work Results

1.4 PRODUCT APPROVALS

.1 Manufacturers' and model numbers named in these specifications indicate an acceptable technical standard of performance and are not intended to be exclusive. Products submitted as alternates must result in a control system that meets or exceeds all technical performance criteria as described.

.2 Products proposed as alternatives to those specified, shall only be considered if submitted for approval no later than 15 working days before tender close. Submit alternates, for approval, as one complete listing. Provide complete product specification sheets with request for approval.

.3 The Bidder must provide a complete list of primary system products offered with their bid.

1.5 SYSTEM DESCRIPTION

.1 The data and voice cable installation, shall include all cable, connectors, patch panels, patch cords, racks, bix blocks, etc., as specified and shown on drawings.

.2 The cabling system shall meet or exceed the minimum characteristics as outlined TIA Standards Category 6A. In addition, the testing method and parameters shall be as per the TIA recommendations and meet requirements for testing Category 6A installations.

.3 The cabling system shall use matched components from a single manufacturer certified to deliver system performance over the lifetime of the applications which the cabling system was originally designed to support. The data system and components to be certified by the manufacturer and shall be guaranteed for a period of twenty-five (25) years from the date of installation against defects in materials and workmanship. The manufacturer shall be Belden.

.4 Each cable shall be equipped with connectors on each end and connected to wall jacks or cable connectors. All field communications cabling to be terminated on patch panels located on the drawings.

.5 The data cabling channel shall not exceed four (4) connections and shall not exceed 90m.

Part 2 Products

2.1 HORIZONTAL COMMUNICATIONS BUILDING CABLE (CBC)

.1 All communication cable (data and voice) shall be unshielded twisted pair, Category 6A four (4) pair #23 AWG, CMP (FT6) rated and meet TIA/EIA/ANSI – 568-C.2, latest revision unless noted otherwise. Data cable shall be white, Voice cable shall be blue.

.2 Each cable shall be equipped with connectors on each end at the wall jacks and patch panels at the data equipment racks.

□

.3 The data cabling channel shall not exceed four (4) connections and overall length shall not exceed 90m. The maximum distance shall include an allowance of 3 meters from the outlet to the workstation and 6 meters for patch cords.

.4 Data and voice may be installed in a common box.

.5 A minimum of two Category 6A UTP cables shall be installed at each workstation unless otherwise noted on the drawings.

2.2 NETWORK PATCH CORDS

.1 Pre-terminated, factory tested patch cords shall be of the same manufacturer as the installed system and shall be part of the certified system. Patch cables shall be labeled at both ends.

.2 Patch cords for data and voice cables shall have stranded conductors and meets the requirements of TIA/EIA 568A (latest revision). Patch cords shall meet Category 6A criteria when tested with the components of the system. Patch cords at workstations shall be Category 6A cable terminated with 8 pin modular male jacks, TIA T568A pinout.

.3 Provide two (2) patch cords for each cable drop located on the plans.

.4 Provide cords in the following lengths: 50% (data total) shall be 1.2m length; 30% (data total) shall be 1.8m length; 20% (data total) shall be 2.1m length.

.5 Fiber patch cords: All fibre cable shall be multimode tight buffered, multi-fibre building cable unless noted otherwise.

.6 Provide one (1) 1220mm length WHITE in colour patch cords for each Telephone cable that enters the building to allow for the cross connection of all installed and future telephone connections on the network equipment rack.

Part 3 Execution

3.1 INSTALLATION OF COMMUNICATION CABLES

.1 All cable shall be pulled using proper wire grips. Pulling force and bend radius shall not exceed manufacturer's specifications.

.2 Velcro straps shall be used in all locations, cable ties are unacceptable.

.3 Parts of cables not in cable management trays shall be strapped at least every 250mm along cable.

3.2 WARRANTY

.1 The contractor must make available to the Owner a local service department of a duly authorized distributor of the equipment manufacturer, which shall stock the manufacturer's standard parts. The service department shall have at least one factory trained repair technician available to the Owner on 24 hours' notice.

.2 Provide warranty of installation of equipment installed by this contractor to be free of defects

for a period of (1) one year from date of Substantial Completion.

.3 Provide during the warranty period, all service, maintenance, parts, etc., required for normal operation of the systems, such that Owner needs not purchase additional maintenance agreement or contracts. Upon request, the manufacturer and his agent shall provide direct to the Owner the following proposals:

.1 Continuation, after the warranty period, of full maintenance, including all service, labour, parts, etc. required to maintain the systems in a fully operational condition.

.4 During the warranty period, provide three (3) separate site visits of four (4) hours each on site for owner revisions and additional training.

3.3 VERIFICATION

.1 Perform tests in accordance with:

.1 Section 26 05 01 - Common Works Results - Electrical

.2 The entire installation shall be performed under the supervision of the manufacturer. Upon completion of the installation, the manufacturer shall check and test the entire system. Certification of all tests shall be submitted in writing to the Consultant and shall certify the following:

.1 That the system is complete in accordance with this specification

.2 That the system is installed in accordance with the manufacturer’s best recommendations

.3 During the certification tests, the contractor shall provide one (1) electrician and (1) helper to assist the manufacturer’s representative. The contractor shall also provide any required equipment such as ladders, scaffolding, etc.

3.4 TRAINING

.1 Perform training in accordance with:

.1 Section 26 05 01 - Common Works Results - Electrical

.2 Written documentation bearing name and signature of Owner's personnel who received the above instructions shall be included in the operating instructions and service manuals.

END OF SECTION

□

Part 1 General

1.1 GENERAL REQUIREMENTS

.1 The General Conditions of Contract, Division 01 General Requirements and all Addenda thereto form an integral part of and must be read in conjunction with the requirements of this Section.

.2 Cooperate and coordinate with the requirements of other units of work specified in other Sections.

1.2 REFERENCES

.1 The Electrical Contractor shall be bound by industry standards, as interpreted by the Consultant, whether or not specifically referenced in this document. Comply with Electrical Protection Act and rules and regulations made pursuant thereto, including the 2012 Canadian Electrical Code. Also, comply with applicable standards of the following:

.1 CSA C22.1-2012, Canadian Electrical Code, Part 1.

.2 Electrical and Electronic Manufacturers Association of Canada (EEMAC).

.3 National Electrical Manufacturers Association (NEMA).

.4 National Building Code 2010 (NBC 2010)

.5 National Fire Protection Association (NFPA)

.6 Institute of Electrical and Electronic Engineers (IEEE).

.7 Audio Engineering Society (AES).

.8 Other Applicable CSA and UL approvals.

.2 Telecommunications Industry Association (TIA)

.1 TIA/EIA/ANSI – 568B.1/2/3 latest revision Commercial Building Telecommunications Cabling Standards for Telecommunications Pathways and Spaces;

.2 TIA/EIA/ANSI – 515000 Generic Specification for Optical Fibre and Cable Splices

.3 TIA-568-C.0 Generic Telecommunications Cabling for Customer Premises;

.4 TIA-568-C Series Commercial Building Telecommunications Cabling Standard;

.5 TIA/EIA-569 Commercial Building Standard for Telecommunications Pathway and Spaces;

.6 TIA/EIA-606 The Administration Standard for the Telecommunications Infrastructure of Commercial Building;

.7 TIA/EIA-607-A Commercial Building Ground (Earthing) and Bonding Requirements for Telecommunications;

.8 Category 6 system and testing as released by TIA/EIA/ANSI – latest revision

.9 TIA/EIA T568-A UTP wiring/pinout

1.3 SHOP DRAWINGS AND PRODUCT DATA

.1 Submit shop drawings in accordance with:

□

.1 Section 01 33 00 - Submittal Procedures

.2 Section 26 05 01 – Common Work Results

.2 Submit shop drawings for review prior to ordering equipment. Shop drawings shall include but not be limited to, photocopies of accredited installers, outlets, coverplates, "water fall kits", cable management.

1.4 PRODUCT APPROVALS

.1 Manufacturers' and model numbers named in these specifications indicate an acceptable technical standard of performance and are not intended to be exclusive. Products submitted as alternates must result in a control system that meets or exceeds all technical performance criteria as described.

.2 Products proposed as alternatives to those specified, shall only be considered if submitted for approval no later than 15 working days before tender close. Submit alternates, for approval, as one complete listing. Provide complete product specification sheets with request for approval.

.3 The Bidder must provide a complete list of primary system products offered with their bid.

1.5 SYSTEM DESCRIPTION

.1 Telecommunications raceways system consists of outlet boxes, cover plates, cabinets, conduits, cable troughs, pull boxes, sleeves and caps, fish wires, service poles, service fittings, concrete encased ducts.

Part 2 Products

2.1 MATERIAL

.1 Conduits: in accordance with Section 26 05 34 - Conduits, Conduit Fastenings and Conduit Fittings

.2 Cable troughs: type, in accordance with Section 26 05 36 - Cable Trays

.3 Junction boxes, in accordance with Section 26 05 31 - Splitters, Junction, Pull Boxes and Cabinets

2.2 OUTLET BOXES

.1 Outlet boxes shall be 100mm square boxes. Multiple boxes shall not be ganged unless noted otherwise.

.2 Wall plates for communication cable systems shall have integral self label. The wall plates must support up to four (4) network drops and be run in a minimum of **27mm** conduit to the nearest equipment rack or stub at the basket tray in the accessible ceiling. Provide blank filler plates for unused drops.

.3 Wall plates shall be modular and in 'Keystone' format opening to allow the possibility of changing connector types in the future without replacing the wall plate. Faceplates shall be

□

equipped with small form factor terminating connectors to fit the individual outlet's requirements (RJ45 and or Dual LC and or CATV bulkheads).

.4 Wall plates shall be equipped with a minimum of four (4) angled keystone openings. The installer shall equip the wall plate with the required amount of blank inserts as required. The minimum standard of acceptance for wallplates are Corning WLL-PL-AP or Panduit NK4VSFWH.

.5 When the wall plates are equipped with fibre optic port, it must be placed in the bottom keystone port position. Install 'Keystone' fibre 'SC' adapter for frame-station connector.

2.3 CABLE MANAGEMENT

.1 Velcro ties shall be used. Each cable type shall be bundled separately; that is data bundle, voice bundle, and fibre bundle. Cable ties wraps are unacceptable. Ensure maximum distance between cable Velcro wraps is 610mm.

Part 3 Execution

3.1 SECURITY

.1 All cabling shall be installed in conduit in areas deemed unsecured. Unsecured areas, unless otherwise noted include the following:

.1 Any area accessible by more than one tenant or the public.

.2 Any area where cabling crosses from one tenant space to another tenant space.

.2 No communication (data, voice or fibre) cabling shall share same raceway or junction boxes with any other pathway system.

3.2 INSTALLATION

.1 All horizontal cables shall be run in conduit. All raceways shall be grounded. All conduits shall have suitable bushings.

.2 Backbone/riser cables (fibre, copper) and horizontal cables shall be run in EMT conduit, minimum 27mm diameter unless otherwise noted on drawings. Maximum allowable percentage conduit fill shall not exceed 40%.

.3 EMT conduit shall be reamed and bushed at both ends and bonded to the distribution system. Rigid PVC or flexible metallic or PVC conduits are not acceptable.

.4 Inside radius bend in EMT conduit shall not be less than 6 times the internal diameter for conduit sizes up to 41mm inside diameter; 10 times the internal diameter for conduit sizes 53mm diameter and larger.

.5 Pull boxes shall be installed in conduit runs where the total number bends exceed 180 degrees; where the overall length of the conduit run is more than 30m, or if there is a reverse bend in the run.

□

.6 Pull boxes shall be installed in the straight sections of the conduit run and shall not be used lieu of a bend. Corresponding ends of conduit shall be aligned with each other. Conduit fittings shall not be used in place of pull boxes or bends.

.7 Use of LL, LR and LL conduit fittings is not permitted.

.8 The use of J-Hooks, brackets, cable ties and other attachments to support cabling **is not** permitted. Meshed-basket Data Cable tray is required.

.9 In all wall outlet boxes, the contractor shall leave 400mm length of cable in each box.

.10 In all wall workstation drops, leave 300mm of cable slack before entering wall or workstation in suspended ceiling.

3.3 WARRANTY

.1 The contractor must make available to the Owner a local service department of a duly authorized distributor of the equipment manufacturer, which shall stock the manufacturer's standard parts. The service department shall have at least one factory trained repair technician available to the Owner on 24 hours' notice.

.2 Provide warranty of installation of equipment installed by this contractor to be free of defects for a period of (1) one year from date of Substantial Completion.

.3 Provide during the warranty period, all service, maintenance, parts, etc., required for normal operation of the systems, such that Owner needs not purchase additional maintenance agreement or contracts. Upon request, the manufacturer and his agent shall provide direct to the Owner the following proposals:

.1 Continuation, after the warranty period, of full maintenance, including all service, labour, parts, etc. required to maintain the systems in a fully operational condition.

.4 During the warranty period, provide three (3) separate site visits of four (4) hours each on site for owner revisions and additional training.

3.4 VERIFICATION

.1 Perform tests in accordance with:

.1 Section 26 05 01 - Common Works Results - Electrical

.2 The entire installation shall be performed under the supervision of the manufacturer. Upon completion of the installation, the manufacturer shall check and test the entire system. Certification of all tests shall be submitted in writing to the Consultant and shall certify the following:

.1 That the system is complete in accordance with this specification

.2 That the system is installed in accordance with the manufacturer's best recommendations

.3 During the certification tests, the contractor shall provide one (1) electrician and (1) helper to assist the manufacturer's representative. The contractor shall also provide any required

□

equipment such as ladders, scaffolding, etc.

3.5 TRAINING

.1 Perform training in accordance with:

.1 Section 26 05 01 - Common Works Results - Electrical

.2 Written documentation bearing name and signature of Owner's personnel who received the above instructions shall be included in the operating instructions and service manuals.

END OF SECTION

□

Part 1 General

1.1 GENERAL REQUIREMENTS

.1 The General Conditions of Contract, Division 01 General Requirements and all Addenda thereto form an integral part of and must be read in conjunction with the requirements of this Section.

.2 Cooperate and coordinate with the requirements of other units of work specified in other Sections.

1.2 REFERENCES

.1 The Electrical Contractor shall be bound by industry standards, as interpreted by the Consultant, whether or not specifically referenced in this document. Comply with Electrical Protection Act and rules and regulations made pursuant thereto, including the 2012 Canadian Electrical Code. Also, comply with applicable standards of the following:

.1 CSA C22.1-2012, Canadian Electrical Code, Part 1.

.2 Electrical and Electronic Manufacturers Association of Canada (EEMAC).

.3 National Electrical Manufacturers Association (NEMA).

.4 National Building Code 2010 (NBC 2010)

.5 Institute of Electrical and Electronic Engineers (IEEE).

.2 Canadian Standards Association (CSA) International

.1 CAN/CSA-C22.2 No.182.4, Plugs, Receptacles and Connectors for Communication Systems.

.2 CSA T529, Telecommunications Cabling Systems in Commercial Buildings (Adopted ANSI/EIA TIA 568a with modifications).

.3 Telecommunications Industry Association (TIA)

.1 TIA/EIA/ANSI – 568-B.1/2/3 latest revision Commercial Building Telecommunications Cabling Standards for Telecommunications Pathways and Spaces;

.2 TIA/EIA/ANSI – 515000 Generic Specification for Optical Fibre and Cable Splices

.3 TIA-568-C.0 Generic Telecommunications Cabling for Customer Premises;

.4 TIA-568-C Series Commercial Building Telecommunications Cabling Standard;

.5 TIA/EIA-569 Commercial Building Standard for Telecommunications Pathway and Spaces;

.6 TIA/EIA-606 The Administration Standard for the Telecommunications Infrastructure of Commercial Building;

.7 TIA/EIA-607-A Commercial Building Ground (Earthing) and Bonding Requirements for Telecommunications;

.8 Category 6A system and testing as released by TIA/EIA/ANSI – latest revision

.9 TIA/EIA T568-A UTP wiring/pinout

.4 Other Applicable CSA and UL approvals.

1.3 SHOP DRAWINGS AND PRODUCT DATA

.1 Submit shop drawings in accordance with:

.1 Section 01 33 00 - Submittal Procedures

.2 Section 26 05 01 – Common Work Results

.2 Submit shop drawings for review prior to ordering equipment. Shop drawings shall include but not be limited to, photocopies of accredited installers, copper patch panels, copper termination jacks, coax jacks, fibre patch panels, fibre terminations, communication racks, cable management, and sample labeling.

1.4 PRODUCT APPROVALS

.1 Manufacturers' and model numbers named in these specifications indicate an acceptable technical standard of performance and are not intended to be exclusive. Products submitted as alternates must result in a control system that meets or exceeds all technical performance criteria as described.

.2 Products proposed as alternatives to those specified, shall only be considered if submitted for approval no later than 15 working days before tender close. Submit alternates, for approval, as one complete listing. Provide complete product specification sheets with request for approval.

.3 The Bidder must provide a complete list of primary system products offered with their bid.

1.7 SYSTEM DESCRIPTION

.1 Termination, patch cords, and cross-connection equipment installed inside building for voice and data for telecommunications systems employing unshielded-twisted-pair (UTP), coaxial (CXC), and future optical fibre (OFC) cables. Refer to drawings for special details.

Part 2 Products

2.1 PATCH PANELS, CONNECTORS AND ADAPTORS

.1 Data and voice patch panels shall be 12 or 24-port panels mounted in the communication equipment racks, as indicated in rack diagrams. A minimum of 12 ports shall be spare for future. Patch panels shall be compatible with Category 6A installations, and shall accept snap-in non keyed modular 8-pin jacks with T568-A pinout.

.2 Connectors shall be modular 8 PIN jacks, rated Category 6A – TIA/EIA T568-A UTP wiring/pinout. All data jacks shall be white and all voice jacks shall be blue.

2.2 NETWORK COMMUNICATION RACKS

.1 The Owner shall supply required Data racks.

.2 All racks shall be bonded to ground by the Contractor with a minimum #6 AWG insulated ground wire connected to the building ground bus within the Data/comm room.

.3 Provide electrical circuits installed into each rack as follows:

.1 2 x 120V 20A

.4 Provide cable tray and “waterfall” kit above each equipment rack.

Part 3 Execution

3.1 LABELLING

.1 Cable labels shall be self laminating labels as manufactured by Burndy or Panduit.

.2 Cable labels shall be self laminating labels as manufactured by Burndy or Panduit.

.3 Labeling shall be neatly typewritten and be in accordance with TIA 660. Cabling shall be labeled with the drop ID number at both termination points. Cable labeling shall be a logical numbering system. Confirm if owner has special labeling system prior to installation. If owner has no set labeling system, confirm contractor suggested labeling with owner or consultant prior to any installation. The owner or consultant must sign off on labeling prior to installation; this sign-off shall be included in the maintenance manuals.

3.2 WARRANTY

.1 The contractor must make available to the Owner a local service department of a duly authorized distributor of the equipment manufacturer, which shall stock the manufacturer’s standard parts. The service department shall have at least one factory trained repair technician available to the Owner on 24 hours’ notice.

.2 Provide warranty of installation of equipment installed by this contractor to be free of defects for a period of (1) one year from date of Substantial Completion.

.3 Provide during the warranty period, all service, maintenance, parts, etc., required for normal operation of the systems, such that Owner needs not purchase additional maintenance agreement or contracts. Upon request, the manufacturer and his agent shall provide direct to the Owner the following proposals:

.1 Continuation, after the warranty period, of full maintenance, including all service, labour, parts, etc. required to maintain the systems in a fully operational condition.

.4 During the warranty period, provide three (3) separate site visits of four (4) hours each on site for owner revisions and additional training.

3.3 VERIFICATION

.1 Perform tests in accordance with:

.1 Section 26 05 01 - Common Works Results - Electrical

.2 The entire installation shall be performed under the supervision of the manufacturer. Upon

completion of the installation, the manufacturer shall check and test the entire system. Certification of all tests shall be submitted in writing to the Consultant and shall certify the following:

.1 That the system is complete in accordance with this specification

.2 That the system is installed in accordance with the manufacturer's best recommendations

.3 During the certification tests, the contractor shall provide one (1) electrician and (1) helper to assist the manufacturer's representative. The contractor shall also provide any required equipment such as ladders, scaffolding, etc.

3.4 TRAINING

.1 Perform training in accordance with:

.1 Section 26 05 01 - Common Works Results - Electrical

.2 Written documentation bearing name and signature of Owner's personnel who received the above instructions shall be included in the operating instructions and service manuals.

END OF SECTION

Part 1 General

1.1 GENERAL REQUIREMENTS

.1 The General Conditions of Contract, Division 01 General Requirements and all Addenda thereto form an integral part of and must be read in conjunction with the requirements of this Section.

.2 Cooperate and coordinate with the requirements of other units of work specified in other Sections.

1.2 RELATED SECTIONS

.1 Section 01 33 00 – Submittal Procedures

.2 Section 01 78 10 – Closeout Submittals

.3 Section 08 71 00 – Door Hardware

.4 Section 26 05 01 – Common Works Results – Electrical

.5 Section 28 31 01 – Fire Alarm Systems

1.3 REFERENCES

.1 2012 Canadian Electrical Code

.2 CAN/ULC-S301, Central and Monitoring Station Burglar Alarm Systems

.3 UL 294, Standard for Safety for Access Control System Units

.4 Reference Drawings: E8, E8.1, E8.2

.1 Detail Drawing - Access Control - Elevation of Single Door with Door Contact, Request to Exit Detector, Wall Mount Reader and Electric Strike

.2 Detail Drawing - Access Control - Elevation of Single Door with Door Contact, Request to Exit Detector, Wall Mount Reader and Electric Strike (With Panic Hardware)

.3 Detail Drawing - Protected Door - Elevation of Single Door with Door Contact

.4 Detail Drawing - Schematic - Cell Block Riot Alarm

.5 CCTV and Alarm Systems and Access Control Conduit Rough-In Plan

1.4 GENERAL

.1 Wherever practical and reasonable, all cabinets and electrical boxes shall be installed in the locations shown on the attached floor plans.

.2 Drawings show conduit connection requirements. Actual conduit runs shall run parallel to building lines.

.3 Unless specified otherwise, all conduits shall be sized according to the number of cables in

the run. Maximum conduit fill is 50%.

.4 Unless specified otherwise, all junction boxes (J1, J2, J3, etc.) shall be steel and sized according to the number of conduits they must accommodate.

.5 All conduits to the A4 or A5 backboards shall enter the room from the ceiling and connect to the appropriate splitter trough. Backboard space below the splitter trough(s) is reserved for PTSS equipment, see A4 or A5 backboard descriptions. Conduit from J6 junction boxes may enter from the floor below.

.6 Unless noted otherwise, all cables pulled to a splitter trough in Room 130 shall have no less than 6000mm of cable slack in the splitter trough.

.7 Unless noted otherwise, all cables pulled to a 'T' Type cabinet (T2, T3, T4, etc.) shall have no less than 1200mm of cable slack in the ‘T’ cabinet.

.8 Unless noted otherwise, all cables terminating in a device or outlet box shall have no less than 600mm of cable slack at the device/outlet box.

.9 All cables terminating in a cabinet, a splitter trough, a device box, a utility box or an outlet box shall be labelled.

The contractor shall test all cables installed as part of this contract for opens, grounds and shorts. The contractor shall replace any cables found to be defective by the owner.

1.5 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.

.2 Include schematic, wiring and interconnection diagrams, which shall include component identification on each circuit board.

.3 Each component shall be identified as to manufacturer, type, description, and catalogue number.

.4 Floor plans show all stations, control modules, cabling and field terminations.

.5 Submit a recently dated support letter from the manufacturer stating that the supplying contractor is an Authorized Distributor for the specified product being supplied.

.6 Include a statement of warranty hardware from the manufacturer.

1.6 CLOSEOUT SUBMITTALS

.1 Provide operation and maintenance data for the Access Control system for incorporation into manual specified in Section 01 78 00 - Closeout Submittals and 26 05 01 – Common Work Results, Electrical.

.2 Include

.1 Operation instructions

.2 Description of system operation

.3 Description of each sub-system operation

.4 List specifying each piece of equipment in the system or sub-system by its original manufacturer name and model number

.5 Part list specifying parts used in equipment by identification numbers that are standard to electronic industry

1.7 SYSTEM START-UP

.1 Manufacturer's factory service engineer to instruct:

.1 One training session totaling (2) hours to train maintenance personnel in the maintenance and operation of the system.

Part 2 Products

2.1 EQUIPMENT GENERAL

.1 Unless specified otherwise, all conduits shall be EMT.

.2 Unless specified otherwise, all outlet, device and pull boxes shall be steel.

.3 Sheet metal enclosure, welded corners and formed hinged cover suitable for locking in closed position.

.4 Ground Bar shall be a Hoffman ASG8

.5 All telephone type (Cat3) cables shall be NORDX D-INSIDE CABLE, 24 AWG, CMR, Category 3 solid copper with a grey jacket (or equivalent).

.6 All Category 5e (Cat5e) cables shall be Provo 24104L5E (or equivalent).

.7 All LVT cables shall be four (4) conductor #18 solid AWG Standard Control LVT cable.

.8 All coaxial cable shall be Provo 5911 (or equivalent).

.9 All single pair shielded cable shall be Provo 7722 cable (or equivalent).

.10 All 8 conductor overall shielded cable shall be Provo 6708 cable (or equivalent).

.11 All two pair shielded cable shall be Provo 5402 (or equivalent).

.12 Pull Cord/Tape shall be Polypropylene type, 200 lb tensile strength minimum.

2.2 EXTRA MATERIALS

.1 Include the following spare materials

.1 1 x Single Reader Interface Module

.2 1 x Dual Reader Interface Module

.3 4 x Input Control Modules

Part 3 Execution

3.1 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.

3.2 INSTALLATION SPECIFICS

.1 **A4 Backboard**

.1 Supply and install 19mm G1S plywood backboard to cover all of the appropriate wall in Room 130 floor to ceiling (as per floor plans).

.2 Plywood backboard to be primed and painted to match adjacent walls.

.3 Supply and install one Hoffman AST4223R 1219W X 210H X 114Dmm Splitter Trough centered 2300mm A.F.F.

.4 Supply and install a Hoffman ASG8 Ground Bar near, but not inside, the splitter trough. Bond to main building ground with a #6 AWG stranded, bare copper conductor.

.5 All conduits to the A4 backboard shall enter the room from the ceiling and shall connect to the splitter trough on the A4 backboard.

.6 The plywood backboard space, below the splitter trough, is reserved for PTSS equipment. Do not run surface conduit in this area.

.2 **A5 Backboard**

.1 Supply and install 19mm G1S plywood backboard to cover all of the appropriate wall in Room 130 floor to ceiling (as per floor plans).

.2 Plywood backboard to be primed and painted to match adjacent walls.

.3 Supply and install one Hoffman AST4223R 1219W X 210H X 114Dmm Splitter Trough centered 2300mm A.F.F.

.4 Supply and install a Hoffman ASG8 Ground Bar near, but not inside, the splitter trough. Connect this ground bar to the ground bar on the A4 backboard.

.5 All conduits to the A5 backboard shall enter the room from the ceiling and shall connect to the splitter trough on the A5 backboard. Conduit from the J6 Junction Box may enter from the floor below.

.6 The plywood backboard space, below the splitter trough, is reserved for PTSS equipment. Do not run surface conduit in this area.

.3 **F1 Fire Alarm Connection**

.1 Supply and install conduit from the main fire alarm control panel to a junction box in the area (as per floor plans).

.2 Supply, install and label one 4 pair telephone (Cat3) cable in the conduit from the main fire alarm control panel to the splitter trough on the A4 backboard. Leave 1200mm of cable slack inside the main fire alarm control panel.

.4 **GA Garage/Overhead Door Interface**

.1 Supply and install 13mm conduit from the overhead door operator to a T2 cabinet in the area (as per floor plans).

.2 Supply and install one four position barrier terminal strip (Curtis 2002) in the T2 cabinet.

.3 Supply one 4 conductor 18 AWG solid copper LVT cable in the conduit from the overhead door operator to the T2 cabinet and terminate on the barrier terminal strip in the T2 cabinet.

.4 Terminate two conductors in the overhead door operator in a manner that will cause the overhead door to open when the conductors are shorted. Label this pair of conductors.

.5 Terminate the other two conductors in the overhead door operator in a manner that will cause the overhead door to close when the conductors are shorted. Label this pair of conductors.

.5 **J1 Junction Box**

.1 Supply and install one junction box above the suspended ceiling. If the ceiling is finished, the junction box shall be recessed on a wall 100mm below finished ceiling but no higher than 2400mm A.F.F. Junction box shall be sized according to the number of conduits that must be accommodated.

.2 Supply and install conduit, sized to fit cables, from this junction box to another junction box in the area OR to the splitter trough on the A4 backboard (as per floor plans).

.6 **J3 Junction Box (200H X 200W X 100D)**

.1 Supply and install one 200H X 200W X 100Dmm junction box 150mm above the suspended ceiling. If the ceiling is finished, the junction box shall be recessed on a wall 100mm below finished ceiling but no higher than 2400mm A.F.F. Junction box shall be accessible and serviceable.

.2 Supply and install conduit, sized to fit cables, from this junction box to another junction box in the area OR to the splitter trough on the A4 backboard.

.7 **J4 Junction Box**

.1 Supply and install one junction box above the suspended ceiling. If the ceiling is finished, the junction box shall be recessed on a wall 100mm below finished ceiling but no higher than 2400mm A.F.F. Junction box shall be sized according to the number of conduits that must be accommodated.

.2 Supply and install conduit, sized to fit cables, from this junction box to the splitter trough on the A5 backboard (as per floor plans).

.8 **J5 Junction Box**

.1 Supply and install one junction box on the floor of the mechanical/service area above the cell block. Junction box shall be sized according to the number of conduits that must be accommodated.

.2 Supply and install conduit, sized to fit cables, from this junction box to the splitter trough on the A5 backboard (as per floor plan).

.9 **J6 Junction Box (450H X 450W X 150D)**

.1 Supply and install one 450H X 450W X 150Dmm junction box on the floor of the mechanical/service area above the monitoring console(s) in the Guardroom.

.2 Supply and install two 38mm conduits from this junction box to the splitter trough on the A5 backboard (as per floor plan).

.10 **J7 Junction Box**

.1 Supply and install one junction box above the suspended ceiling. If the ceiling is finished the junction box should be recessed on a wall 100mm below finished ceiling but no higher than 2400mm A.F.F.. Junction box shall be sized according to the number of conduits that must be accommodated.

.2 Supply and install conduit, sized to fit cables, from this junction box to the T3 cabinet in Room 130.

.11 **J8 Junction Box (300H X 300W X 100D)**

.1 Supply and install one recessed 300H X 300W X 100Dmm Type 1 Telephone cabinet (BEL Products TCFKO12124) mounted 150mm above the suspended ceiling. If the ceiling is finished, the cabinet should be recessed on the wall 100mm below finished ceiling but no higher than 2400mm A.F.F..

.2 Supply and install conduit, sized to fit cables, from this junction box to another junction box in the area OR to the A5 splitter trough (as per floor plans).

.12 **T2 "T" Cabinet (300H X 300W X 100D)**

.1 Supply and install one 300H X 300W X 100Dmm Type 1 Telephone cabinet with wood back (BEL Products TCFKO12124WB or equivalent) mounted 150mm above the suspended ceiling on the protected side of the wall. If the ceiling is finished, the cabinet should be recess mounted 225mm above the strike side of the frame on the protected side of the wall. See attached detail drawings for Access Controlled doors. Cabinet must be accessible and serviceable.

.2 Supply and install conduit, sized to fit cables, from this cabinet to another T2 in the area OR to a J2/J3 in the area OR to the splitter trough on the A4 backboard (as per floor plans).

.3 Supply, install and label one Provo 6708 cable (or equivalent) and one 4 conductor 18 AWG solid copper LVT cable in the conduit from the T2 cabinet to the splitter trough on the A4 backboard.

.4 Supply no less than 6000mm of cable slack at the A4 splitter trough.

.13 **T3** **"T" Cabinet (450H X 450W X 100D)**

.1 Supply and install one surface mounted 450H X 450W X 100Dmm Type "T" cabinet, complete with 3/4" wood back, centered 300mm A.F.F..

.14 **T4** **"T" Cabinet (300H X 300W X 100D)**

.1 Supply and install one recessed 450H X 450W X 100Dmm Type 1 Telephone cabinet mounted 150mm A.F.F.. Recess mount the cabinet so that it remains accessible yet concealed by the Guard / Matron's console.

.2 Supply and install a duplex 120VAC receptacle in the top left corner inside this cabinet (mount receptacle on the side of the cabinet not the back). This duplex receptacle shall be wired to a separate 120VAC circuit, on its own breaker, which is connected to emergency backup power (when available).

.3 Supply and install one 32mm conduit from this cabinet to the J6 junction box.

.4 Supply, install and label eight Provo 5911 co-ax video cables (or equivalent) in the conduit from this cabinet to the splitter trough on the A5 backboard.

.5 Supply, install and label two Category 5e (Cat5e) cables in the conduit from this cabinet to the A5 splitter trough.

.6 Supply no less than 6000mm of cable slack at the T4 cabinet.

.7 Supply no less than 4500mm of cable slack at the A5 splitter trough.

.15 **T7** **"T" Cabinet (450H X 300W X 100D)**

.1 Supply and install one recessed 450H X 300W X 100Dmm Type 1 Telephone cabinet, complete with 3/4" wood back (BEL Products TCFKO18124WB or equivalent) centered 2250mm A.F.F..

.2 Supply and install one duplex 120VAC receptacle in the top left corner inside this cabinet (mount receptacle on the side of the cabinet not the back). This duplex receptacle shall be wired to a separate 120VAC circuit, on its own breaker, which is connected to emergency backup power (when available).

.3 Supply, install and connect one 24VAC 75VA transformer and one RELECO C3-A30X/24VAC 3PDT relay (or equivalent) inside this cabinet.

.4 Connect Riot Alarm Panic pushbuttons (see device 53), Riot Alarm horns (see device 04) and the Riot Alarm RESET pushbutton (see device 73) to the 3PDT relay inside the T7 cabinet as per attached detail drawing "SCHEMATIC - CELL BLOCK RIOT ALARM" and as per floor plans.

.5 Supply and install one 19mm conduit from the T7 cabinet to the splitter trough on the A4 backboard (as per floor plans).

.6 Supply, install and label three 4 pair telephone (Cat3) cable(s) in the conduit from the T7 cabinet to the splitter trough on the A4 backboard.

.7 Test each Riot Alarm Panic pushbutton for proper operation. The panic pushbuttons latch the horn(s) and the Reset pushbutton silences the horn(s).

.16 **01** **Square Outlet Box**

.1 Supply and install one recessed 100 X 100 X 63mm double gang device box c/w

blank cover plate 150mm below finished ceiling but no higher than 2400mm A.F.F..

.2 Supply and install conduit from this device box to a junction box in the area OR to the splitter trough on the A4 backboard (as per floor plans).

.3 Supply, install and label two 4 pair telephone (Cat3) cables in the conduit from this outlet box to the splitter trough on the A4 backboard.

.17 **02** **Device Box**

.1 Supply and install one recessed 100 X 100 X 63mm double gang waterproof device box c/w blank cover plate. Mount device box 3000mm above ground level on the exterior side of the building.

.2 Supply and install conduit from this device box to a junction box in the (as per floor plans).

.3 Supply, install and label two 4 pair telephone (Cat3) cables in the conduit from this outlet box to the splitter trough on the A4 backboard.

.18 **04** **Riot Alarm Horn**

.1 Supply, install and connect one Edwards 874-G5 24VAC vibrating alarm horn (or equivalent) in a recessed 4" square outlet box mounted 100mm below finished ceiling but no higher than 2400mm A.F.F..

.2 Supply and install conduit from the outlet box to a Riot Alarm Reset Pushbutton outlet box in the area OR to the T7 cabinet (as per floor plan).

.3 Supply, install and label one 4 conductor 18 AWG solid copper LVT cable in the conduit from this outlet box to the T7 cabinet.

.4 Connect vibrating alarm horn to the 3PDT relay in the T7 cabinet as per attached detail drawing “SCHEMATIC - CELL BLOCK RIOT ALARM”.

.19 **11** **Square Outlet Box**

.1 Supply and have door-frame fabricator spot weld one 100 X 100 X 40mm outlet box on top of the frame as per attached detail drawing “PROTECTED DOOR - ELEVATION OF SINGLE DOOR WITH DOOR CONTACT”.

.2 Drill a 19mm hole 75mm (center point) from the edge of the door casing to allow for door switch installation and access to frame mounted outlet box.

.3 Supply and install conduit from the outlet box in the door frame to a 100 X 50 X 63mm pull box mounted above the door on the protected side of the wall. This pull box shall have a blank cover plate installed and shall be mounted above the suspended ceiling OR 100mm below the ceiling if the ceiling is finished.

.4 Supply and install conduit from the pull box to a junction/pull box in the area OR to the splitter trough on the A4 backboard (as per floor plans).

.5 Supply, install and label one 4 pair telephone (Cat3) cable in the conduit from the outlet box in the door frame to the splitter trough on the A4 backboard.

.6 The cable slack at the outlet box in the door frame shall be tucked into the outlet box to protect the cable from damage.

.20 **12** **Square Outlet Box**

.1 Supply and have door-frame fabricator spot weld one 100 X 100 X 40mm outlet box on top of the door frame as per attached detail drawing(s) for access controlled doors.

.2 Drill a 19mm hole 75mm (center point) from the edge of the door casing to allow for door switch installation and access to frame mounted outlet box.

.3 Supply and install conduit from the outlet box in the door frame to a T2 cabinet in the area (as per floor plan).

.4 Supply, install and label one 4 pair telephone (Cat3) cable in the conduit from the outlet box in the door frame to the T2 cabinet.

.5 The cable slack at the outlet box in the door frame shall be tucked into the outlet box to protect the cable from damage.

.21 **14** **Square Outlet Box**

.1 Supply and have door-frame fabricator spot weld one 100 X 100 X 40mm outlet box on top of the door frame as per attached detail drawing(s) for access controlled doors.

.2 Drill a 19mm hole 75mm (center point) from the edge of the door casing to allow for door switch installation and access to frame mounted outlet box.

.3 Supply and install conduit from the outlet box in the door frame to a T2 cabinet in the area (as per floor plan).

.4 Supply, install and label one 4 pair telephone (Cat3) cable in the conduit from the outlet box in the door frame to the splitter trough on the A4 backboard.

.5 Supply, install and label a second 4 pair telephone (Cat3) cable in the conduit from this outlet box in the door frame to the T2 cabinet.

.6 The cable slack at the outlet box in the door frame shall be tucked into the outlet box to protect the cable from damage.

.22 **21** **Device Box**

.1 Supply and install one recessed 100 X 150 X 63mm three gang device box c/w blank cover plate centered 1500mm A.F.F.

.2 Supply and install conduit from this device box to a junction box in the area OR to the splitter trough on the A4 backboard (as per floor plans).

.3 Supply, install and label one 4 pair telephone (Cat3) cable in the conduit from this device box to the splitter trough on the A4 backboard.

.23 **31** **Conduit to Electric Strike**

.1 Supply and install conduit from a point 25mm above the strike plate inside the door frame to a T2 cabinet in the area (as per floor plans).

.2 Supply, install and label one 4 pair telephone (Cat3) cable in the conduit from the door frame to the T2 cabinet. Leave 600mm of slack inside the door frame.

.3 For more information, see attached detail drawing(s) for access controlled doors.

.24 **41** **Octagon Outlet Box**

.1 Supply and install one 4" octagon outlet box located no more than 300mm above the suspended ceiling. If the ceiling is finished, the outlet box should be recess mounted and supplied with a cover plate.

.2 Supply and install conduit from this outlet box to an outlet/junction box in the area OR to the splitter trough on the A4 backboard (as per floor plans).

.3 Supply, install and label one 4 pair telephone (Cat3) cable in the conduit from this outlet box to the splitter trough on the A4 backboard.

.4 Supply no less than 3600mm of cable slack at the outlet box.

.25 **42** **Device Box**

.1 Supply and install one recessed 100 X 50 X 63mm single gang device box c/w blank cover plate. Mount device box 25mm from the corner of the room and 100mm below suspended/finished ceiling but no higher than 2400mm A.F.F.

.2 Supply and install conduit from the device box to a device/junction box in the area OR to the splitter trough on the A4 backboard (as per floor plans).

.3 Supply, install and label one 4 pair telephone (Cat3) cable in the conduit from this device box to the splitter trough on the A4 backboard.

.26 **43** **Device Box**

.1 Supply and install one recessed 100 X 50 X 63mm single gang device box c/w blank cover plate. Mount device box 100mm below suspended/finished ceiling but no higher than 2400mm A.F.F.

.2 Supply and install conduit from the device box to a device/junction box in the area OR to the splitter trough on the A4 backboard (as per floor plans).

.3 Supply, install and label one 4 pair telephone (Cat3) cable in the conduit from this device box to the splitter trough on the A4 backboard.

.27 **44** **Device Box**

.1 Supply and install one recessed 100 X 50 X 63mm single gang device box c/w blank cover plate centered 100mm above the top of the door frame on the protected side of the wall as per attached detail drawing(s) for access controlled doors.

.2 Supply and install conduit from the device box to a T2 cabinet in the area (as per floor plans).

.3 Supply, install and label one 4 pair telephone (Cat3) cable in the conduit from this device box to the T2 cabinet.

.4 For more information, see E8.1 and E8.2 detail drawing(s) for access controlled doors.

.28 **52** **Device Box**

.1 Supply and install one recessed 100 X 50 X 63mm single gang device box c/w blank cover plate. Mount device box below the finished counter top in a location which is

accessible. Installation on a wall behind a removable drawer is acceptable.

.2 Supply and install conduit from the device box to a junction box in the area OR to the splitter trough on the A4 backboard (as per floor plans).

.3 Supply, install and label one 4 pair telephone (Cat3) cable in the conduit from this device box to the splitter trough on the A4 backboard.

.4 Supply no less than 3600mm of cable slack at the device box.

.29 **53** **Riot Alarm Panic Pushbutton**

.1 Supply, install and connect one red 57mm mushroom head “Square D” 9001KR25R momentary pushbutton with two “Square D” 9001KA2 normally open contact blocks and one “Square D” 9001K25 Flush Plate in a recessed 100 X 50 X 63mm single gang device box centered 1350mm A.F.F..

.2 Supply and install conduit from the device box to another device box in the area OR to the T7 cabinet (as per floor plans).

.3 Supply, install and label one 4 conductor 18 AWG solid copper LVT cable in the conduit from this device box thru all junction/device boxes and terminate at the T7 cabinet.

.4 Connect the panic switch to the 3PDT relay in the T7 cabinet as per attached detail drawing “SCHEMATIC - CELL BLOCK RIOT ALARM”.

.30 **61** **Device Box**

.1 Supply and install one recessed 100 X 50 X 63mm single gang device box c/w blank cover plate centered 1300mm A.F.F..

.2 Supply and install conduit from the device box to a T2 cabinet in the area (as per floor plans).

.3 Supply, install and label one Provo 6708 cable (or equivalent) in the conduit from this device box to the T2 cabinet.

.4 For more information, see E8.1 and E8.2 detail drawing(s) for access control on doors with wall mounted readers.

.31 **73** **Riot Alarm Reset Pushbutton**

.1 Supply, install and connect one green 57mm mushroom head “Square D” 9001KR25G momentary pushbutton with one “Square D” 9001KA3 normally closed contact block and one “Square D” 9001K25 Flush Plate in a recessed 100 X 50 X 63mm single gang device box centered 1500mm A.F.F..

.2 Supply and install conduit from the device box to the T7 cabinet (as per floor plans).

.3 Supply, install and label one 4 conductor 18 AWG solid copper LVT cable in the conduit from this device box to the T7 cabinet.

.4 Connect the reset pushbutton to the 3PDT relay in the T7 cabinet as per attached detail drawing “SCHEMATIC - CELL BLOCK RIOT ALARM”.

.5 Label pushbutton:

RIOT ALARM

RESET

.32 **81** **Octagon Outlet Box**

.1 Supply and install one recessed 4" octagon outlet box c/w blank cover plate in the ceiling. If ceiling is suspended, the octagon outlet box shall be located 300mm above the suspended ceiling.

.2 Supply and install conduit from the outlet box to a junction box in the area OR to the A5 splitter trough (as per floor plans).

.3 Supply, install and label one Category 5e (Cat5e) cable in the conduit from this outlet box to the A5 splitter trough.

.4 Supply no less than 2400mm of cable slack at the outlet box.

.5 Supply no less than 4500mm of cable slack at the A5 splitter trough.

.33 **83** **Device Box**

.1 Supply and install one recessed 100 X 50 X 63mm single gang device box c/w blank cover plate. Wall mount device box 300mm below finished ceiling but no higher than 2400mm A.F.F.

.2 Supply and install conduit from this device box to a junction box in the area OR to the A5 splitter trough (as per floor plans).

.3 Supply, install and label one Category 5e (Cat5e) cable in the conduit from this outlet box to the A5 splitter trough.

.4 Supply no less than 1200mm of cable slack at the outlet box.

.5 Supply no less than 4500mm of cable slack at the A5 splitter trough.

.34 **84** **Octagon Outlet Box (2-1/8" Deep)**

.1 Supply and install one recessed 4" octagon outlet box, 2-1/8" deep, c/w blank cover plate in the ceiling. If ceiling is suspended, the octagon outlet box shall be located 300mm above the suspended ceiling.

.2 Supply and install conduit from this outlet box to a J7 junction box in the area (as per floor plan).

.3 Supply, install and label one Provo 5911 co-ax video cable (or equivalent) and one 4 conductor 18 AWG solid copper LVT cable in the conduit from this outlet box to the T3 cabinet in Room 130.

.4 Supply, install and label one Category 5e (Cat5e) cable in the conduit from this outlet box to the T3 cabinet in Room 130.

.5 Supply no less than 2400mm of cable slack at the outlet box.

.6 Supply no less than 6000mm of cable slack at the T3 Cabinet.

.35 **85** **Octagon Outlet Box (2-1/8" Deep)**

.1 Supply and install one recessed 4" octagon outlet box, 2-1/8" deep, c/w blank cover plate in the ceiling. If ceiling is suspended, the octagon outlet box shall be located 300mm above the suspended ceiling.

.2 Supply and install conduit from this outlet box to a J8 junction box in the area (as per floor plan).

.3 Supply, install and label one Category 5e (Cat5e) cable in the conduit from this outlet box thru all junction boxes to the A5 splitter trough.

.4 Supply no less than 2400mm of cable slack at the outlet box.

.5 Supply no less than 4500mm of cable slack at the A5 splitter trough.

.36 **86** **Device Box**

.1 Supply and install one recessed 100 X 50 X 63mm single gang weatherproof device box c/w blank weatherproof cover plate. Mount 2400mm above concrete sidewalk or above ground level on the exterior side of the building.

.2 Supply and install conduit from this device box to a junction box in the area OR to the A5 splitter trough (as per floor plans).

.3 Supply, install and label Category 5e (Cat5e) cable in the conduit from the device box to the A5 splitter trough.

.4 Supply no less than 1200mm of cable slack at the outlet box.

.5 Supply no less than 4500mm of cable slack at the A5 splitter trough.

.37 **91** **Device Box**

.1 Supply and install one recessed 100 X 50 X 63mm single gang device box c/w blank cover plate centered 1400mm A.F.F.

.2 Supply and install conduit from this device box to a J7 junction box in the area (as per floor plan).

.3 Supply, install and label one Provo 7722 cable (or equivalent) in the conduit from this device box to the T3 cabinet in Room 130.

.4 Supply, install and label one Category 5e (Cat5e) cable in the conduit from this outlet box to the T3 cabinet in Room 130.

.5 Supply no less than 6000mm of cable slack at the T3 cabinet.

.38 **92** **Device Box**

.1 Supply and install one recessed 100 X 50 X 63mm single gang device box c/w blank cover plate centered 1400mm A.F.F.

.2 Supply and install conduit from this device box to a J8 junction box in the area (as per floor plan).

.3 Supply, install and label one Provo 7722 cable (or equivalent) in the conduit from this device box to the J8 junction box.

.4 Supply no less than 4500mm of cable slack at the J8 junction box.

3.3 FIELD QUALITY CONTROL

.1 Perform tests in accordance with Section 26 05 01 - Common Work Results - Electrical.

.2 All EAC system shall be installed in full compliance with the manufacturer's recommendations and these specifications. On completion, a technical representative from the manufacturer shall fully check out and test the system, and make necessary adjustments to ensure perfect operation. The manufacturer and contractor shall provide all necessary personnel. The Owner may wish to observe the checkout, but will not provide assistance to either the manufacturer or the contractor.

.3 Manufacturer's Services:

.1 The manufacturer of the products supplied under this Section shall review Work involved in the handling, installation/application, protection and cleaning, of its products and submit written reports, in acceptable format, to verify compliance of Work with Contract.

.2 Manufacturer's Field Services: 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.

3.4 VERIFICATION

.1 Perform tests in accordance with Section 26 05 01 - Common Work 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.

END OF SECTION

□

Part 1 General

1.1 RELATED SECTIONS

.1 Section 26 05 01 – Common Work Results – Electrical

1.2 REFERENCES

.1 NBC-2010, National Building Code of Canada.

.2 All equipment shall be listed by Underwriters' Laboratory of Canada. The entire installation shall be in full compliance with the 2010 National Building Code, 2012 Canadian Electrical Code, National Standard of Canada/Underwriters' Laboratory of Canada Standards, and the Saskatchewan Human Rights Commission, Accessibility Standard.

.3 The system design, installation and verification, shall comply with the following National Standard of Canada/Underwriters' Laboratories of Canada Standards:

.1 CAN/ULC-S524-M06 "Standard for the Installation of Fire Alarm Systems".

.2 CAN/ULC-S536-M04 "Standard for the Inspection and Testing of Fire Alarm Systems".

.3 CAN/ULC-S537-M04 "Standard for the Verification of Fire Alarm System Installations".

1.3 DESCRIPTION OF SYSTEM

.1 Provide a complete micro processor based, supervised, non-coded, closed circuit, annunciated, single stage and addressable fire alarm system as shown on the drawings and as herein specified.

.2 The system design, installation and verification shall comply with the United States ADA Accessibility Guidelines.

.3 Addressable fire alarm system includes:

.1 Control panel programming revisions to carry out fire alarm and protection functions including receiving alarm signals, initiating alarm, supervising system continuously, and initiating trouble signals.

.2 Trouble signal indication.

.3 Manual alarm stations.

.4 Automatic alarm initiating devices.

.5 Audible signal devices.

.6 Visual alarm signal devices.

.7 End-of-line devices

.8 Ancillary devices.

1.4 SYSTEM OPERATION

.1 Single stage addressable operation

.2 If an alarm is caused by activation of any of the following devices:

.1 Pulling a manual station;

.2 Operation of an automatic fire alarm thermal detector;

.3 Operation of a smoke detector (ceiling or duct mounted); or

.4 Operation of a sprinkler flow valve

The following shall occur:

.1 The evacuation alarm shall sound on all audible signal appliances throughout the building. All strobe lights installed as visual alarms shall flash.

.2 The main control panel shall record the alarm location and address alarm type (pull station, smoke detector, thermal detector, etc.), location description along with time. The control panel and remote annunciator panel LCD shall indicate a priority alarm and will also advise of location, type and time.

.3 The evacuation alarm shall continue until the alarm is acknowledged and the system is silenced. The device causing the alarm shall cause the system to remain in alarm until the device is cleared or reset, and the system alarm is acknowledged.

.4 The system shall automatically send a signal to the fire department. The fire alarm system shall be interconnected to the new building security alarm panel, which provides a signal to the Owner's off-site central monitoring agency. The fire department connection to the security alarm panel shall be the responsibility of the Owner to maintain.

.5 Signals shall be sent to the building management system for the shut down of all ventilation systems in the correct sequence for shut-down. Control relay modules shall be provided for each mechanical ventilation unit to shut-down to be located at the MCC. Shut-downs shall be direct to each unit and not through any building management system.

.6 The fire alarm system shall release all electromagnetic locks at egress doors by providing a fire alarm module to open the magnetic lock power circuit at the door location.

.7 A subsequent alarm from any receiving circuit (device) shall cause the audible signals to sound again. Subsequent alarms shall be recorded by the system in order of priority and then in the order in which they occur. Subsequent alarms may occur prior to acknowledgement of the initial alarm.

.8 All alarms shall be recorded by the main fire alarm panel.

.3 The entire system shall be electrically supervised against opens, shorts and grounds on any wire on the alarm initiating circuits or any wire on the signal circuits. Trouble conditions shall display as a lower priority than an alarm. Fault isolators shall be provided for all initiating circuits which pass through each floor and each fire barrier and shall be provided every twenty five (25) devices minimum.

.4 Coordinate with the Mechanical Contractor to ensure that all necessary wiring and controls have been provided to accommodate fire alarm interconnections with the sprinkler and mechanical control systems.

.5 Ensure that all necessary wiring and controls have been provided to accommodate fire alarm interconnections to shut down the make-up air, exhaust fans, central air conditioning units, and release of all door hold open devices. Provide separate fire alarm control modules for all mechanical shut down points and/or starters.

.6 There shall be a capability provided in the fire alarm control panel and remote annunciator panel that permits the operator to bypass or disable the shutdown of the mechanical ventilation system during testing of the fire alarm systems; for testing purposes only. The Electrical Contractor with the Mechanical Contractor shall confirm the ventilation units to be controlled on site the ventilation units to be bypassed during the testing. Activation of this bypass shall initiate a trouble condition on the fire alarm system.

.7 Sprinkler and fire hose cabinet shut-off valves equipped with tamper switches shall be connected to the fire alarm system and each assigned a separate address point. Tamper switches shall cause a trouble indication when the shut-off valve is closed or partially closed. Coordinate final location and quantity with the Sprinkler Contractor and Mechanical Contractor.

.8 Provide a control relay module at the door access control panel to release and reset all electric locks simultaneously.

.9 All new points shall be included into the computer software program, and the software program shall be regenerated twice. The first regeneration shall be provided during the completion of the fire alarm system. The second regeneration shall be provided approximately three months after the first regeneration and shall reflect any contract changes and any owner initiated changes.

.10 All new fire alarm equipment shall be powered from a single source as shown on the drawings.

1.5 SHOP DRAWINGS

.1 Submit shop drawings in accordance with Section 26 05 01 – Common Work Results – Electrical.

.2 Shop drawings shall include but not be limited to complete floor plans, riser, equipment, control schematics and wiring diagrams. Each component shall be identified as to manufacture, type, description and catalogue number.

1.6 CLOSEOUT SUBMITTALS

.1 Provide operation and maintenance data for Fire Alarm System for incorporation into electrical maintenance and operating manual specified in Section 16050 – Basic Electrical Materials and Methods.

.2 Include:

.1 Overall system riser wiring diagram identifying control equipment, initiating addresses, signalling circuit; identifying terminations, terminal numbers, conductors and raceways.

.2 Details and performance specification of devices added for control, annunciation and peripherals with item by item cross reference to specification for compliance.

.3 Operation and maintenance instructions for complete fire alarm system to permit effective operation and maintenance.

.4 Technical data - illustrated parts lists with parts catalogue numbers.

.5 Copy of approved shop drawings.

.6 List of recommended spare parts for system.

.7 Certification of tests, upon completion, shall be issued in writing to the Consultant by the manufacturer's representative.

.8 Certification shall include audibility test results of the fire alarm system measured within each room affected by the project as required by the National Building Code.

1.7 MAINTENANCE

.1 Provide one year's free maintenance with three (3) free inspections by manufacturer during warranty period. Inspection tests to conform to CAN/ULC-S536. Submit inspection report to Engineer.

Part 2 Products

2.1 MATERIALS

.1 Equipment and devices: ULC listed and labelled and supplied by single manufacturer.

.1 Control Panel

.2 Remote Annunciator Panel

.3 Remote Booster Power Supply Panels

.4 Manual Pull Stations

.5 Detectors

.6 Duct Detectors

.7 Remote Keyed Test Stations for Duct Detectors

.8 Monitor Modules

.9 Control Modules

.10 Fault Isolator Modules

.11 Audible/Visual Fire Alarm Signal Devices

.2 All products shall have been manufactured within at least one year prior to their installation. Products older than this criterion will be rejected. Provide supporting documents within the shop drawing submission.

.3 All devices shall be installed in outlets boxes.

.4 All wiring shall be run in conduit raceway.

.5 All equipment and devices shall be manufactured by **GE Troy Life Safety (Edwards) or Notifier.**

.6 The new materials are as specified herein:

2.2 FIRE ALARM CONTROL PANELS

.1 Fire Alarm Control Panels shall be modular and solid state design for ease of expansion and servicing. The control panels shall continuously supervise all field wiring and control panel modules connected to alarm initiating devices, alarm signalling devices, annunciator indications and battery connections for open-circuits, shorts, grounds and placement.

.2 The control panels shall be as located on the floor plans. The panel covers shall be hinged, and shall have clear windows and locking mechanism to prevent tampering. Panel cabinets/back-boxes and chassis shall be provided for surface and flush mounted applications. In finished areas, the panels shall be flush mounted in existing or new partitions. Surface boxes shall be provided for panels located in utility rooms such as electrical rooms, telephone rooms and fan rooms.

.3 All controls shall be labelled, all addresses shall be identified, and the control panels shall be provided with permanently mounted operating instructions.

.4 The control panel shall maintain the following features:

.1 All required hardware and software to allow the panel configuration and operation to be changed. Field programmable at the panel. Systems that require off-site programming will not be accepted.

.2 The memory data for panel configuration and operation shall reside in non-volatile memory or battery-backed RAM.

.3 Multi-port motherboard to facilitate plug-in modules.

.4 All plug-in modules shall be supervised against removal, improper module position and incorrect module type.

.5 Absolute electronic protection of all circuitry such that any module may be inserted or removed, while the control panel is fully powered without causing an alarm condition, or any damage to the equipment.

.6 Backlit LCD display indicating device location, address designation, and time of event.

.7 Keypad for panel and system programming.

.8 Built-in alarms, trouble, security and supervisory relays.

.9 Provide switches for Panel Setup, Disable/Test, Reset, Drill (via monitor modules), Manual Evacuation Alarm, Acknowledgement/Panel Silence, Alarm Silence, and Status.

.10 Provide individual supervisory LED’s for Power, Fire Alarm, Pre-Alarm, Security, Supervisory, Disable/Test, System Trouble, CPU Failure, Low Battery, Ground Fault, Signals Silenced, Drill. Remote Silence and Remote Reset inputs shall also be provided.

.11 Built-in Degraded Mode operation. In the event of a CPU failure, the system is capable of providing an alarm in the event of a fire condition.

.12 Provide a day/night mode to enable a higher level of detector sensitivity (for example) during a buildings non-occupied time and a lower sensitivity during heavily occupied hours. Multiple sensitivity levels shall be available for pre-signal alarm based on pre-determined levels of alarm. These levels may be set manually, or can change automatically between day and night.

.13 Alarm verification section per point with tally. Interrogate each device, and interpret the response from each device, analyzing the response from each device according to specific address, type of device and its present status.

.14 All signal circuits shall be installed as per the signal circuit notations as shown on the drawings and herein specified. All signal circuits shall be Class 'B' type. Class 'B' loops shall run on separate sides of the corridors and shall not be run together. Refer to drawings for the number of signal circuits required.

.15 Provide appropriate number of circuits to power all strobe lights. Strobes shall be connected to the same panel as the surrounding initiating devices. All strobe circuits shall be fully synchronized.

.5 For control of addressable devices, the fire alarm control panels shall have the following features:

.1 Provide plug-in modules to monitor a minimum of (2) one intelligent Signalling Line Circuits (addressable Fault-Tolerant Class 'B' loops). All initiating circuits shall be Class 'B' type.

.2 Have the minimum capacity to communicate with up to 125 detectors and 125 modules (N.O. manual stations, two-wire smoke, notification, or relay) per Signalling Line Circuit (addressable loop); to a maximum of 250 devices per loop/2500 per fire alarm control panel.

.3 Provide a numeric display which shall uniquely show the device type, its specific address and device location.

.4 Provide alarm confirmation by device. To avoid spurious nuisance alarms, the control panel will identify the device and locations as well as noting its continuing alarm status thereby case the control panel to initiate the required sequence.

.5 Detect and identify a loop short circuit, ground or open circuit.

.6 Through the use of fault isolator modules, immediately isolate the wiring fault so that as possible field devices are made inoperative with all other devices remaining fully operational. As a minimum, fault isolators shall be provided at every fire separation and barrier and every twenty five (25) devices.

.7 Provide a minimum 30% spare capacity on each loop for future expansion.

.6 Provide compatible contact for connection to telephone system to close at the initiation of any signal device.

.7 Provide a software programming scheme in the main control panel to bypass the shutdown of ventilation equipment feature during fire alarm testing purposes only. Activation of this scheme shall initiate a trouble condition on the fire alarm system.

.8 Provide a manually operated switch in the control panel that will permit the resetting of the electromagnetic locks in the facility following the disabling of the locks upon activation of fire alarm system.

.9 The fire alarm control panel shall have the capacity to operate a minimum of two (2) visual alarm circuits for the facility.

2.3 REMOTE ANNUNCIATOR PANEL

.1 Remote Annunciator Panels: Intelligent annunciator panels shall be as located on the floor plans. The annunciator panels shall include the following features:

.1 80-character backlit LCD fire annunciator panel, compact design, semi-flush cabinet for mounting in new and existing partitions. Cabinet shall include hinged door with key lock.

.2 Power from the host control panel.

.3 Non-volatile memory.

.4 Mimic all display information on the host control panel.

.5 Keypad with audible feedback.

.6 LED indication for Power, Fire, Security Alarm, Supervisory, Trouble, Signals Silence, CPU Failure.

.7 Switches for Acknowledge, Signal Silence, System Reset, and Lamp Test.

.2 Provide a manually operated switch in the annunciator panel to bypass the shutdown of ventilation equipment during fire alarm testing purposes only. Activation of the bypass switch shall initiate a trouble condition on the fire alarm system.

.3 Provide a manually operated switch in the annunciator panel that will permit the resetting of the electromagnetic locks in the facility following the disabling of the locks upon activation of the fire alarm system.

2.4 DEVICES

.1 **Manual Pull Stations:** Manual fire alarm pull stations shall be addressable single-stage, pull lever type, finished in red metal semi-flush mounting. Manual pull stations shall be mounted up 1350mm.

.2 **Detectors:** Provide multi-sensor low-profile intelligent analog detectors designed to increase immunity to false alarms. The detectors shall be microprocessor-based, combination photoelectric and thermal technology. The detector shall adjust its sensitivity automatically without needing operator intervention or control panel programming. The thermal sensing rating shall be fixed-temperature set point 135°F (57°C). Includes LED red indicator when in alarm; flashes green in standby for normal conditions. The device shall include LED red indicator flashes when in alarm, flashes green when polled in normal conditions.

.3 **Smoke Detector Protective Cages:** Detectors mounted in Rooms 143, 144, 146 and 147 shall have protective cages installed as indicated on the drawings and details. Cages shall be one of the following models: Simplex model 2098-9829C, GE security model 6255-004 or Notifier G1A-2.

.4 **Thermal Detectors:** Provide low-profile intelligent thermal detectors using thermistor sensing circuit to produce 135°F (57°C) fixed temperature. Includes LED red indicator when in alarm; flashes green in standby for normal conditions.

.5 Thermal detectors located in high ambient rooms such as Boiler Rooms, Generator Rooms, attic spaces, shall be fixed temperature, 200°F (93°C).

.6 **Duct Detectors:** Photoelectric type smoke detectors shall operate on the light scattering principle and be activated by smoke particles. Smoke duct detectors shall be plug-in base type equipped with sampling tubes and framework to support the sampling tubes. LED's shall be provided on the detector to indicate an alarm condition. Duct detectors shall be of the same manufacturer as the fire alarm system from which the device is connected.

.7 **Monitor and Control Relay Modules:** Provide addressable monitor and control relay modules to interface to conventional non-addressable devices. All modules shall be of the same manufacturer as the fire alarm system from which the devices are connected.

.1 Monitor modules shall be installed to supervise a circuit of dry-contact input devices, such as conventional thermal detectors and pull stations, or monitor and power a circuit of two-wire smoke detectors. Powered directly by the SLC loop, high-noise (EMF/RFI) immunity, LED flashes green for normal operation and latches on steady red to indicate alarm.

.2 Control modules provide the control panels a circuits for operating horns, strobes, speakers, etc., or to monitor a telephone circuit. Addressability allows the control module to be activated, either manually or through panel programming on a select zone or area of coverage. LED blinks green each time a communication is received from the control panel and turns on in steady red when activated.

.3 Relay modules provide the system with a dry-contact output for activating a variety of auxiliary devices, such as fans, dampers, control equipment, etc. Addressability allows the dry contact to be activated, either manually or through panel programming. LED blinks green each time a communication is received from the control panel and turns on in steady red when activated.

.4 In locations where there are a multiple of devices required to be monitored, 10-input monitor modules may be supplied and installed. Such locations best suited for this requirement are at the main sprinkler assembly where multiple points are required to be monitored by the fire alarm system. The 10-input monitor module shall be mounted in a surface mounted lockable cabinet.

.8 **Fault Isolators:** Provide fault isolator modules to detect and isolate short-circuited segments of the Class 'A' fault tolerant loops. The module shall automatically determine return-to-normal condition of the loop and restore the isolated segment.

.9 **End-of-Lines:** End-of-line devices for signalling zones and sprinkler flows and tampers shall be mounted in separate single gang box with red cover plate. Mount end of line in wall above device but not above 1800 mm above finished floor.

.10 **Audible/Visual Fire Alarm Signalling Devices:** Audible and visual signal devices shall be combined horn/strobe type, surface wall mounted unless otherwise noted. The horns shall produce a code-3 temporal pattern. The horn shall have a minimum dBA output of approximately 92 dBA. The horns shall be provided with adjustable audible output with High setting for 98 dBA output or Low setting for 94 dBA sound output. The synchronizing strobe shall produce white light with a minimum of 75 candela across all viewing angles in common areas. Signal devices shall be surface wall mounted on flush outlet boxes.

.11 Ceiling mounted audible/visual signal devices shall be low-profile, combination horn/strobe type, surface mount application, white textured housing and clear polycarbonate lens. The horns shall produce a code-3 temporal pattern and shall have a minimum dBA output of 92 dBA. The synchronizing strobe shall produce white light with a minimum 75 candela across all viewing angles common areas.

.12 Audible/visual signalling devices shall be WHITE and shall be labelled with 'FIRE markings in RED.

.13 All signal circuits shall be supervised. All signal devices shall be synchronized.

2.5 SPARE DEVICES

.1 Provide the following spare devices with material, labour, and verification to install the devices along with 10m of conduit and wire to each device:

.1 Two (2) pull stations

.2 Four (4) multi-sensor detectors

.3 Six (6) monitor modules

.4 Six (6) control relay modules

.5 Four (4) horn/strobes, surface ceiling mounted

.6 Four (4) horn/strobe, surface wall mounted

Part 3 Execution

3.1 INSTALLATION

.1 The contractor must make available to the Owners a local service department of the equipment manufacturer, which shall stock the manufacturer's standard parts. The service department shall have at least one factory trained repairman available to the Owner on a 24 hours' notice. The systems shall be guaranteed for a period of one year. Refer to section 260501 – Common Works Results. Provide, during the guarantee period, all service, maintenance, parts, etc., required for the normal operation of the systems, such that the Owner need not purchase additional maintenance agreement or contracts. The manufacturer shall visit the jobsite a minimum of once every four (4) months during the guarantee period to perform above noted maintenance at no cost to the owner.

.2 The overall system co-ordination shall be the responsibility of the contractor, and he shall ensure that all of the necessary system components are installed to result in a complete, workable system.

.3 All field devices including manual pull stations, detectors, monitor, control and relay modules shall be externally labelled showing the address and device controlled and monitored. A self-adhesive identification label shall be applied to the device, and shall be 12mm WHITE laminated marker tape with black typed lettering. Identification shall be placed on the inside of doors where doors are either controlled by magnetic door holders, electric locks, or magnetic locks.

.4 Detectors shall be mounted in suitable mounting plates with finish ring. Where shown in proximity to unit heaters, detectors shall be located at least 3000mm from such unit heaters, and

out of line of direct heat. Detectors shall be located 1500mm from any air handling diffusers or grilles.

.5 All ceiling mounted fire detection devices shall be installed as close as possible to the centre of ceilings in rooms, shafts and portions of corridors or as noted on drawings. Detectors in stair shafts shall be safely reachable by ladder. Detectors shall be mounted at highest point of area to be protected. Ensure that these detectors are sufficiently spaced from supply air diffusers, light fixtures and other ceiling mounted items that might block the movement of heat or smoke to the detectors. Smoke detectors shall not be located within 900mm of the peak of a vaulted ceiling.

.6 Duct detectors shall be provided with new sampling tubes and framework to support the sampling tubes. Detector assembly shall be security mounted on the outside of the duct in a location easily accessible for servicing. Detectors shall be located along a straight section of the duct away from bends, silencers, coils and vanes. An air-flow meter shall be used to ensure that the air sample through the detectors is acceptable for the manufacturer's listing requirements.

.7 Where duct detectors are located in areas where it is difficult to reach or access by ladder for verification purposes, remote keyed test stations shall be installed.

.8 Where fire alarm devices are installed within unheated spaces or spaces where temperatures may drop below 0°C, appropriate fire alarm devices intended for those conditions shall be provided.

3.2 WIRING

.1 Perform tests in accordance with Section 260501 – Common Works Results, and CAN/ULC-S537.

.2 All wiring shall be color coded. Wire and conduit necessary to make the system operable shall be provided and installed as instructed by the manufacturer of the fire alarm system. All wiring shall be installed in conduit with a maximum conduit fill of 40%.

.3 Wiring shall be as follows:

.1 Wiring for signal device circuits shall be a minimum #14 gauge RW90, 300 volt, solid copper. Wiring may be run in same conduit system as the initiating circuits.

.2 Addressable devices shall be #18 gauge, twisted shielded jacketed pair. Shielding must be continuous throughout and isolated from ground except at the control panel. All existing shielded wiring being reused for the addressable loops shall be taped at every termination point.

.3 Ancillary circuits shall be #14 gauge RW90, 300 volt, solid copper. Run in separate conduit.

.4 Annunciator wiring shall be as per manufacturer's recommendations.

.5 Interconnection to the Building Security Alarm Panel shall be 2 x Z-wire, 4 conductor #22 AWG solid copper.

.4 All wiring and its installation must comply with all appropriate codes including CAN/ULC-S524-M06. Refer to Appendix 'A' of CAN/ULC-S524-M06 for further requirements.

3.3 FIELD QUALITY CONTROL

.1 Perform tests in accordance with Section 26 05 01 – Common Work Results - Electrical, and CAN/ULC-S537.

.2 Manufacturer shall allow for a required amount of on-the-job site assistance for the contractor during the construction period.

.3 The entire installation shall be performed under the supervision of the manufacturer. Upon completion of the installation, the manufacturer shall check the entire system to the approval of the Consultant. The manufacturer shall verify the entire system and demonstrate its complete operation to those having jurisdiction.

.4 The manufacturer shall perform a complete verification and inspection of all installed equipment, including each and every component, such as manual stations, automatic detectors, sprinkler switches, audible signalling appliances, station indicating lamps, control equipment, remote peripherals, etc., to ensure the following:

.1 That the type of equipment installed is that designated by the Consultant's specifications and plans;

.2 That the wiring connections to all equipment are correct and in accordance with CSA and ULC requirements;

.3 That the equipment is installed in accordance with the manufacturer's recommendations;

.4 That the regulations concerning the supervision of components have been adhered to (e.g. stations, detectors, signal devices, etc.), and are properly wired and supervised;

.5 That any subsequent changes necessary to conform to the above will be done by the contractor, with technical advice supplied by the manufacturer.

.5 During the period of inspection, the Contractor shall supply to the manufacturer, one (1) electrician and one (1) helper.

.6 The contractor shall also supply any required equipment such as ladders, scaffolding, etc.

.7 To assist the installer in preparing his bid, the manufacturer shall indicate the number of hours necessary to complete this inspection.

.8 Upon completion of the inspection, and when all of the above conditions have been compiled with, the manufacturer shall issue to the Consultant the following:

.1 A copy of the inspecting technician's report, showing the location of each device, and certifying the test results of each device.

.2 A certificate of verification confirming that the inspection has been completed, and showing the condition upon which such inspection and certification have been rendered.

.3 Proof of liability insurance for the inspection.

.9 All verification certificates shall include the testing of the audibility of the signal devices to confirm compliance with the 2010 National Building Code.

3.4 TRAINING

.1 Arrange and pay for on-site lectures and demonstrations by fire alarm equipment manufacturer to train operational personnel in use and maintenance of fire alarm system.

.2 The Owner's operating and maintenance personnel shall be instructed in the operation and maintenance of the system for a minimum of two separate 2-hour training sessions totally four (4) hours. 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

Approved: 2006-06-30

Part 1 General

1.1 RELATED REQUIREMENTS

.1 Section 31 14 13 Soil Stripping and Stockpiling.

.2 Section 31 22 13 Rough Grading.

1.2 DEFINITIONS

.1 Clearing consists of cutting off trees and brush vegetative growth to not more than specified height above ground and disposing of felled trees, previously uprooted trees and stumps, and surface debris.

.2 Close-cut clearing consists of cutting off standing trees, brush, scrub, roots, stumps and embedded logs, removing at, or close to, existing grade and disposing of fallen timber and surface debris.

.3 Clearing isolated trees consists of cutting off to not more than specified height above ground of designated trees, and disposing of felled trees and debris.

.4 Underbrush clearing consists of removal from treed areas of undergrowth, deadwood, and trees smaller than 50 mm trunk diameter and disposing of fallen timber and surface debris.

.5 Grubbing consists of excavation and disposal of stumps and roots, boulders and rock fragments of specified size to not less than specified depth below existing ground surface.

1.3 ACTION AND INFORMATIONAL SUBMITTALS

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

1.4 QUALITY ASSURANCE

.1 Do construction occupational health and safety in accordance with Section 01 35 29.06 - Health and Safety Requirements.

1.5 STORAGE AND PROTECTION

.1 Prevent damage to fencing, trees, landscaping, natural features, bench marks, existing buildings, existing pavement, utility lines, site appurtenances, water courses, root systems of trees which are to remain.

.1 Repair damaged items to approval of Consultant.

.2 Replace trees designated to remain, if damaged, as directed by Consultant.

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.

Part 2 Products

2.1 MATERIALS

.1 Soil Material for Fill:

.1 Excavated soil material: free of debris, roots, wood, scrap material, vegetable matter, refuse, soft unsound particles, deleterious, or objectionable materials.

.2 Remove and store soil material for reused.

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, according to requirements of authorities having jurisdiction .

.2 Inspect, repair, and maintain erosion and sedimentation control measures during construction until permanent vegetation has been established.

.3 Remove erosion and sedimentation controls and restore and stabilize areas disturbed during removal.

3.2 PREPARATION

.1 Inspect site and verify with Consultant, items designated to remain.

.2 Locate and protect utility lines: preserve in operating condition active utilities traversing site.

.1 Notify Consultant immediately of damage to or when unknown existing utility line[s] are encountered.

.2 When utility lines which are to be removed are encountered within area of operations, notify Consultant in ample time to minimize interruption of service.

.3 Notify utility authorities before starting clearing and grubbing.

.4 Keep roads and walks free of dirt and debris.

3.3 APPLICATION

.1 Manufacturer's instructions: comply with manufacturer's written recommendations or specifications, including product technical bulletins, handling, storage and installation instructions, and datasheet.

3.4 CLEARING

.1 Clearing includes felling, trimming, cutting of trees into sections and satisfactory disposal of trees and other vegetation designated for removal, including downed timber, snags, brush, and rubbish occurring within cleared areas.

.2 Clear as indicated by Consultant, by cutting at height of not more than 300 mm above ground. In areas to be subsequently grubbed, height of stumps left from clearing operations to be not more than 300 mm above ground surface.

.3 Cut off branches overhanging area cleared as directed by Consultant.

.4 Cut off unsound branches on trees designated to remain as directed by Consultant.

3.5 ISOLATED TREES

.1 Cut off isolated trees as directed by Consultant at height of not more than 300 mm above ground surface.

.2 Grub out isolated tree stumps.

.3 Prune individual trees as indicated.

.4 Trim trees designated to be left standing within cleared areas of dead branches 4 cm or more in diameter; and trim branches to heights as indicated.

.5 Cut limbs and branches to be trimmed close to bole of tree or main branches.

.6 Paint cuts more than 3 cm in diameter with approved tree wound paint.

3.6 UNDERBRUSH CLEARING

.1 Clear underbrush from areas as indicated at ground level.

3.7 GRUBBING

.1 Remove and dispose of roots larger than 7.5 cm in diameter, matted roots, and designated stumps from indicated grubbing areas.

.2 Grub out stumps and roots to not less than 200 mm below ground surface.

.3 Grub out visible rock fragments and boulders, greater than 300 mm in greatest dimension, but less than 0.25 m^3.

.4 Fill depressions made by grubbing with suitable material and to make new surface conform with existing adjacent surface of ground.

3.8 REMOVAL AND DISPOSAL

.1 Remove cleared and grubbed materials off site.

3.9 FINISHED SURFACE

.1 Leave ground surface in condition suitable for stripping of topsoil to approval of Consultant.

END OF SECTION

Approved: 2006-06-30

Part 1 General

1.1 RELATED REQUIREMENTS

.1 Section 31 11 00 Clearing and Grubbing.

.2 Section 31 22 13 Rough Grading

1.2 REFERENCES

.1 U.S. Environmental Protection Agency (EPA)/Office of Water

.1 EPA 832R92005, Storm Water Management for Construction Activities: Developing Pollution Prevention Plans and Best Management Practices.

Part 2 Products

2.1 NOT USED

.1 Not Used.

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, according to requirements of authorities having jurisdiction.

.2 Inspect, repair, and maintain erosion and sedimentation control measures during construction until permanent vegetation has been established.

.3 Remove erosion and sedimentation controls and restore and stabilize areas disturbed during removal.

3.2 STRIPPING OF TOPSOIL

.1 Ensure that procedures are conducted in accordance with applicable Municipal requirements.

.2 Remove topsoil before construction procedures commence to avoid compaction of topsoil.

.3 Handle topsoil only when it is dry and warm.

.4 Remove vegetation from targeted areas by non-chemical means and dispose of stripped vegetation by alternative disposal.

.5 Remove brush from targeted area by non-chemical means and dispose of through alternative disposal.

.6 Strip topsoil to depths as directed by Consultant.

.1 Avoid mixing topsoil with subsoil.

.7 Pile topsoil in berms in locations as directed by Consultant.

.1 Stockpile height not to exceed 3 m.

.8 Dispose of unused topsoil off-site in location as indicated by Consultant.

.9 Protect stockpiles from contamination and compaction.

.10 Cover topsoil that has been piled for long term storage, with trefoil or grass to maintain agricultural potential of soil.

3.3 PREPARATION OF GRADE

.1 Verify that grades are correct and notify Consultant if discrepancies occur. Do not begin work until instructed by Consultant.

.1 Grade area only when soil is dry to lessen soil compaction.

3.4 PLACING OF TOPSOIL

.1 Place topsoil only after Consultant has accepted subgrade.

.2 Spread topsoil during dry conditions in uniform layers not exceeding 200 mm, over unfrozen subgrade free of standing water.

.3 Establish traffic patterns for equipment to prevent driving on topsoil after it has been spread to avoid compaction.

.4 Cultivate soil following spreading procedures.

3.5 CLEANING

.1 On completion and verification of performance of installation, remove surplus materials, excess materials, rubbish, tools and equipment.

END OF SECTION

Approved: 2012-06-30

Part 1 General

1.1 RELATED REQUIREMENTS

.1 Section 31 14 13 Soil Stripping and Stockpiling..

1.2 REFERENCES

.1 ASTM International

.1 ASTM D698-, Test Method for Laboratory Compaction Characteristics of Soil Using Standard Effort m^3.

.2 Underwriters' Laboratories of Canada (ULC)

1.3 ACTION AND INFORMATIONAL SUBMITTALS

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

1.4 EXISTING CONDITIONS

.1 Examine subsurface investigation report which is available for inspection from Consultant.

Part 2 Products

2.1 MATERIALS

.1 Excavated or graded material existing on site suitable to use as fill for grading work if approved by Consultant.

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 rough grading installation in accordance with manufacturer's written instructions.

.1 Inform Consultant of unacceptable conditions immediately upon discovery.

.2 Proceed with installation only after unacceptable conditions have been remedied.

3.2 GRADING

.1 Rough grade to levels, profiles, and contours allowing for surface treatment as indicated.

.2 Rough grade to following depths below finish grades:

.1 150 mm for grassed areas.

.2 300 mm for asphalt or gravel paving.

.3 Slope rough grade away from building 1:50 minimum.

.4 Grade ditches to depth as indicated.

.5 Prior to placing fill over existing ground, scarify surface to depth of 150 mm minimum before placing fill over existing ground. Maintain fill and existing surface at approximately same moisture content to facilitate bonding.

.6 Compact filled and disturbed areas to maximum dry density to ASTM D698, as follows:

.1 85% under landscaped areas.

.2 95% under paved and walk areas.

.7 Do not disturb soil within branch spread of trees or shrubs to remain.

3.3 TESTING

.1 Inspection and testing of soil compaction will be carried out by testing laboratory designated by ULC. Costs of tests will be paid for by Contractor.

.2 Density testing of fill: one test for each 500 square metres for each 150mm compacted lift.

3.4 CLEANING

.1 Progress Cleaning:

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

.2 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment.

.3 Waste Management: separate waste materials for reuse or recycling.

.1 Remove recycling containers and bins from site and dispose of materials at appropriate facility.

3.5 PROTECTION

.1 Protect existing fencing, trees, landscaping, natural features, bench marks, buildings, pavement, surface or underground utility lines which are to remain as directed by Consultant. If damaged, restore to original or better condition unless directed otherwise.

.2 Maintain access roads to prevent accumulation of construction related debris on roads.

END OF SECTION

Approved: 2012-06-30

Part 1 General

1.1 RELATED REQUIREMENTS

.1 Section 31 22 13 Rough Grading.

1.2 REFERENCES

.1 Definitions:

- .1 Rock Excavation: excavation of:
  - .1 Material from solid masses of igneous, sedimentary or metamorphic rock which, prior to removal, was integral with parent mass. Material that cannot be ripped with reasonable effort with a Caterpillar D9 crawler bulldozer or equivalent to be considered integral with parent mass.
  - .2 Boulder or rock fragments measuring in volume 1 cubic metre or more.
- .2 Common Excavation: excavation of materials that are not Rock Excavation or Stripping.
- .3 Unclassified Excavation: excavation of whatever character other than stripping encountered in the Work.
- .4 Free Haul: distance that excavated material is hauled without compensation. Free haul distance to be 1.0 km or less.
- .5 Stripping: excavation of organic material covering original ground.
- .6 Over Haul: authorized hauling in excess of free haul distance that excavated material is moved.
- .7 Embankment: material derived from usable excavation and placed above original ground or stripped surface up to top of subgrade.
- .8 Waste Material: material unsuitable for embankment, embankment foundation or material surplus to requirements.
- .9 Borrow Material: material obtained from areas outside right-of-way and required for construction of embankments or for other portions of work.
- .10 Topsoil: material capable of supporting good vegetative growth and suitable for use in top dressing, landscaping and seeding.

.2 Reference Standards:

- .1 ASTM International
  - .1 ASTM D698-, Standard Test Method for Laboratory Compaction Characteristics of Soil Using Standard Effort.

1.3 ACTION AND INFORMATIONAL SUBMITTALS

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

1.4 QUALITY ASSURANCE

.1 Regulatory Requirements:

.1 Adhere to regulations of authority having jurisdiction when blasting is required.

.2 Adhere to Provincial and National Environmental requirements when potentially toxic materials are involved.

Part 2 Products

2.1 MATERIALS

.1 Embankment materials require approval by Consultant.

.2 Material used for embankment not to contain more than 3% organic matter by mass, frozen lumps, weeds, sod, roots, logs, stumps or other unsuitable material.

.3 Borrow material:

.1 Obtain from sources such as quarry, or borrow pit.

.1 Earth Embankment materials to consist of acceptable earth material and processed rock material free from objectionable quantities of organic matter, frozen soil, stumps, trees, moss, and other unsuitable materials.

Part 3 Execution

3.1 EXAMINATION

.1 Verification of Conditions: verify that condition of substrate is acceptable for roadway embankment Work:

.1 Inform Consultant of unacceptable conditions immediately upon discovery.

.2 Proceed with installation only after unacceptable conditions have been remedied.

3.2 COMPACTION EQUIPMENT

.1 Compaction equipment: vibratory rollers or vibrating plate compactors capable of obtaining required density in materials on project.

.1 Replace or supplement equipment that does not achieve specified densities.

.2 Operate compaction equipment continuously in each embankment when placing material.

3.3 WATER DISTRIBUTORS

.1 Apply water with equipment capable of uniform distribution.

3.4 EXCAVATING

.1 General:

.1 Notify Consultant when waste materials are encountered and remove to depth and extent directed.

.2 Treat ground slopes, where subgrade is on transition from excavation to embankment, at grade points as directed by Consultant.

.2 Drainage:

.1 Maintain profiles, crowns and cross slopes to provide good surface drainage.

.2 Provide ditches as work progresses to provide drainage.

.3 Construct interceptor ditches as indicated or as directed before excavating or placing embankment in adjacent area.

.3 Rock excavation:

.1 Notify Consultant, when material appearing to conform to classification for rock is encountered, to enable measurements to be made to determine volume of rock. Provide 48 hour notification.

.4 Borrow Excavation:

.1 Completely use in embankments, suitable materials removed from right-of-way excavations before taking material from borrow areas.

.2 Where imported embankment material is required, Contractor to arrange and pay for all imported material. Obtain embankment materials, in excess of what is available from cut areas, from designated borrow areas.

3.5 EMBANKMENTS

.1 Scarify or bench existing slopes in side hill or sloping sections to ensure proper bond between new materials and existing surfaces.

.2 Break up or scarify existing road surface prior to placing embankment material.

.3 Do not place material which is frozen nor place material on frozen surfaces except in areas authorized by Consultant.

.4 Maintain crowned surface during construction to ensure ready run-off of surface water.

.5 Drain low areas before placing materials.

.1 Place and compact to full width in layers not exceeding 200 mm loose thickness. Consultant may authorize thicker lifts if specified compaction can be achieved and if material contains more than 25% by volume stone and rock fragments larger than 100 mm.

.6 Deductions from excavation will be made for overbuild of embankments.

3.6 COMPACTION

.1 Break material down to sizes suitable for compaction and mix for uniform moisture to full depth of layer.

.2 Deposit, spread, and level, embankment material in layers 200 mm maximum thickness before compaction.

.1 Ensure required compaction for each layer before placing any material for next layer.

.3 Use specialized compaction equipment supplemented by routing, hauling, and leveling equipment over each layer of fill.

.4 Compact each layer to minimum 95% maximum dry density: ASTM D698 except top 150 mm of subgrade.

.1 Compact top 150 mm to 97% maximum dry density.

.5 Add water or dry as required to bring moisture content of materials to level required to achieve specified compaction.

3.7 FINISHING

.1 Shape entire roadbed to within 25 mm of design elevations.

.2 Finish slopes, ditch bottoms and borrow pits true to lines, grades and drawings where applicable.

.3 Remove rocks over 150 mm in dimension from slopes and ditch bottoms.

.4 Hand finish slopes that cannot be finished satisfactorily by machine.

.5 Round top of backslope 1.5 m both sides of top of slope.

.6 Trim between constructed slopes and edge of clearing to provide drainage and free of humps, sags and ruts.

3.8 CLEANING

.1 Progress Cleaning:

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

.2 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment.

.3 Waste Management: separate waste materials for reuse or recycling.

.1 Remove recycling containers and bins from site and dispose of materials at appropriate facility.

3.9 PROTECTION

.1 Maintain finished surfaces in condition conforming to this section until acceptance by Consultant.

.2 Provide silt fences and erosion protection as required to mitigate and prevent impacts to adjacent properties.

3.10 TESTING

.1 Inspection and testing of soil compaction will be carried out by testing laboratory designated by ULC. Costs of tests will be paid for by the Contractor.

.2 Density testing of roadway embankments: one test for each 500 square metres for each 150 mm compacted lift.

.3 Density testing of subgrade: one test for each 250 square metres of subgrade.

END OF SECTION

Approved: 2006-09-30

Part 1 General

1.1 RELATED REQUIREMENTS

.1 Section 33 42 13 Pipe Culverts.

1.2 REFERENCES

.1 American Society for Testing and Materials (ASTM)

- .1 ASTM C144, Standard Specification for Aggregate for Masonry Mortar.
- .2 ASTM C618, Standard Specification for Coal Fly Ash and Raw or Calcined Natural Pozzolan for Use as a Mineral Admixture in Concrete.

.2 Canadian Standards Association (CSA)

- .1 CAN/CSA-A23.1, Concrete Materials and Methods of Concrete Construction.
- .2 CAN/CSA-A3000, Cementitions Materials Compendium.

1.3 WASTE MANAGEMENT AND DISPOSAL

.1 Separate and recycle waste materials.

.2 Collect and separate plastic, paper packaging and corrugated cardboard.

.3 Place materials defined as hazardous or toxic in designated containers.

.4 Fold up metal banding, flatten and place in designated area for recycling.

.5 Divert left over aggregate materials from landfill to local facility for reuse as approved by Consultant.

.6 Divert left over hardened cement materials from landfill to local facility for reuse as approved by Consultant.

.7 Divert left over geotextiles to local plastic recycling facility as approved by Consultant.

Part 2 Products

2.1 STONE

.1 Hard, dense, durable quarry stone, free from seams, cracks or other structural defects, to meet following size distribution for use intended:

- .1 Hand placed rip-rap:
  - .1 Minimum size of individual stones 10 dm^3.
  - .2 Not less than 75% of total volume of stones with individual volume of 15 dm^3 or more.
  - .3 Supply rock spalls or cobbles to fill open joints.

2.2 GEOTEXTILE FILTER

.1 Geotextile: under lay rip-rap with medium weight non-woven geotextile.

.2 Provide anchor trench for geotextile along entire perimeter of each installation.

Part 3 Execution

3.1 PLACING

.1 Where rip-rap is to be placed on slopes, excavate trench at toe of slope to dimensions as indicated.

.2 Fine grade area to be rip-rapped to uniform, even surface. Fill depressions with suitable material and compact to provide firm bed.

.3 Place geotextile on prepared surface and as indicated. Avoid puncturing geotextile. Vehicular traffic over geotextile not permitted.

.4 Place rip-rap to thickness and details as indicated.

.5 Place stones in manner approved by Consultant to secure surface and create a stable mass. Place larger stones at bottom of slopes.

.6 Hand placing:

.1 Use larger stones for lower courses and as headers for subsequent courses.

.2 Stagger vertical joints and fill voids with rock spalls or cobbles.

.3 Finish surface evenly, free of large openings and neat in appearance.

.7 Secure rip rap in place with 20 MPa Concrete as per details.

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 Excavation and concrete required for construction of auger placed concrete piles.
.2 Establish and/or verify required pile cut off elevations.
.3 Correct as directed all piles not meeting requirements of this specification at no expense to the Owner.
.4 Leave site neat, tidy, free of plant and/or equipment and in safe condition. Remove excavation material from site or deposit on site as directed.

1.3 RELATED WORK

.1	Geotechnical Investigation	Section 02 32 00
.2	Concrete Reinforcement	Section 03 20 00
.3	Cast-in-Place Concrete	Section 03 30 00

1.4 REFERENCES

.1 Canadian Standards Association (CSA)

.1 CSA-A23.2-09, Methods of Test for Concrete.
.2 CAN/CSA-G30.18-09, Billet Steel Bars for Concrete Reinforcement.
.3 CSA-G40.21-04, Structural Quality Steel.
.4 CAN/CSA-S16-01, Limit States Design of Steel Structures.
.5 CSA W48-01, Filler Metals and Allied Materials for Metal Arc Welding.

1.5 TESTING AND INSPECTION

.1 Refer to Section 03 30 00 - Cast-in-Place Concrete for testing and inspection procedures.

1.6 SHOP DRAWINGS

.1 Submit shop drawings in accordance with Section 01 33 00 - Submittal Procedures for reinforcing steel and installation procedures.

Part 2 Products

2.1 REINFORCING STEEL

.1 Reinforcing Steel: deformed steel bars conforming to requirements of CSA G30.18-09; 400 MPa yield strength, weldable.

.2 Reinforcement to conform to standards as specified under Section 03 20 00 Concrete Reinforcement.

.3 No splicing in reinforcement is permitted unless specifically shown on drawings or approved by the Consultant.

.4 Weld ties to main reinforcement as indicated on drawings.

.5 Spiral ties may be used in lieu of horizontal ties.

2.2 CONCRETE AND GROUT MATERIALS

.1 Cement: Sulphate Resistant Symbol 50 Portland, conforming to CSA/A3000-08.

.2 Coarse and Fine Aggregates: Standard concrete type, conforming to CSA A23.1-09 and CSA A179-04.

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

2.3 ADMIXTURES

.1 Air Entrainment Admixtures for Concrete, Chemical Admixtures; water reducing, strength increasing Type WN – normal setting and Pozzolanic Mineral as per CSA/A3000-08 "Cementitious Materials Compendium". Type "C" or Type "F" fly ash permitted to a maximum of 20% by weight of cementitious materials and CSA A179-04.

2.4 CONCRETE GROUT MIX

.1 The concrete grout used shall consist of a mixture of Portland cement, sand, fluidifier and water so proportioned and mixed to be pumped and to fill all voids in the foundation material. The mix shall be proportioned to provide a minimum strength of 25 MPa at 28 days with a maximum water/cement ratio of 0.45 and an air content of 5 to 7%.

2.5 SOURCE QUALITY CONTROL

.1 Mill report: to CAN/CSA-S16-01.

.2 Concrete tests: to CSA-A23.2-09.

2.6 EQUIPMENT

.1 Augering Equipment:

.1 Equipment shall be of sufficient size and in good working order to smoothly turn and advance augers to the specified depths. The equipment will be free of oil and hydraulic leaks and be equipped with required OSHA safety features.

.2 Augers shall be bottom centre discharge augers.

.3 The auger flighting shall be continuous from the auger head to the top of auger without gaps or other breaks. The auger flighting shall be uniform in diameter throughout its length and shall be the diameter specified for the piles less a maximum of 3 percent.

.4 The hole through which the high-strength grout is pumped during the placement of the pile shall be located at the bottom of the auger head below the bar containing the cutting teeth.

.5 Augers over 12000 mm in length shall contain a middle guide.

.6 The piling leads should be prevented from rotating by a stabilizing arm or by firmly placing the bottom of the leads into the ground or by some other acceptable means. Leads shall be marked at 300 mm intervals to facilitate measurement of auger penetration.

.2 Mixing and Pumping Equipment:

.1 Only approved pumping and mixing equipment shall be used in the preparation and handling of the grout. A screen to remove oversize particles shall be placed at the pump inlet. All oil or other rust inhibitors shall be removed from mixing drums and grout pumps. All materials shall be such as to produce a homogeneous grout of the desired consistency.

.1 The grout pump shall be a positive displacement piston type pump capable of developing displacing pressures at the pump not less than 2.5 MPa. The grout pump shall be provided with a pressure gauge in clear view of the equipment operator. The grout pump shall be calibrated at the beginning of the work to determine the volume of grout pumped per stroke. A positive method of counting grout pump strokes shall be provided by the Pile Contractor. Such methods may include digital or mechanical stroke counters or other acceptable methods.

Part 3 Execution

3.1 FIELD RECORDS

.1 Maintain accurate record for each pile including elevation of penetration, depth of pile, cut-off elevation and grout pressures.

.2 Provide Consultant with a copy of records.

3.2 INSTALLATION

.1 Advance the auger at a continuous rate that prevents removal of excess soil. Stop advancement after reaching the required depth of refusal criteria.

.2 Auger refusal is defined as a rate of auger penetration of less than 300 mm per minute of drilling.

.3 The hole in the bottom of the auger shall be closed while being advanced into the ground with a suitable plug. The plug shall be removed by grout pressures or with the reinforcing bar.

.4 Place continuous center reinforcing through the hollow-stemmed auger prior to placement of grout. Tie top of reinforcing in place after removal of auger. Use bar spacers to center reinforcing bars.

.5 At the start of pumping grout, raise the auger from 150 to 300 mm and after the grout pressure builds up sufficiently, redrill the auger to the previously established tip elevation.

.6 Maintain at least 3000 mm of grout on the auger flighting above the injection point during raising of the auger. Positive rotation of the auger shall be maintained throughout placement of the grout. Rate of grout injection and rate of auger withdrawal from the soil shall be co-ordinated as to maintain at all times the minimum grout head and a positive pressure on the gauges. The total volume of grout shall be at least 115 percent of the theoretical volume for each pile, except after grout is flowing at the ground surface from the auger flighting, the rate of grout injection and auger withdrawal shall be co-ordinated so that there is a constant grout flow at the surface. If pumping of grout is interrupted for any reason, the Contractor shall reinsert the auger at least 1500 mm into the pile and regrout.

.7 Minimum volume of grout placed in hole shall be at least nominal volume plus 15 percent of hole. Volume of grout per linear meter/foot of piles shall be not less than volume of grout per meter/foot of test pile. Make volume measurements in the presence of the Consultant.

.8 Auger hoisting equipment shall be provided that will enable the auger to be rotated while being withdrawn smoothly and steadily.

.9 The spoil that accumulates around the auger during injection of the grout shall be promptly cleared away upon completion of the installation.

.10 Materials shall be accurately measured by volume or by weight as they are fed to the mixer. Provide grout injection equipment with a pressure gage in clear view of the equipment operator. A second pressure gauge shall be located near auger rig where it can be observed. Rate of injection and rate of auger withdrawal from soil shall be so co-ordinated as to maintain at all times a positive pressure on gage which will indicate existence of a removing pressure on bottom of auger flight. Magnitude of this pressure and performance of other augering and grouting procedures, such as a rate of augering, rate of grout injection, and control of grout return around the auger flight, are dependent on soil conditions and equipment capability shall be at option of Contractor, subject to approval of Consultant. Equipment for pumping grout shall be positive displacement pump capable of developing a pressure at pump not less that 2.5 MPa. Pump shall be calibrated by an approved method to verify accuracy of indicated discharge. Remove oil or other rust inhibitors from mixing drums and pumps. Auger hoisting equipment shall be capable of withdrawing auger smoothly and at a constant rate. If the auger jumps upward during withdrawal, it shall be reinserted, and rate of withdrawal decreased to prevent further jumping.

.11 Cut off the tops of piles, square with pile axis and at the elevations indicated by removing fresh grout from the top of the pile or by cutting off hardened grout down to final cutoff point at any time after initial set has occurred. Where the pile cutoff is near the surface or above the bottom of the excavation, sleeves or casing of the proper diameter and at least 457 mm in length shall be placed around the pile tops.

.12 Redrill the pile to the original depth at no additional cost to the Owner if any of the following occurs:

.1 The design pile reinforcement cannot be placed manually in the top of any pile following completion of grouting.

.2 The trap door at the bottom discharge outlet fails to open completely, effectively creating a side discharge condition.

.3 Loss of grout head occurs for any reason during pile installation.

.4 There is more than a 40 minute delay during the grouting of any individual pile.

.5 There is a drop in grout level after completion of the pile, which exceeds the average for the remainder of the pile installations by more than 0.61 meters.

3.3 OBSTRUCTIONS

.1 In the event that non-augerable material is encountered, such as cobbles, boulders, rock ledge, metal timbers or debris which causes the rate of penetration to be reduced to less than one foot per minute above the desired tip elevation, or causes the pile to drift from its location, then the pile shall be completed to the depth of the non-augerable material in accordance with these specifications. The length of such short piles shall be included in the total linear feet of pile for payment at the unit price. If required by the Consultant, additional adjacent piles shall be placed and the length of these additional piles shall also also be included in the total linear feet of piles for payment.

3.4 QUALITY CONTROL

.1 Inspection:

.1 The Owner shall employ a Consultant to provide inspection of all pile operations. The pile contractor shall co-operate with the Consultant in the performance of this work. The presence of Owner's Consultant shall in no way relieve the pile contractor of his obligation to perform the pile installation in accordance with the drawings and these specifications.

.2 Reports:

.1 Contractor shall maintain an installation record of each pile. The record shall note the project name and number, name of contractors, pile location, design pile capacity, pile tip elevation, pile top elevation, depth of auger advancement, (total and continuous) quantity of grout placed, reinforcing steel placement and any

unusual occurrences during the pile installation. The grout quantity shall be determined by recording grout pump displacement or by other acceptable means.

3.5 DEFECTIVE PILES

.1 Defective pile, as directed by Consultant, may be left in place to be cut off at elevation specified by Consultant.

3.6 CLEANUP

.1 All debris from excavation of objectionable material, removal of obstructions and any material not to remain as part of the construction is to be removed and disposed of by the subcontractor in a legal manner at no additional cost to the Owner.

.2 The site shall be cleaned at frequent intervals and no material shall be stored on the site in a manner which would obstruct the easy access of equipment and personnel.

END OF SECTION

Approved: 2011-06-30

Part 1 General

1.1 RELATED REQUIREMENTS

.1 Section 31 24 13 Roadway Embankments.

1.2 REFERENCES

.1 ASTM International

- .1 ASTM C117, Standard Test Methods for Material Finer Than 0.075 mm Sieve in Mineral Aggregates by Washing.
- .2 ASTM C131, Standard Test Method for Resistance to Degradation of Small-Size Coarse Aggregate by Abrasion and Impact in the Los Angeles Machine.
- .3 ASTM C136, Standard Test Method for Sieve Analysis of Fine and Coarse Aggregates.
- .4 ASTM D422, Standard Test Method for Particle-Size Analysis of Soils.
- .5 ASTM D698, Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400ft-lbf/ft^3) (600kN-m/m^3).
- .6 ASTM D1557, Standard Test Method for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000ft-lbf/ft^3) (2,700kN-m/m^3).
- .7 ASTM D1883, Standard Test Method for CBR (California Bearing Ratio) of Laboratory Compacted Soils.
- .8 ASTM D4318, Standard Test Methods for Liquid Limit, Plastic Limit and Plasticity Index of Soils.

.2 Canadian General Standards Board (CGSB)

- .1 CAN/CGSB-8.2, Sieves, Testing, Woven Wire, Metric.

1.3 ACTION AND INFORMATIONAL SUBMITTALS

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

Part 2 Products

2.1 MATERIALS

.1 Granular sub-base material: in accordance with the following requirements:

- .1 Crushed, pit run or screened stone, gravel or sand.
- .2 Gradations and properties to Saskatchewan Ministry of Highways and Infrastructure Type 8 granular sub-base.

Part 3 Execution

3.1 EXAMINATION

.1 Verification of Conditions: verify conditions of substrate previously installed under other Sections or Contracts are acceptable for granular sub-base installation.

.1 Inform Consultant of unacceptable conditions immediately upon discovery.

.2 Proceed with installation only after unacceptable conditions have been remedied.

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 construction until permanent vegetation has been established.

.3 Remove erosion and sedimentation controls and restore and stabilize areas disturbed during removal.

3.3 PLACING

.1 Place granular sub-base after subgrade is inspected and approved by Consultant.

.2 Construct granular sub-base to depth and grade in areas indicated.

.3 Ensure no frozen material is placed.

.4 Place material only on clean unfrozen surface, free from snow or ice.

.5 Begin spreading sub-base material on crown line or high side of one-way slope.

.6 Place granular sub-base materials using methods which do not lead to segregation or degradation.

.7 Place material to full width in uniform layers not exceeding 150 mm compacted thickness.

.1 Consultant may authorize thicker lifts if specified compaction can be achieved.

.8 Shape each layer to smooth contour and compact to specified density before succeeding layer is placed.

.9 Remove and replace portion of layer in which material has become segregated during spreading.

3.4 COMPACTION

.1 Compaction equipment to be capable of obtaining required material densities.

.2 Sub-base course shall be compacted until no further settlement is apparent and particles are well keyed into place. The sub-base course shall be free of any rutting or deformations before placement of the next course.

.3 Shape and roll alternately to obtain smooth, even and uniformly compacted sub-base.

.4 Apply water as necessary during compaction to obtain specified density.

.5 In areas not accessible to rolling equipment, compact to specified density with mechanical tampers approved by Consultant.

.6 Correct surface irregularities by loosening and adding or removing material until surface is within specified tolerance.

3.5 PROOF ROLLING

.1 For proof rolling use a loaded tandem axle truck.

.2 Obtain written approval from Consultant to use non-standard proof rolling equipment.

.3 Proof roll at level in sub-base as indicated.

.1 If non-standard proof rolling equipment is approved, Consultant will determine level of proof rolling.

.4 Make sufficient passes with proof roller to subject every point on surface to three separate passes of loaded tire.

.5 Where proof rolling reveals areas of defective subgrade:

.1 Remove sub-base and subgrade material to depth and extent as directed by Consultant.

.2 Backfill excavated subgrade with sub-base material and compact in accordance with this section.

.3 Replace sub-base material and compact.

.6 Where proof rolling reveals areas of defective sub-base, remove and replace in accordance with this section at no extra cost.

3.6 CLEANING

.1 Progress Cleaning:

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

.2 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment.

.3 Waste Management: separate waste materials for reuse and recycling.

.1 Remove recycling containers and bins from site and dispose of materials at appropriate facility.

3.7 SITE TOLERANCES

.1 Finished sub-base surface to be within 10 mm of elevation as indicated but not uniformly high or low.

3.8 PROTECTION

.1 Maintain finished sub-base in condition conforming to this section until succeeding base is constructed.

3.9 TESTING

.1 Gradation testing of sub-base material: one test per 500 tonnes of material placed no compaction testing requirement.

END OF SECTION

Approved: 2011-06-30

Part 1 General

1.1 RELATED REQUIREMENTS

.1 Section 32 11 16.01 Granular Sub-base.

1.2 REFERENCES

.1 ASTM International

.1 ASTM C117, Standard Test Methods for Material Finer Than 0.075 mm (No. 200) Sieve in Mineral Aggregates by Washing.

.2 ASTM C131, Standard Test Method for Resistance to Degradation of Small-Size Coarse Aggregate by Abrasion and Impact in the Los Angeles Machine.

.3 ASTM C136, Standard Test Method for Sieve Analysis of Fine and Coarse Aggregates.

.4 ASTM D698, Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400ft-lbf/ft^3) (600kN-m/m^3).

.5 ASTM D1557, Test Method for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000ft-lbf/ft^3) (2,700kN-m/m^3).

.6 ASTM D1883, Standard Test Method for CBR (California Bearing Ratio) of Laboratory Compacted Soils.

.7 ASTM D4318, Standard Test Methods for Liquid Limit, Plastic Limit and Plasticity Index of Soils.

.2 Canadian General Standards Board (CGSB)

.1 CAN/CGSB-8.1, Sieves, Testing, Woven Wire, Inch Series.

.2 CAN/CGSB-8.2, Sieves, Testing, Woven Wire, Metric.

.3 U.S. Environmental Protection Agency (EPA) / Office of Water

.1 EPA 832/R-92-005, Storm Water Management for Construction Activities: Developing Pollution Prevention Plans and Best Management Practices.

1.3 ACTION AND INFORMATIONAL SUBMITTALS

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

1.4 DELIVERY, STORAGE AND HANDLING

.1 Deliver, store and handle materials in accordance with Section 01 61 00 - Common Product Requirements.

.2 Storage and Handling Requirements:

.1 Stockpile minimum 50% of total aggregate required prior to beginning operation.

.2 Store materials in dry location and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.

.3 Replace defective or damaged materials with new.

.3 Develop Construction Waste Management Plan related to Work of this Section.

.4 Packaging Waste Management: remove for reuse of pallets, crates, padding, packaging materials as specified in Construction Waste Management Plan.

Part 2 Products

2.1 MATERIALS

.1 Granular base: material in accordance with the following requirements:

.1 Crushed stone or gravel.

.2 Gradations and properties to Saskatchewan Ministry of Highways and Infrastructure Type 33 granular base.

.1 Liquid limit: to maximum 25.

.2 Plasticity index: to maximum 6.

.3 Crushed particles: at least 50% of particles by mass to have at least [1] freshly fractured face.

Part 3 Execution

3.1 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 construction until permanent vegetation has been established.

.3 Remove erosion and sedimentation controls and restore and stabilize areas disturbed during removal.

3.2 PLACEMENT AND INSTALLATION

.1 Place granular base after sub-base or subgrade surface is inspected and approved in writing by Consultant.

.2 Placing:

.1 Construct granular base to depth and grade in areas indicated.

.2 Ensure no frozen material is placed.

.3 Place material only on clean unfrozen surface, free from snow and ice.

.4 Begin spreading base material on crown line or on high side of one-way slope.

.5 Place material using methods which do not lead to segregation or degradation of aggregate.

.6 Place material to full width in uniform layers not exceeding 150 mm compacted thickness.

.1 Consultant may authorize thicker lifts (layers) if specified compaction can be achieved.

.7 Shape each layer to smooth contour and compact to specified density before succeeding layer is placed.

.8 Remove and replace that portion of layer in which material becomes segregated during spreading.

.3 Compaction Equipment:

.1 Ensure compaction equipment is capable of obtaining required material densities.

.4 Compacting:

.1 Compact to density not less than 100 % corrected maximum dry density.

.2 Shape and roll alternately to obtain smooth, even and uniformly compacted base.

.3 Apply water as necessary during compacting to obtain specified density.

.4 In areas not accessible to rolling equipment, compact to specified density with mechanical tampers approved by Consultant.

.5 Correct surface irregularities by loosening and adding or removing material until surface is within specified tolerance.

.5 Proof rolling:

.1 For proof rolling use load tandem axle truck.

.2 Obtain written approval from Consultant to use non-standard proof rolling equipment.

.3 Proof roll at level in granular base as indicated.

.1 If use of non-standard proof rolling equipment is approved, Consultant to determine level of proof rolling.

.4 Make sufficient passes with proof roller to subject every point on surface to three separate passes of loaded tire.

.5 Where proof rolling reveals areas of defective subgrade:

.1 Remove base, sub-base and subgrade material to depth and extent as directed by Consultant.

.2 Backfill excavated subgrade with sub-base material and compact in accordance with Section 32 11 16.01 - Granular Sub-Base.

.3 Replace sub-base material and compact in accordance with Section 32 11 16.01 - Granular Sub-base.

.4 Replace base material and compact in accordance with this Section.

.6 Where proof rolling reveals defective base or sub-base, remove defective materials to depth and extent as directed by Consultant and replace with new materials in accordance with Section 32 11 16.01 - Granular Sub-base and this section at no extra cost.

3.3 SITE TOLERANCES

.1 Finished base surface to be within plus or minus 10 mm of established grade and cross section but not uniformly high or low.

3.4 CLEANING

.1 Progress Cleaning:

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

.2 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment.

.3 Waste Management: separate waste materials for reuse or recycling.

.1 Remove recycling containers and bins from site and dispose of materials at appropriate facility.

.2 Divert unused granular material from landfill to local facility approved by Consultant.

3.5 PROTECTION

.1 Maintain finished base in condition conforming to this Section until succeeding material is applied.

3.6 TESTING

.1 Gradation testing of base material: one test per 500 tonnes of material placed test should include fractured faces determination.

.2 Density testing of base: one test for each 250 square metres of surface.

END OF SECTION

Approved: 2012-06-30

Part 1 General

1.1 RELATED REQUIREMENTS

.1 Section 32 12 16 Asphalt Paving.

1.2 REFERENCES

.1 American Association of State Highway and Transportation Officials (AASHTO)

.1 AASHTO M081-92-UL, Standard Specification for Cutback Asphalt (Rapid-Curing Type).

.2 ASTM International

.1 ASTM D140/D140M, Standard Practice for Sampling Bituminous Materials.

.2 ASTM D633, Standard Volume Correction Table for Road Tar.

.3 ASTM D1250, Standard Guide for Use of the Petroleum Measurement Tables.

.3 Canadian General Standards Board (CGSB)

.1 CAN/CGSB-16.2, Emulsified Asphalts, Anionic Type, for Road Purposes.

1.3 ACTION AND INFORMATIONAL SUBMITTALS

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

1.4 QUALITY ASSURANCE

.1 Upon request from Consultant, submit manufacturer's test data and certification that asphalt prime material meets requirements of this Section.

1.5 DELIVERY, STORAGE AND HANDLING

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

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

.3 Storage and Handling Requirements:

.1 Store materials off ground and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.

.2 Store and protect asphalt tack coats from nicks, scratches and blemishes.

.3 Replace defective or damaged materials with new.

.4 Deliver, store and handle materials in accordance with ASTM D140.

.5 Provide, maintain and restore asphalt storage area.

1.6 WASTE MANAGEMENT AND DISPOSAL

.1 Separate waste materials for reuse or recycling.

Part 2 Products

2.1 MATERIALS

.1 Anionic emulsified asphalt: to CAN/CGSB-16.2, grade: SS-1 [SS-1h].

.2 Cut-back asphalt; to AASHTO M081-92-UL, grade RC-70 or RC-250.

.3 Water: clean, potable, free from foreign matter.

2.2 EQUIPMENT

.1 Equipment required for Work of this Section to be in satisfactory working condition and maintained for duration of Work.

.2 Pressure distributor:

.1 Designed, equipped, maintained and operated so that asphalt material can be:

.1 Maintained at even temperature.

.2 Applied uniformly on variable widths of surface up to 5 m.

.3 Distribute in uniform spray without atomization at temperature required.

.2 Equipped with meter, registering travel in metres per minute, visibly located to enable truck driver to maintain constant speed required for application at specified rate.

.3 Equipped with pump having flow meter graduated in units of 5 L or less per minute passing through nozzles and readily visible to operator. Pump power unit to be independent of truck power unit.

.4 Equipped with easily read, accurate and sensitive device which registers temperature of liquid in reservoir.

.1 Measure temperature to closest whole number.

.5 Equipped with accurate volume measuring device or calibrated tank.

.6 Equipped with nozzles of same make and dimensions, adjustable for fan width and orientation.

.7 Equipped with nozzle spray bar, with operational height adjustment in increments of 0.6 metres and capable of being raised or lowered.

.8 Cleaned if previously used with incompatible asphalt material.

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 asphalt tack coat installation in accordance with manufacturer's written instructions.

.1 Visually inspect substrate in presence of Consultant.

.2 Inform Consultant of unacceptable conditions immediately upon discovery.

.3 Proceed with installation only after unacceptable conditions have been remedied.

3.2 APPLICATION

.1 Apply asphalt tack coat only on clean and dry surface.

.2 Dilute asphalt emulsion with water at 1:[1] ratio for application.

.1 Mix thoroughly by pumping or other method approved by Consultant.

.3 Apply asphalt tack coat evenly to pavement surface at approved rate but not to exceed 0.7 L/m^2.

.4 Paint contact surfaces of curbs, gutters, headers, manholes and like structures with thin, uniform coat of asphalt tack coat material.

.5 Apply asphalt tack coat only when air temperature greater than 2 degrees C and when rain is not forecast within 2 hours minimum of application.

.6 Apply asphalt tack coat only on unfrozen surface.

.7 Evenly distribute localized excessive deposits of tack coat by brooming as directed by Consultant.

.8 Keep traffic off tacked areas until asphalt tack coat has set.

.9 Re-tack contaminated or disturbed areas as directed by Consultant.

.10 Permit asphalt tack coat to set before placing asphalt pavement.

.11 Inspect tack coat application to ensure uniformity.

.1 Re-spray areas of insufficient or non-uniform tack coat coverage as directed by Consultant.

.2 Ensure tack coating performed using hand held devices is consistent in appearance with adjacent areas of machine applied material.

3.3 CLEANING

.1 Progress Cleaning:

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

.2 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment.

.3 Waste Management: separate waste materials for reuse and recycling.

.1 Remove recycling containers and bins from site and dispose of materials at appropriate facility.

END OF SECTION

Approved: 2012-06-30

Part 1 General

1.1 RELATED REQUIREMENTS

.1 Section 32 11 23 Aggregate Base Courses.

1.2 REFERENCES

.1 ASTM International

.1 ASTM D140/D140M, Standard Practice for Sampling Bituminous Materials.

.2 Canadian General Standards Board (CGSB)

.1 CAN/CGSB-16.1, Cutback Asphalts for Road Purposes.

.2 CAN/CGSB-16.2, Emulsified Asphalts, Anionic Type, for Road Purposes.

1.3 ACTION AND INFORMATIONAL SUBMITTALS

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

1.4 QUALITY ASSURANCE

.1 Upon request from Consultant, submit manufacturer's test data and certification that asphalt prime material meets requirements of this Section.

1.5 DELIVERY, STORAGE AND HANDLING

.1 Deliver materials in accordance with manufacturer's written instructions.

.2 Storage and Handling Requirements:

.1 Deliver, store and handle materials to ASTM D140.

.2 Store materials off ground and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.

.3 Replace defective or damaged materials with new.

.3 Packaging Waste Management: remove for reuse and return by manufacturer of pallets, crates, padding, packaging materials as specified.

Part 2 Products

2.1 MATERIAL

.1 Asphalt material: to CAN/CGSB-16.1 grade: RM-20, MC-30, MC-250. CAN/CGSB-16.2 grade: SS-1.

.2 Sand blotter: clean granular material passing 4.75 mm sieve and free from organic matter or other deleterious materials.

.3 Water: clean, potable, free from foreign matter.

2.2 EQUIPMENT

.1 Pressure distributor:

.1 Designed, equipped, maintained and operated so that asphalt material can be:

.1 Maintained at even temperature.

.2 Applied uniformly on variable widths of surface up to 5 m.

.3 Applied at controlled rates from 0.5 to 5.4 L/$m^2$with uniform pressure, and allowable variation from any specified rate not exceeding 0.1 L/m^2.

.4 Distributed in uniform spray without atomization at temperature required.

.2 Equipped with meter registering travel distance in metres per minute, visibly located to enable truck driver to maintain constant speed required for application at specified rate.

.3 Equipped with pump having flow meter graduated in units of 5 L or less per minute passing through nozzles and readily visible to operator.

.1 Pump power unit to be independent of truck power unit.

.4 Equipped with easily read, accurate and sensitive device which registers temperature of liquid in reservoir.

.1 Temperature to be measured to nearest whole number.

.5 Equipped with accurate volume measuring device or calibrated tank.

.6 Equipped with nozzles of same make and dimensions, adjustable for fan width and orientation.

.7 Equipped with nozzle spray bar, with operational height adjustment in increments of 0.6 metres and capable of being raised or lowered.

.8 Cleaned if previously used with incompatible asphalt material.

.2 Aggregate Spreader:

.1 Apply blotter sand to primed surfaces using roll type spreader, or rotating disc sander capable of applying aggregate at variable widths and at variable rates.

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 asphalt prime coat installation in accordance with manufacturer's written instructions.

.1 Inform Consultant of unacceptable conditions immediately upon discovery.

.2 Proceed with installation only after unacceptable conditions have been remedied.

3.2 APPLICATION

.1 Proceed with application of prime coat only after receipt of approval of granular base surface from Consultant.

.2 Cutback asphalt:

.1 Heat asphalt prime as recommended prior to pumping and spraying.

.2 Apply asphalt prime to granular base at rate as directed by Consultant, between 0.5 and 0.8 L/m^2 but not to exceed 2 L/m^2.

.3 Apply on dry surface unless otherwise directed by Consultant.

.3 Anionic emulsified asphalt:

.1 Dilute asphalt emulsion with clean water at 1:1 ratio for application.

.2 Mix thoroughly by pumping or other method approved by Consultant.

.3 Apply diluted asphalt emulsion at rate directed by Consultant, but do not exceed 5 L/m^2.

.4 Apply diluted asphalt emulsion on damp surface unless otherwise directed by Consultant.

.4 Apply asphalt prime only on unfrozen surface.

.5 Apply asphalt tack coat only when air temperature is greater than 10 degrees C and when rain is not forecast within 2 hours minimum of application.

.6 Paint contact surfaces of curbs, gutters, headers, manholes and like structures with thin, uniform coat of asphalt prime material.

.7 Where traffic is to be maintained, treat no more than one-half width of surface in one application.

.8 Prevent overlap at junction of applications.

.9 Do not prime surfaces that will be visible when paving is complete.

.10 Apply additional material to areas not sufficiently covered as directed by Consultant.

.11 Keep traffic off primed areas until asphalt prime has cured.

.12 Permit prime to cure before placing asphalt paving.

3.3 USE OF SAND BLOTTER

.1 If asphalt prime fails to penetrate within 24 hours, spread sand blotter material in amounts required to absorb excess material.

.2 Allow sufficient time for excess prime to be absorbed.

.3 Apply second application of sand blotter as required.

.4 Do not roll blotter sand.

.5 Sweep and remove excess blotter material.

3.4 CLEANING

.1 Progress Cleaning:

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

.2 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment.

.3 Waste Management: separate waste materials for reuse or recycling.

.1 Remove recycling containers and bins from site and dispose of materials at appropriate facility.

END OF SECTION

Approved: 2011-06-30

Part 1 General

1.1 RELATED REQUIREMENTS

.1 Section 32 11 23 Aggregate Base Courses.

1.2 REFERENCES

.1 American Association of State Highway and Transportation Officials (AASHTO)

- .1 AASHTO M320, Standard Specification for Performance Graded Asphalt Binder.
- .2 AASHTO R29, Standard Specification for Grading or Verifying the Performance Graded of an Asphalt Binder.
- .3 AASHTO T245, Standard Method of Test for Resistance to Plastic flow of Bituminous Mixtures Using Marshall Apparatus.

.2 Asphalt Institute (AI)

- .1 AI MS-2, Mix Design Methods for Asphalt Concrete and Other Hot-Mix Types.

.3 ASTM International

- .1 ASTM C88, Standard Test Method for Soundness of Aggregates by Use of Sodium Sulphate or Magnesium Sulphate.
- .2 ASTM C117, Standard Test Method for Material Finer Than 0.075mm (No.200) Sieve in Mineral Aggregates by Washing.
- .3 ASTM C123, Standard Test Method for Lightweight Particles in Aggregate.
- .4 ASTM C127, Standard Test Method for Specific Gravity and Absorption of Coarse Aggregate.
- .5 ASTM C128, Standard Test Method for Density, Relative Density (Specific Gravity), and Absorption of Fine Aggregate.
- .6 ASTM C131, Standard Test Method for Resistance to Degradation of Small-Size Coarse Aggregate by Abrasion and Impact in the Los Angeles Machine.
- .7 ASTM C136, Standard Method for Sieve Analysis of Fine and Coarse Aggregates.
- .8 ASTM C207, Standard Specification for Hydrated Lime for Masonry Purposes.
- .9 ASTM D995, Standard Specification for Mixing Plants for Hot-Mixed, Hot-Laid Bituminous Paving Mixtures.
- .10 ASTM D2419, Standard Test Method for Sand Equivalent Value of Soils and Fine Aggregate.
- .11 ASTM D3203, Standard Test Method for Percent Air Voids in Compacted Dense and Open Bituminous Paving Mixtures.
- .12 ASTM D4791, Standard Test Method for Flat Particles, Elongated Particles, or Flat and Elongated Particles in Coarse Aggregate.

.4 Canadian General Standards Board (CGSB)

.1 CAN/CGSB-8.1, Sieves Testing, Woven Wire, Inch Series.

.2 CAN/CGSB-8.2, Sieves Testing, Woven Wire, Metric.

.5 U.S. Environmental Protection Agency (EPA) / Office of Water

.1 EPA 832/R-92-005, Storm Water Management for Construction Activities: Developing Pollution Prevention Plans and Best Management Practices.

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 asphalt mixes and aggregate and include product characteristics, performance criteria, physical size, finish and limitations.

.2 Submit viscosity-temperature chart for asphalt cement to be supplied showing either Saybolt Furol viscosity in seconds or Kinematic Viscosity in centistokes, temperature range 105 to 175 degrees C 4 weeks prior to beginning Work.

.3 Test and Evaluation Reports:

.1 Submit manufacturer's test data and certification that asphalt cement meets specification requirements.

.2 Submit manufacturer's test data and certification that hydrated lime meets specified requirements.

.3 Submit asphalt concrete mix design and trial mix test results to Consultant for review at least 4 weeks prior to beginning Work.

1.4 DELIVERY, STORAGE AND HANDLING

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

.2 Deliver and stockpile aggregates in accordance with and erosion and sedimentation control plan. Stockpile minimum 50 % of total amount of aggregate required before beginning asphalt mixing operation.

.3 When necessary to blend aggregates from one or more sources to produce required gradation, do not blend in stockpiles.

.4 Stockpile fine aggregate separately from coarse aggregate, although separate stockpiles for more than two mix components are permitted.

.5 Provide approved storage, heating tanks and pumping facilities for asphalt cement.

Part 2 Products

2.1 MATERIALS

.1 Asphalt Concrete Mix Design and Characteristics to meet Saskatchewan Ministry of Highways and Infrastructure Type 2 or 3.

.2 Performance graded asphalt cement: to 150-200A.

.3 Stability: Minimum 8000 N.

2.2 EQUIPMENT

.1 Pavers: mechanical self-powered pavers capable of spreading mix within specified tolerances, true to line, grade and crown indicated.

.2 Rollers: sufficient number of type and weight to obtain specified density of compacted mix.

.3 Vibratory rollers:

.1 Drum diameter: 1200 mm minimum.

.2 Amplitude of vibration (machine setting): 0.5 mm maximum for lifts less than 40 mm thick.

.4 Haul trucks: sufficient number and of adequate size, speed and condition to ensure orderly and continuous operation and as follows:

.1 Boxes with tight metal bottoms.

.2 Covers of sufficient size and weight to completely cover and protect asphalt mix when truck fully loaded.

.3 In cool weather or for long hauls, insulate entire contact area of each truck box.

.4 Use only trucks which can be weighed in single operation on scales supplied.

.5 Hand tools:

.1 Lutes or rakes with covered teeth for spreading and finishing operations.

.2 Tamping irons having mass 12 kg minimum and bearing area not exceeding 310 cm^2 for compacting material along curbs, gutters and other structures inaccessible to roller. Mechanical compaction equipment, when approved by , may be used instead of tamping irons.

.3 Straight edges, 4.5 m in length, to test finished surface.

2.3 MIX DESIGN

.1 Mix design to be approved in writing by Consultant.

.2 Mix design to be developed by testing laboratory approved in writing by Consultant.

.3 Mix to contain maximum 50% by mass of RAP. Consultant may approve higher proportion of RAP if Contractor demonstrates ability to produce mix meeting requirements of specification.

.4 Design of mix: by Marshall method to Saskatchewan Ministry of Highways and Infrastructure Type 2 or 3mix design and the requirements below.

.1 Compaction blows on each face of test specimens: 50.

.2 Mix physical requirements:

Property	Roads
Marshall Stability at 60 degrees C kN min	8.0 surface course/8.0 lower course
Flow Value mm	1.5-3.5
Air Voids in Mixture, %	3-5 surface course
Voids in Mineral Aggregate,	15 surface course

% min	
Index of Retained Stability % minimum	70

.3 Measure physical requirements as follows:

.1 Marshall load and flow value: to AASHTO T245.

.2 Compute void properties on basis of bulk specific gravity of aggregate to ASTM C127 and ASTM C128. Make allowance for volume of asphalt absorbed into pores of aggregate.

.3 Air voids: to ASTM D3203.

.4 Voids in mineral aggregates: to AI MS2.

.4 Do not change job-mix without prior approval of Consultant. When change in material source proposed, new job-mix formula to be approved by Consultant.

.5 Return plant dust collected during processing to mix in quantities acceptable to Consultant.

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 asphalt paving in accordance with manufacturer's written instructions.

.1 Inform Consultant of unacceptable conditions immediately upon discovery.

.2 Proceed with installation only after unacceptable conditions have been remedied.

3.2 PLANT AND MIXING REQUIREMENTS

.1 Batch and continuous mixing plants:

.1 To ASTM D995.

.2 Feed aggregates from individual stockpiles through separate bins to cold elevator feeders.

.1 Do not load frozen materials into bins.

.3 Feed cold aggregates to plant in proportions to ensure continuous operations.

.4 Calibrate bin gate openings and conveyor speeds to ensure mix proportions are achieved.

.5 Before mixing, dry aggregates to moisture content not greater than 1 % by mass or to lesser moisture content if required to meet mix design requirements. Heat to temperature required to meet mixing temperature as directed by Consultant after combining with RAP.

.6 Immediately after drying, screen aggregates into hot storage bins in sizes to permit recombining into gradation meeting job-mix requirements.

.7 Store hot screened aggregates in manner to minimize segregation and temperature loss.

.8 Heat asphalt cement and aggregate to mixing temperature directed by Consultant. Do not heat asphalt cement above maximum temperature indicated on temperature-viscosity chart.

.9 Make available current asphalt cement viscosity data at plant. With information relative to viscosity of asphalt being used, Consultant to review temperature of completed mix at plant and at paver after considering hauling and placing conditions.

.10 Maintain temperature of materials within 5 degrees C of specified mix temperature during mixing.

.11 Mixing time:

.1 In batch plants, both dry and wet mixing times as directed by Consultant. Continue wet mixing as long as necessary to obtain thoroughly blended mix but not less than 30s or more than 75s.

.2 In continuous mixing plants, mixing time as directed by Consultant but not less than 45s.

.12 Where RAP is to be incorporated into mix:

.1 Feed from separate cold feed bin specially designed to minimize consolidation of material.

.1 Provide 50 mm scalping screen on cold feed to remove oversized pieces of RAP.

.2 Ensure positive and accurate control of RAP cold feed by use of hydraulic motor or electric clutch and equip with anti rollback device to prevent material from sliding backward on feed belt.

.3 Combine RAP and new aggregates in proportions as specified. Dry mix thoroughly, until uniform temperature within plus or minus 5 degrees C of mix temperature, as directed Consultant, is achieved prior to adding new asphalt cement.

.1 Do not add new asphalt cement where temperature of dried mix material is above 160 degrees C.

.2 Dryer drum mixing plant:

.1 To ASTM D995.

.2 Load aggregates from individual stockpiles to separate cold feed bins. Do not load frozen materials into bins.

.3 Feed aggregates to burner end of dryer drum by means of multi-bin cold feed unit and blend to meet job-mix requirements by adjustments of variable speed feed belts and gates on each bin.

.4 Where RAP is to be incorporated into mix, dryer drum mixer is to be designed to prevent direct contact of RAP with burner flame or with exhaust gases hotter than 180 degrees C.

.5 Feed RAP from separate cold feed bin designed to minimize reconsolidation of material.

.6 Meter total flow of aggregate and RAP using electronic weigh belt system with indicator that can be monitored by plant operator and which is interlocked with asphalt pump to ensure proportions of aggregate, RAP and asphalt entering mixer remain constant.

.7 Allow for easy calibration of weighing systems for aggregates and RAP without having material enter mixer.

.8 Calibrate bin gate openings and conveyor speeds to ensure mix proportions are achieved.

.1 Calibrate weigh bridge on charging conveyor by weighing amount of aggregate passing over weigh bridge in set amount of time.

.2 Difference between this value and amount shown by plant computer system to differ by not more than plus or minus 2 %.

.9 Make provision for conveniently sampling full flow of materials from cold feed.

.10 Provide screens or other suitable devices to reject oversize particles or lumps of aggregate and RAP from cold feed prior to entering drum.

.11 Provide system interlock stop on feed components if either asphalt or aggregate from bin stops flowing.

.12 Accomplish heating and mixing of asphalt mix in approved parallel flow dryer-mixer in which aggregate enters drum at burner end and travels parallel to flame and exhaust gas stream.

.1 Control heating to prevent fracture of aggregate or excessive oxidation of asphalt.

.2 Equip system with automatic burner controls and provide for continuous temperature sensing of asphalt mixture at discharge, with printing recorder that can be monitored by plant operator.

.3 Submit printed record of mix temperatures at end of each week.

.13 Ensure mixing period and temperature to produce uniform mixture in which particles are thoroughly coated, and moisture content of material as it leaves mixer is 2 % maximum.

.3 Temporary storage of hot mix:

.1 Provide mix storage of sufficient capacity to permit continuous operation and designed to prevent segregation.

.2 Do not store asphalt mix in storage bins in excess of 3 hour.

.4 Mixing tolerances:

.1 Permissible variation of asphalt cement from job mix: 0.25%.

.2 Permissible variation of mix temperature at discharge from plant: [5] degrees C.

3.3 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 construction until permanent vegetation has been established.

.3 Remove erosion and sedimentation controls and restore and stabilize areas disturbed during removal.

.2 Apply prime coat and tack coat in accordance with Section 32 12 13.23 - Asphalt Prime Coats and Section 32 12 13.16 - Asphalt Tack Coats prior to paving.

.3 Prior to laying mix, clean surfaces of loose and foreign material.

3.4 TRANSPORTATION OF MIX

.1 Transport mix to job site in vehicles cleaned of foreign material.

.2 Paint or spray truck beds with limewater, soap or detergent solution, or non petroleum based commercial product, at least daily or as required.

.1 Raise truck bed and thoroughly drain, and ensure no excess solution remains in truck bed.

.3 Schedule delivery of material for placing in daylight, unless Consultant approves artificial light for night placing.

.4 Deposit mix from surge or storage silo to trucks in multiple drops to reduce segregation.

.1 Do not dribble mix into trucks.

.5 Deliver material to paver at uniform rate and in an amount within capacity of paving and compacting equipment.

.6 Deliver loads continuously in covered vehicles and immediately spread and compact.

.1 Deliver and place mixes at temperature within range as directed by Consultant, but not less than 135 degrees C.

3.5 PLACING

.1 Obtain Consultant's approval of base prime coat prior to placing asphalt.

.2 Place asphalt concrete to thicknesses, grades and lines as indicated.

.3 Placing conditions:

.1 Place asphalt mixtures only when air temperature is 3 degrees C minimum.

.2 When temperature of surface on which material is to be placed falls below 10 degrees C, provide extra rollers as necessary to obtain required compaction before cooling.

.3 Do not place hot-mix asphalt when pools of standing water exist on surface to be paved, during rain, or when surface is damp.

.4 Place asphalt concrete in compacted lifts of thickness as follows:

.1 Levelling course[s] to thicknesses required but not exceeding 70 mm.

.2 Surface course in layer of maximum 70 mm.

.5 Where possible do tapering and levelling where required in lower lifts. Overlap joints by not less than 300 mm.

.6 Place individual strips no longer than 500 m.

.7 On airport runways and taxiways, aprons and parking lots commence spreading at high side of pavement or at crown and span crowned centerlines with initial strip.

.8 Spread and strike off mixture with self propelled mechanical finisher.

.1 Construct longitudinal joints and edges true to line markings.

.1 Position and operate paver to follow established line closely.

.2 When using pavers in echelon, have first paver follow marks or lines, and second paver follow edge of material placed by first paver.

.1 Work pavers as close together as possible and in no case permit them to be more than 30 m apart.

.3 Maintain constant head of mix in auger chamber of paver during placing.

.4 If segregation occurs, immediately suspend spreading operation until cause is determined and corrected.

.5 Correct irregularities in alignment left by paver by trimming directly behind machine.

.6 Correct irregularities in surface of pavement course directly behind paver.

.1 Remove excess material forming high spots using shovel or lute.

.1 Fill and smooth indented areas with hot mix.

.2 Do not broadcast material over such areas.

.7 Do not throw surplus material on freshly screeded surfaces.

.9 When hand spreading is used:

.1 Use approved wood or steel forms, rigidly supported to assure correct grade and cross section.

.1 Use measuring blocks and intermediate strips to aid in obtaining required cross-section.

.2 Distribute material uniformly without broad casting material.

.3 During spreading operation, thoroughly loosen and uniformly distribute material by lutes or covered rakes.

.1 Reject material that has formed into lumps and does not break down readily.

.4 After placing and before rolling, check surface with templates and straightedges and correct irregularities.

.5 Provide heating equipment to keep hand tools free from asphalt.

.1 Control temperature to avoid burning material.

.2 Do not use tools at higher temperature than temperature of mix being placed.

3.6 COMPACTING

.1 Roll asphalt continuously to density not less than 98 % of 50 blow Marshall density to AASHTO T245.

.2 General:

.1 Provide at least 2 rollers and as many additional rollers as necessary to achieve specified pavement density. When more than 2 rollers are required, 1 roller must be pneumatic tired type.

.2 Start rolling operations as soon as placed mix can bear weight of roller without excess displacement of material or cracking of surface.

.3 Operate roller slowly initially to avoid displacement of material. Do not exceed 5 km/h for breakdown and intermediate rolling for static steel-wheeled and pneumatic tired rollers. Do not exceed 9 km/h for finish rolling.

.4 Use static compaction for levelling coarse less than 25 mm thick.

.5 For lifts 50 mm thick and greater, adjust speed and vibration frequency of vibratory rollers to produce minimum of 25 impacts per metre of travel. For lifts less than 50 mm thick, impact spacing not to exceed compacted lift thickness.

.6 Overlap successive passes of roller by minimum of 200 mm and vary pass lengths.

.7 Keep wheels of roller slightly moistened with water to prevent pick-up of material but do not over-water.

.8 Do not stop vibratory rollers on pavement that is being compacted with vibratory mechanism operating.

.9 Do not permit heavy equipment or rollers to stand on finished surface before it has been compacted and has thoroughly cooled.

.10 After traverse and longitudinal joints and outside edge have been compacted, start rolling longitudinally at low side and progress to high side.

.1 Ensure that all points across width of pavement receive essentially equal numbers of passes of compactors.

.11 When paving in echelon, leave unrolled 50 to 75 mm of edge which second paver is following and roll when joint between lanes is rolled.

.12 Where rolling causes displacement of material, loosen affected areas at once with lutes or shovels and restore to original grade of loose material before re-rolling.

.3 Breakdown rolling:

.1 Begin breakdown rolling with vibratory roller immediately following rolling of transverse and longitudinal joint and edges.

.2 Operate rollers as close to paver as necessary to obtain adequate density without causing undue displacement.

.3 Operate breakdown roller with drive roll or wheel nearest finishing machine. When working on steep slopes or super-elevated sections use operation approved by Consultant.

.4 Use only experienced roller operators.

.4 Intermediate rolling:

.1 Use pneumatic-tired, steel wheel or vibratory rollers and follow breakdown rolling as closely as possible and while paving mix temperature allows maximum density from this operation.

.2 Rolling to be continuous after initial rolling until mix placed has been thoroughly compacted.

.5 Finish rolling:

.1 Accomplish finish rolling with two-axle or three-axle tandem steel wheeled rollers while material is still warm enough for removal of roller marks.

.1 If necessary to obtain desired surface finish, use pneumatic-tired rollers as directed by Consultant.

.2 Conduct rolling operations in close sequence.

3.7 JOINTS

.1 General:

.1 Remove surplus material from surface of previously laid strip.

.1 Do not deposit on surface of freshly laid strip.

.2 Construct joints between asphalt concrete pavement and Portland cement concrete pavement as indicated.

.3 Paint contact surfaces of existing structures such as manholes, curbs or gutters with bituminous material prior to placing adjacent pavement.

.2 Transverse joints:

.1 Offset transverse joint in succeeding lifts by at least 600 mm.

.2 Cut back to full depth vertical face and tack face with thin coat of hot asphalt prior to continuing paving.

.3 Compact transverse joints to provide smooth riding surface. Use methods to prevent rounding of compacted surface at joints.

.3 Longitudinal joints:

.1 Offset longitudinal joints in succeeding lifts by at least 150 mm.

.2 Overlap previously laid strip with spreader by 25 to 50 mm.

.3 Before rolling, carefully remove and discard coarse aggregate in material overlapping joint with lute or rake.

.4 Roll longitudinal joints directly behind paving operation.

.5 When rolling with static or vibratory rollers, have most of drum width ride on newly placed lane with remaining 150 mm extending onto previously placed and compacted lane.

.4 Construct feather joints so that thinner portion of joint contains fine graded material obtained by changed mix design or by raking out coarse aggregate in mix.

.1 Place and compact joint to ensure joint is smooth and without visible breaks in grade.

.2 Locate feather joints as indicated.

.5 Construct butt joints as indicated.

3.8 FINISH TOLERANCES

.1 Finished asphalt surface to be within 5 mm of design elevation but not uniformly high or low.

.2 Finished asphalt surface not to have irregularities exceeding 5 mm when checked with 4.5 m straight edge placed in any direction.

3.9 DEFECTIVE WORK

.1 Correct irregularities which develop before completion of rolling by loosening surface mix and removing or adding material as required.

.1 If irregularities or defects remain after final compaction, remove surface course promptly and lay new material to form true and even surface and compact immediately to specified density.

.2 Repair areas showing checking, rippling, or segregation.

.3 Adjust roller operation and screed settings on paver to prevent further defects such as rippling and checking of pavement.

3.10 CLEANING

.1 Progress Cleaning:

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

.2 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment.

.3 Waste Management: separate waste materials for reuse or recycling.

.1 Remove recycling containers and bins from site and dispose of materials at appropriate facility.

3.11 TESTING

.1 Marshall Extraction and Sieve of Asphalt: one test for each 400 tonnes of asphalt minimum one per day.

.2 Nuclear density testing of asphalt: one test per 250 square metres of asphalt.

.3 Corning of finished asphalt for thickness and one density text for each 500 square metres of surface.

END OF SECTION

Part 1 General

1.1 RELATED REQUIREMENTS

.1 Section 32 11 16.01 Granular Sub-base.

1.2 REFERENCES

.1 ASTM International

.1 ASTM C136, Standard Test Method for Sieve Analysis of Fine and Coarse Aggregates.

.2 ASTM C117, Standard Test Method for Material Finer Than 0.075 mm (No. 200) Sieve in Mineral Aggregates by Washing.

.3 ASTM D4318, Standard Test Method for Liquid Limit, Plastic Limit and Plasticity Index of Soils.

.4 ASTM D698, Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft^3 (600 kN-m/m^3).

.2 Canadian General Standards Board (CGSB)

.1 CAN/CGSB-8.1, Sieves, Testing, Woven Wire, Inch Series.

.2 CAN/CGSB-8.2, Sieves, Testing, Woven Wire, Metric.

1.3 ADMINISTRATIVE REQUIREMENTS

.1 Scheduling: co-ordinate paving schedule to minimize interference with normal use of premises.

1.4 ACTION AND INFORMATIONAL SUBMITTALS

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

1.5 DELIVERY, STORAGE AND HANDLING

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

.2 Store crushed stone as and where directed by Consultant.

.3 Packaging Waste Management: remove for reuse and return pallets, crates, padding, packaging materials.

Part 2 Products

2.1 MATERIALS

.1 Granular sub-base: in accordance with Section 32 11 16.01 Granular Sub-base.

.2 Granular base: in accordance with Section 32 11 23 Aggregate Base Courses.

.3 Crusher dust topping: crushed rock screenings; free from shale, clay, organic matter and debris; to approved sample; gradation within the following limits. Submit sieve analysis of source material for Consultant review.

Sieve Size (mm)	%Passing
9.5	100
4.8	50 to 80
1.1	20 to 55
0.425	10 to 30
0.075	3 to 12

.4 Landscape Fabric: Geotex 601 Landscape Fabric, or approved equivalent.

Part 3 Execution

3.1 SUBGRADE

.1 Ensure subgrade preparation conforms to levels and compaction required, to allow for installation of granular base.

3.2 GRANULAR SUB-BASE

.1 Granular sub-base material minimum thickness: as indicated.

.2 Place material in uniform layers not to exceed 150 mm compacted thickness.

.1 Compact layer in accordance with Section 32 11 16.01 Granular Sub-base.

3.3 CRUSHED STONE SURFACING

.1 Granular base material: in accordance with Section 32 11 23 Aggregate Base Courses.

.2 Place material in uniform layers not to exceed 150 mm.

.1 Compact layer to 100% Standard Density in accordance with ASTM D698.

3.4 FIELD QUALITY CONTROL

.1 Inspection and testing of crushed stone paving: carried out by designated testing laboratory.

3.5 CLEANING

.1 Progress Cleaning:

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

.2 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment.

.3 Waste Management: separate waste materials for reuse or recycling.

.1 Remove recycling containers and bins from site and dispose of materials at appropriate facility.

3.6 PROTECTION

.1 Prevent damage to buildings, landscaping, curbs, sidewalks, trees, fences, roads and adjacent property.

.1 Repair damages incurred.

3.7 TESTING

.1 Same requirement as specified in 32 11 23 Aggregate Base Courses.

END OF SECTION

Approved: 2006-12-31

Part 1 General

1.1 RELATED REQUIREMENTS

.1 Section 32 11 16.01 Granular Sub-base.

1.2 REFERENCES

.1 American Society for Testing and Materials International (ASTM)

.1 ASTM C117, Standard Test Method for Materials Finer than 0.075 mm (No. 200) Sieve in Mineral Aggregates by Washing.

.2 ASTM C136, Standard Test Method for Sieve Analysis of Fine and Coarse Aggregates.

.3 ASTM D260, Standard Specification for Boiled Linseed Oil.

.4 ASTM D698, Standard Test Method for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400ft-lbf/ft^3) (600 kN-m/m^3).

.2 Canadian General Standards Board (CGSB)

.1 CAN/CGSB-3.3, Kerosene, Amend. No. 1, National Standard of Canada.

.2 CAN/CGSB-8.1, Sieves, Testing, Woven Wire, Inch Series.

.3 Canadian Standards Association (CSA International)

.1 CSA-A23.1/A23.2, Concrete Materials and Methods of Concrete Construction/Methods of Test and Standard Practices for Concrete.

1.3 ACTION AND INFORMATIONAL SUBMITTALS

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

.2 Submit concrete mix design for concrete curbs 4 weeks prior to start of construction.

1.4 DELIVERY, STORAGE AND HANDLING

.1 Waste Management and Disposal:

.1 Separate waste materials for reuse and recycling.

Part 2 Products

2.1 MATERIALS

.1 Concrete mixes and materials: in accordance with Section 03 30 00 - Cast-in-Place Concrete.

.2 Table: Class of Concrete:

Class	Location	(MPa)	Cement Type	Aggregate Max. (mm)	Slump (mm)	Total Air Content (%)

A	Extruded Curb	32	GU	20	30±10	6±1
B	Handed-formed C&G	32	GU	20	75±20	6±1

.3 Reinforcing steel: in accordance with Section 03 20 00 - Concrete Reinforcing.

.4 Joint filler and Curing Compound: in accordance with Section 03 30 00 - Cast-in-Place Concrete.

.5 Granular base: material to Section 32 11 16.01 Granular Sub-base.

.6 Non-staining mineral type form release agent: chemically active release agents containing compounds that react with free lime to provide water-soluble soap.

.7 Fill material: to Section 32 11 16.01 Granular Sub-base.

Part 3 Execution

3.1 GRADE PREPARATION

.1 Do grade preparation work in accordance with Section 31 24 13 Roadway Embankments.

.2 Construct embankments using excavated material free from organic matter or other objectionable materials.

.1 Dispose of surplus and unsuitable excavated off site.

.3 When constructing embankment provide for minimum 1.0 m shoulders, where applicable, outside of neat lines of concrete.

.4 Place fill in maximum 150 mm layers and compact to at least 97 % of maximum dry density to ASTM D698.

3.2 GRANULAR BASE

.1 Obtain Consultant's approval of subgrade before placing granular base.

.2 Place granular base material to lines, widths, and depths as indicated.

.3 Compact granular base in maximum 150 mm layers to at least 97 % of maximum density to ASTM D698.

3.3 CONCRETE

.1 Obtain Consultant's approval of granular base and reinforcing steel prior to placing concrete.

.2 Do concrete work in accordance with Section 03 30 00 - Cast-in-Place Concrete.

.3 Immediately after floating, give sidewalk surface uniform broom finish to produce regular corrugations not exceeding 2 mm deep, by drawing broom in direction normal to centre line.

.4 Provide edging as indicated with 10 mm radius edging tool.

.5 Slip-form pavers equipped with string line system for line and grade control may be used if quality of work acceptable to Consultant can be demonstrated. Hand finish surfaces when directed by Consultant.

3.4 TOLERANCES

.1 Finish surfaces to within 3 mm in 3 m as measured with 3 m straightedge placed on surface.

3.5 EXPANSION AND CONTRACTION JOINTS

.1 Install tooled transverse contraction joints after floating, when concrete is stiff, but still plastic, at intervals of 3.0 m.

.2 Install expansion joints at intervals of 6 m.

.3 When sidewalk is adjacent to curb, make joints of curb, gutters and sidewalk coincide.

3.6 CURING

.1 Apply curing compound evenly to form continuous film, in accordance with manufacturer's requirements.

3.7 BACKFILL

.1 Allow concrete to cure for 7 days prior to backfilling.

.2 Backfill to designated elevations with material as directed by Consultant.

.1 Compact and shape to required contours as indicated.

3.8 CLEANING

.1 On completion and verification of performance of installation, remove surplus materials, excess materials, rubbish, tools and equipment.

3.9 TESTING

.1 Concrete testing sidewalks and curbs: one complete test as defined by the CSA for each 50 cubic metres or portion thereof per day per class or supplier of concrete.

END OF SECTION

PART 1 General

1.1 SUBMITTALS

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

.2 Product Data:

.1 Submit manufacturer's printed product literature, specifications and data sheet.

.3 Shop Drawings:

.1 Indicate location, type, size, arrangement, anchor and mounting details.

1.2 CLOSEOUT SUBMITTALS

.1 Provide maintenance data for incorporation into manual specified in Section 01 78 00 - Closeout Submittals.

1.3 STORAGE AND PROTECTION

.1 Deliver, store, handle and protect materials in accordance with Section 01 61 00 - Common Product Requirements.

PART 2 Products

2.1 PRODUCTS

.1 Fence Fabric: 50 mm mesh by 9 gauge, zinc coated after weaving. Minimum zinc coating to be 490 grams per square metre of surface area.

.2 Fabric height: 1,830 mm unless otherwise indicated.

.3 Terminal and Straining Posts: The terminal posts and straining posts shall be 90 mm O.D. with minimum weight of 11.24 kg per metre, Schedule 40 pipe, zinc coated with minimum coating of 490 grams per square metre. The minimum length of terminal posts and straining posts shall be 2,900 mm

.4 Line Posts: Posts shall be 60 mm O.D. with minimum weight of 5.43 kg per metre, Schedule 40 pipe, zinc coated with minimum coating of 490 grams per square metre. The minimum length of line posts shall be 2,670 mm unless otherwise indicated.

.5 Top Rails and Pipe Braces: The top rails and pipe braces shall be 43 mm O.D., Schedule 40 pipe, zinc coated with minimum coating of 490 grams per square metre.

.6 Top and Bottom Wire: Wire shall be Number 6 Gauge, single strand 57 grams electro-galvanized and be stretched taut along the top and bottom of the fabric fastened at 460 mm intervals

.7 Gate Frames: Gate frames are to be made of 43 mm O.D., Schedule 40 pipe, zinc coated with minimum coating of 490 grams per square metre. All joints to be electrically welded. Gates are to be supplied complete with zinc coated malleable iron

hinges, latch and latch catch. Double gates to have centre rest with drop bolt for closed position and chain hold open. Gate latches are to be suitable for padlock which can be attached and operated from either side of gate. Hinges are to permit gate to swing back 180 degrees against fence. Gate braces shall be 33 mm O.D. zinc coated steel pipe with minimum coating of 490 grams per square metre.

.8 Accessories: other components such as tension bars, bands, rail ends, terminal post tops, line post tops, top rail sleeves, wire ties, nuts, bolts, and washers to be zinc coated steel with a minimum coating of 490 grams per square metre.

PART 3 Execution

3.1 INSTALLATION

.1 Embed terminal posts and straining posts 900 mm. Set terminal posts and straining posts plumb and in accordance with the alignment staked.

.2 Straining posts shall be installed as per the manufacturer's instructions.

.3 Brace terminal sections, straining sections and corner sections with a pipe brace as per the manufacturer's instructions and as shown in the detailed plans and specifications.

.4 Attach fence fabric, wire ties, top rail, pipe braces, tension bar and fittings to the posts and assembled according to the manufacturer's instructions and as specified on the plans as designated by the Engineer.

.5 The chain link fence fabric shall be attached to the inside of the posts facing the dust collector. Gates open in the direction shown on the drawings.

END OF SECTION

Part 1 General

1.1 WORK INCLUDED

.1 Landscape irrigation system.

1.2 RELATED WORK

.1 Section 32 92 23 - Sodding

.2 Section 32 93 10 - Planting

.3 Section 32 93 20 - Landscape Maintenance

1.3 LAYING OUT WORK AND INSPECTIONS

.1 Lay out work and be responsible for accuracy. Provide the necessary personnel to assist the Consultant in checking the work.

.2 Coordinate with other contractors working on-site. In particular, ensure coordination with contractors undertaking landscape development, roadways, walkways, underground services and other work directly affected by, or which will have an affect on, irrigation installation.

.3 The Consultant will not be responsible for coordinating work of the various contractors working on site.

.4 Stake locations of heads and valves and review with the Consultant prior to excavation and installation.

.5 Do not allow, nor cause, work to be covered or enclosed until it has been inspected, tested, and approved by the Consultant. Should work be enclosed or covered before such inspection, uncover work at Contractor expense; after inspection and approval make all repairs with equal materials necessary to restore work, and that of other Contractors, to original condition.

1.4 TESTING AND ADJUSTING

.1 Upon completion of the installation, the entire system shall be tested. Air shall be flushed from the pipes and all components shall be checked for proper operation. The system shall not be accepted by the Consultant until all portions are operating as intended and until all deficiencies have been corrected.

.2 Balance and adjust the various components of the irrigation system so that the overall operation is efficient and coverage is uniform.

1.5 AS-BUILT PLAN / MAINTENANCE MANUALS

.1 Upon completion of the work, provide the Consultant with an as-built plan showing the exact location of all components of the system, and four (4) copies of a manual outlining system operation, procedures and maintenance instructions.

.2 The maintenance manuals shall include product information, controller operation and programming instructions, servicing and replacement procedures for all sprinklers and valves, and procedures for blowing out the system in the fall and charging the system in the spring.

1.6 MAINTENANCE (BEFORE WARRANTY PERIOD)

.1 Be responsible for all aspects of system maintenance from completion of installation to date of Substantial Performance of the Work.

.2 System maintenance shall include, but not necessarily be limited to, servicing, repair and replacement of system components as required for efficient operation and uniform coverage.

1.7 MAINTENANCE (DURING WARRANTY PERIOD)

.1 Test and adjust all equipment for smooth trouble-free operation of the irrigation system at the start of the warranty period.

.2 Defects or misalignment of any part of the work caused by settlement of bedding or backfill material within the warranty period shall be corrected at Contractor expense.

.3 Emergency repairs may be required to protect property or permit operation of the work. The Owner shall notify the Contractor immediately, who shall make all necessary repairs. The cost of such emergency repairs shall be paid by the Contractor. Maintenance not of an emergency nature shall be brought to the attention of the Contractor, in writing, who shall take the necessary action to correct the faulty work.

.4 Blow-out all irrigation water lines prior to freeze-up in the fall (October) of the year of completion of the maintenance contract, and reconnect the irrigation system in the spring of the following year.

.5 Notify the Owner and Landscape Contractor two (2) weeks prior to blowing out the system to allow the proper watering-in of plant material prior to fall freeze up.

.6 At the end of the maintenance period, provide on-site orientation to familiarize the maintenance personnel with the operation of the irrigation system and locations of control equipment.

1.8 WARRANTY

.1 All irrigation system equipment and installation shall be warranted for two full years following the date of Substantial Performance of the Work. Exempted is equipment and installation damaged, after date of Substantial Performance of the Work, by accidental causes or vandalism.

.2 End of warranty inspection will be conducted.

Part 2 Products

2.1 PIPE

.1 Underground irrigation pipe: low density minimum Series 75 polyethylene (P.E.) pipe conforming to current CSA B137.0 and CSA B137.1.

2.2 FITTINGS AND CONNECTORS

.1 Pipe fittings: PVC insert fittings with stainless steel clamps and Rainbird brass saddles with stainless steel bolts.

.2 Risers: threaded schedule 80 PVC pipe unless otherwise specified.

2.3 SPRINKLERS AND NOZZLES

.1 Sprays: Hunter, PS Ultra, with nozzle type and size as noted, or approved equivalent.

2.4 QUICK COUPLING VALVES

.1 Hunter HQ-3RC, or approved equivalent.

2.5 MANUAL VALVES

.1 Manual valves at water connections and on lines over 50mm: iron body, flanged ends, 1380 kPa W.O.G. gate valve with bronze trim and non-rising stem. Use Newman Hatterly 150's, Kitz #75, Crane #461 or Red and white #415A.

.2 Ball valves - 50 mm and smaller use bronze body, screwed ends, full port, 1380 kPa W.O.G. with chromium plated bronze ball and teflon seat. Use Newman Hatterly 1969F Kitz #58, Crane #9322 or TOYO 5044A.

2.6 VALVE BOXES

.1 For automatic and manual valves, and quick couplers: approved fibreglass reinforced plastic boxes complete with bolt down cover; Carson or approved equal.

.2 Granular backfill: 19 mm diameter crushed stone, washed.

2.7 SLEEVES

.1 Install sleeves at locations where lines and/or wires pass under walks and roads.

.2 Sleeves shall extend a minimum of 300mm beyond edge of surfaces.

.3 Sleeves to be 2 dimensional sizes larger than pipe diameter to allow clear passage of all water lines.

.4 Sleeves in areas subject to pedestrian traffic shall conform to the following:

.1 PVC: SDR-35, SDR-28

.2 Polyethylene: 50 mm and under, to CSA B137.1 Series 75

.3 ABS: DB-2, or approved equal.

.4 Pipe sleeves shall be one continuous length.

2.8 CONTROL LINES

.1 CSA approved, 14 gauge direct burial UF-UL listed TWU-40 wire with the common wire white and the tracer wire green. All other wires can be any colour except white or green.

2.9 ZONE CONTROL VALVES

.1 Hunter PGV Series or approved equivalent; sizes to match incoming line size.

.2 All automatic electric valves shall have plastic or brass ID tags labelled clearly to match numbers at controller.

2.10 RAIN SENSOR

.1 Hunter, Model Rain-Click or approved equivalent.

2.11 WATER MAIN CONNECTION

.1 At location noted on the drawing.

2.12 CONTROLLER

.1 Hunter, Pro-C Series, wall mounted with lockable case, or approved equivalent.

Part 3 Execution

3.1 EXCAVATION

.1 Excavation shall be unclassified and shall include all materials encountered except material which cannot be excavated by normal chain trenching methods. Such exceptions shall be brought to the attention of the Consultant and an adjustment in price shall be agreed upon before excavation of these areas proceeds. Such price adjustments and agreements shall include responsibility for disposal of the unsuitable materials removed from the trench and the acquiring of additional backfill material.

.2 Depth of cover: minimum 300 mm except where structural requirements and underground service lines interfere. These areas shall have a maximum allowable depth of cover.

.3 Backfill material shall be free from rocks, large stones, and other unsuitable materials which could damage the pipe or create unusual settling problems. Backfilling shall be in maximum 150 mm layers and tamped after each layer to prevent excessive settling.

.4 Avoid damage to any and all existing trees and shrubs including those planted concurrent with the irrigation installation. Where possible, place lines outside the drip line of existing trees. Hand trench around existing trees to avoid damage to root systems. Review conflicts with Consultant.

.5 Avoid damage to any and all underground utilities and structures. Notify utility companies including the power, gas and telephone and have locations staked prior to commencing excavations.

3.2 INSTALLATION OF PIPES AND SLEEVES

.1 Installation of pipes and fittings shall be in accordance with the manufacturer's instructions and shall proceed from the point of connection to supply. Pipes shall be secured to prevent excessive movement from water pressures. Double clamp all connections on continuously pressurized lines.

.2 Sprinkler connections to pipe: approved brass saddles with stainless steel bolts. See detail.

.3 Polyethylene pipe may be installed by standard trenching techniques or by pulling in pipe. If the pull-in method is used, the pipe plow shall be a vibratory type. The mole or bullet, which precedes the pipe and is used to form the opening for the pipe, shall not be less than 25 mm larger in diameter than the outside diameter of the pipe. Hand dig trenches where lines are close to existing structures.

.4 Install sleeves with the top of the pipe 300 to 400 mm below finished grade. Extend sleeves 300 mm beyond hard surfaces and mark locations on the edges of walks and curbs with Tapcon screws or other approved method. Verify with Consultant.

3.3 SPRINKLERS

.1 Pop-up sprinklers in turf areas shall be installed with top slightly above finished grade, level and marked to prevent damage by other equipment during construction. Where heads are adjacent to walks and curbs, install heads 12 mm below top surface of concrete.

.2 All threaded connections shall be wrapped with two layers of teflon tape.

.3 Backfill around the swing joint and sprinkler heads shall be free of rocks larger than 12 mm diameter, roots, debris, and other extraneous matter.

3.4 MANUAL AND AUTOMATIC VALVES

.1 Install valves at the location shown on the plan, according to manufacturer's instructions, in a valve box set plumb and flush with the surface. Provide 75 mm depth granular backfill at base.

.2 Label all electric valves with weather resistant tags attached to the handles indicating valve number and controller.

.3 Valve cover shall be bolted/locked down.

3.5 CONTROL WIRES

.1 Control wires shall be installed in a neat and orderly fashion and may be installed in the pipe trenches or in separate trenches. The wires shall be bundled together and taped every 1.5 m.

.2 Splicing shall be minimized. Where required, splices shall be made waterproof with the use of waterproof splice connection kits.

.3 All 24 volt wiring shall be installed in accordance with existing codes.

.4 Install wires in galvanized steel conduit from controller to 300 below grade.

.5 Wires inside the building shall be installed in conduit.

3.6 RAIN SENSOR

.1 Sensor shall be installed per manufacturer’s directions in location where rain sensing head will receive direct rainfall, above spray of sprinklers and not under leaves, tree branches etc.

.2 Confirm location with Consultant prior to installation.

.3 Wires shall be installed in conduit.

3.7 WATER CONNECTION

.1 Water service connection shall be made by the Contractor at the location shown on the plan.

3.8 CONTROLLER

.1 Automatic Controller shall be installed on the wall according to the manufacturer’s recommendations at the location shown on the drawing.

.2 Coordinate with other infrastructure.

END OF SECTION

Part 1 General

1.1 WORK INCLUDED

.1 Topsoil, planting mix, fertilizer and finish grading.

1.2 RELATED WORK

.1 Section 32 93 10 - Planting

.2 Section 32 92 20 – Seeding

.3 Section 32 92 23 - Sodding

1.3 SOIL TESTS

.1 Stockpiled topsoil will be available on site.

.2 Conduct soil tests of topsoil and planting mix as required to determine recommended soil amendments and fertilizer compositions for seeding and planting. Samples shall be taken in accordance with recommendations of ALS Laboratory Group, 819 58th Street East, 306-668-8370, Saskatoon, SK. Testing regimen as follows:

.1 PSA-2 (Particle size analysis)

.2 C-TOT-ORG (Total organic carbon)

.3 SAL-DETAIL+TGR (detailed salinity)

.4 Soil Analysis Package 1 (For NPKS – with recommendations)

.3 Soil tests shall be paid for by the Contractor and shall be conducted by an approved testing laboratory.

.4 Submit two (2) copies of soil test results and fertilizer recommendations to the Consultant for review.

1.4 WASTE MANAGEMENT AND DISPOSAL

.1 Separate and recycle waste materials in accordance with Section 01 74 21 - Construction Waste Management and Disposal.

Part 2 Products

2.1 MATERIALS

.1 Topsoil: stockpiled and imported material shall be free from subsoil, roots, grass, weeds, toxic materials, stones and foreign objects, and shall be subject to analysis by a testing laboratory before use. Topsoil shall consist of black topsoil, a fertile, friable natural loam, neither heavy clay nor very light sand, consisting of not less than 4% organic matter for clay loams and not less than 2% for sandy loams, with an acidity value ranging from pH 6.0 to 8.0. Amend as recommended by soil tests. Topsoil to be screened and in a moist, not wet, condition when incorporated into the work. Submit a one (1) litre sample to Consultant for approval prior to incorporation into the work.

.2 Peatmoss: derived from partially decomposed fibrous or cellular stems and leaves of species of Sphagnum Mosses; elastic and homogeneous, brown in colour; free of wood and

deleterious material which could prohibit growth; maximum shredded particle size: 5 mm; to approved sample.

.3 Sand: homogeneous, sharp-grained, 0.5 – 1.5 mm; to approved sample

.4 Planting mix: 60% topsoil, 20% peatmoss or well-rotted manure, 20% sand; to approved sample.

.5 Fertilizer: Complete commercial synthetic slow release fertilizer with maximum 35% water soluble nitrogen; uniform in composition and free flowing. Formulation ratio: as recommended by soil tests.

Part 3 Execution

3.1 COORDINATION

.1 Ensure proper scheduling of work to avoid conflicts with completed and intended work.

3.2 PREPARATION

.1 Eliminate uneven areas and low spots from areas that have been rough graded. Ensure positive drainage in accordance with grading plans. Notify Consultant of grading problems before proceeding. Remove debris, roots, tree shoots, branches, stones in excess of 50 mm diameter and other extraneous materials. Remove subsoil that has been contaminated with oil, gasoline, calcium chloride or other undesirable chemicals. Dispose of removed materials off site on a daily basis and at a location approved by local officials.

.2 Cultivate all areas, which are to receive planting mix and topsoil to depth of 100 mm. Repeat cultivation in those areas where equipment used for hauling and spreading has compacted the subgrade.

.3 Do not damage structures, trees, or other materials adjacent to landscaped areas.

3.3 PLANTING MIX

.1 Do not spread planting mix or topsoil until Consultant has inspected subgrade.

.2 Spread planting mix with adequate moisture in uniform layers during dry weather over approved, dry, unfrozen subgrade, where in raised planters and plaza beds as indicated.

.3 Bring planting mix to finish grade

.4 Uniformly place planting mix as indicated in maximum 150 mm loose lifts to the following minimum compacted depths:

.1 100 mm topsoil for seeded and sodded areas.

.2 450 mm planting mix for planting beds.

.3 200 mm planting mix for grasses in rock swale area.

.4 Compact each lift to minimum 90% Standard Proctor Density.

3.4 FERTILIZER

.1 Apply fertilizer at least 6 days before seeding or planting.

.2 Spread fertilizer uniformly with mechanical spreaders at rate determined on basis of soil tests.

.3 Incorporate fertilizer thoroughly into upper 50 mm of growing media.

3.5 FINISH GRADING

.1 Remove stones, roots, grass, debris and foreign non organic objects from growing media.

.2 Manually spread material in planting beds and turf areas.

.3 Fine grade entire landscaped area. Eliminate rough spots and low areas to ensure positive drainage. Notify Consultant of grading problems before proceeding.

.4 Leave surface smooth and uniform, with a fine loose texture.

END OF SECTION

Part 1 General

1.1 WORK INCLUDED

.1 Seed and application of seed.

1.2 RELATED WORK

.1 Section 32 91 21 – Topsoil & Finish Grading
.2 Section 32 92 23 – Sodding
.3 Section 32 93 10 – Planting
.4 Section 32 93 20 – Landscape Maintenance

1.3 WASTE MANAGEMENT AND DISPOSAL

.1 Separate and recycle waste materials in accordance with Section 01 74 21 - Construction Waste Management and Disposal.

Part 2 Products

2.1 MATERIALS

.1 Grass seed: Certified Canada No. 1 Grade to Government of Canada Seeds Regulations and having minimum germination of 75% and minimum purity of 97%.

2.2 SEED MIX (by weight)

30% Canada blue var. Reubens or Canon
30% Creeping red fescue (Festuca. rubra) Var: Aberdeen, Jasper 2,
20% Hard fescue (Festuca duriscul) Var. Spartan, Aurora
15% Nakiska sheeps fescue (Festuca ovina)
5% Annual Rye, Oats or Barley

Seed at a rate of 2.2 kg/100 m2

2.3 HYDRO-MULCH

.1 All seeded areas are to be hydro-mulched.

.2 Hydro-mulch:

.1 Straw: oat, barley, alfalfa or wheat straw, reasonably free from weeds and foreign matter detrimental to plant life.

.2 Fibre: wood or wood cellulose fibre free of germination or growth-inhibiting ingredients and forming blotter like ground cover allowing absorption and percolation of water.

.3 Tackifier: plant derived hydrocolloid polysaccharide (guar), organic psyllium fiber, or water dilatable liquid dispersion containing thermoplastic resin.

Part 3 Execution

3.1 SEEDING

.1 Provide seed mix tag to consultant for review prior to start of seeding preparation.

.2 Areas to be seeded shall be harrowed once with a landscape harrow to a maximum depth of 50 mm.

.3 Fertilize: Section 32 91 21

.4 Seed shall be evenly applied with an approved mechanical seeder. Seeding shall be done in two operations at right angles to one another.

.5 Sow during calm weather (winds less than 10 km/h), using equipment suitable for area involved. Sow half of required amount of seed in one direction and remainder at right angles. Incorporate seed into soil to a maximum depth of 13 mm simultaneously or within one hour after seeding operation. Mix carefully with light chain harrow or wire rakes.

.6 Water with fine spray, avoiding washing out of seed. Apply enough water to ensure penetration of minimum 50 mm.

.7 Protect seeded areas against damage. Maintain protection until acceptance of seeded areas.

.8 Reseed at 2 week intervals where germination has failed.

3.2 HYDRO-MULCH

.1 Confirm hydro-mulch mix and application methods with Consultant prior to application.

.2 After grading and seeding are completed apply hydro-mulch per manufacturer's recommendations.

3.3 ESTABLISHMENT

.1 Keep soil moist during germination period and adequately water seeded areas until accepted by Consultant.

.2 Apply water to ensure moisture penetration of 50 to 100 mm. Control watering to prevent wash-outs.

.3 Be responsible for protection of seeded areas, including installation of temporary barriers if necessary.

.4 Cut grass when it reaches height of 75mm, and cut to a height of 50mm. Evenly distribute (do not remove) clippings which exceed 10 mm in depth.

.5 Maintain grassed areas free of weeds and disease.

3.4 ACCEPTANCE

.1 Seeded areas will be accepted provided that:

.1 Seeded areas are properly established and true to grade.

.2 Turf is free of eroded, bare, or dead spots and 90 - 95% free of weeds.

.3 No surface soil is visible when grass has been cut to height of 65 mm.

.4 Seeded areas have been cut at least twice, the last cut being carried out within 24 hours of acceptance.

.2 Areas seeded in fall will be accepted in the following spring one month after start of growing season provided acceptance conditions are fulfilled.

END OF SECTION

3.6 MAINTENANCE MANUALS

.1 Submit four (4) copies of a landscape maintenance manual to Consultant for review. Prepare in accordance with Close-Out Procedures. Include brief statements on the following aspects of work: mowing and care of turf; fertilizing; weed and disease control; watering; care of plant material; and pruning.

3.7 CONTRACTOR RESPONSIBILITY

.1 Prior to warranty expiration, ensure that the Owner is prepared to carry out maintenance operations. Familiarize grounds keeping staff with proper maintenance practices, in addition to the written instructions.

END OF SECTION

Part 1 General

1.1 WORK INCLUDED

.1 Supply and installation of sod.

1.2 RELATED WORK

.1 Section 32 84 10 - Irrigation

.2 Section 32 91 21 - Topsoil and Finish Grading

.3 Section 32 92 20 - Seeding

.4 Section 32 93 10 - Planting

.5 Section 32 93 20 - Landscape Maintenance

Part 2 Products

2.1 MATERIALS

.1 Sod: All sod shall be Certified No. 1 grade cultivated turf grass, grown in accordance with CNTA classifications. At time of sale it must have a strong, fibrous root system and be free of stone and burned or bare spots. It shall be composed of a minimum of 60% Kentucky Bluegrass (Poa pratensis). Field or pasture sod shall not be accepted. The sod shall not contain more than ten (10) broadleaf weeds per 45 square meters and shall be free of disease. The sod shall be of sufficient density that no surface soil will be visible when mowed to a height of 40 mm. The sod shall be cut a minimum of 25 mm in thickness and in no cases shall it exceed 40 mm in thickness. All sod supplied shall be mowed to a height of 50 mm prior to delivery.

.2 Fertilizer: shall be high in phosphorus (eg. 11-48-0). Exact formulation ratio and application rates to be as directed by Consultant. Fertilizer shall be uniform in composition, dry and free-flowing, and shall be delivered to the site in the original unopened containers, each bearing the manufacturer's guaranteed analysis. Any fertilizers which become caked or otherwise unsuitable for use, will not be accepted.

.3 Water: shall be potable and free of minerals which may be detrimental to plant growth.

.4 Wooden Pegs: (when required) shall be 25 x 25 x 230 mm in length. Ensure pegs are long enough to securely anchor sod.

Part 3 Execution

3.1 LAYING OF SOD

.1 Immediately, or as soon as possible after delivery to the site, lay the sod. Do not allow to dry before laying. Lay sod evenly and closely packed together, using an alternate pattern. Roll and pack entire sodded area to form an even surface. Complete sodded areas including patching, watering and rolling within 48 hours of laying.

.2 Edge sod to form neat 1000 mm diameter circular openings at the base of all trees. Place a full row of sod, not less than 300 mm in width, along the perimeter of sodded areas adjacent to the edges of shrub beds, walks, curbs and walls.

.3 Thoroughly water sodded areas within 24 hours of laying sod. After watering, roll edges to form an even surface and to adjoin level with existing grades, and +/- 20 mm below adjacent walks and curbs.

.4 Do not lay sod when in a frozen state or in weather conditions unfavourable for transplanting or for growth.

3.2 ACCEPTANCE

.1 Sodded areas will be accepted provided that:

.2 Sodded areas are properly established and true to grade.

.3 Sod is free of bare and dead spots and without weeds.

.4 No surface soil is visible when grass has been cut to height of 50 mm.

.5 Sodded areas have been cut at least twice, the last cut being carried out within 24 hours of acceptance.

.6 Lawns sodded in fall, after the normal growing period, will be accepted in the following spring one month after start of growing season provided acceptance conditions are fulfilled.

END OF SECTION

Part 1 General

1.1 WORK INCLUDED

.1 Supply and installation of plant material.

1.2 RELATED WORK

.1 Section 32 91 21 – Topsoil & Finish Grading

.2 Section 32 93 15 – Mulches

.3 Section 32 93 20 – Landscape Maintenance

1.3 SOURCE QUALITY CONTROL

.1 The nursery source shall be located in a hardiness zone 3a or hardier. Contractor to notify Consultant of source of material at least 7 days in advance of shipment.

.2 No work under this Section is to proceed without written approval of plant material at source.

.3 Imported plant material must be accompanied with necessary permits and import licenses. Contractor to conform to all federal, provincial and municipal regulations.

.4 Roses shall be sourced from areas free of the pathogen *Phytophthora ramorum*.

1.4 SHIPMENT AND PRE-PLANTING CARE

.1 Contractor to coordinate shipping of plants and excavation of holes to ensure minimum time lapse between digging and planting.

.2 Contractors to tie branches of trees and shrubs securely and protect plant material against abrasion, exposure and extreme temperature change during transit. Avoid binding of planting stock with rope or wire which would damage bark, break branches or destroy natural shape of plant. Give full support to root ball of large trees during lifting.

.3 Cover plant foliage with tarpaulin, and protect bare roots by means of dampened straw, peat moss, saw dust or other acceptable material to prevent loss of moisture during transit and storage.

.4 Remove broken and damaged roots with sharp pruning shears. Make clean cut and cover cuts over 10 mm diameter with wound dressing.

.5 Keep roots moist and protected from sun and wind. Heel-in trees and shrubs, which cannot be planted immediately, in shaded areas and water well.

1.5 SUBSTITUTIONS

.1 Species and/or size substitutions of plant material may be required by the Landscape Contractor for availability and/or horticultural reasons.

.2 Substitutions must be approved in advance of bid closing in accordance with the bidding process. No substitutions will be considered after bid closing date except under extraordinary circumstances.

1.6 LAYING OUT WORK

.1 Lay out work and be responsible for accuracy. Provide the necessary personnel to assist the Consultant in checking the proposed plant locations.

1.7 GUARANTEE

.1 The Contractor shall agree to guarantee to replace and replant any plant material found dead or in poor condition within two year of the date of substantial completion, without cost to the Owner. "Poor condition" shall be interpreted as meaning plant material on which the branches are dead or dying, or have not shown satisfactory growth of leaves in the judgement of the Consultant.

.2 The Contractor shall not be held responsible for plant material destroyed by vandalism, after substantial performance is achieved.

.3 Required replacements shall be made promptly and replacements of all unsatisfactory trees and shrubs continue, with all costs borne by the contractor, until the original numbers planted are satisfactory and complete.

.4 The Consultant reserves the right to extend Contractor's warranty responsibilities for an additional one year if, at the end of the initial warranty period, leaf development and growth is not sufficient to indicate future survival.

1.8 REPLACEMENTS

.1 During warranty period, promptly remove from site any plant material that has died or failed to grow satisfactorily as determined by the Consultant.

.2 Replace plant material in the next planting season.

.3 Extend warranty on replacement plant material for a period equal to the original warranty period.

.4 Continue such replacement and warranty until plant material is acceptable.

.5 Flag replaced plant material securely with surveyors flagging.

1.9 CONTRACTOR QUALIFICATIONS

.1 Contractors supplying and/or installing plant material are required, at the discretion of the Consultant, to be Members in-good-standing of the Saskatchewan or Canadian Nursery Landscape Association. Upon request, provide evidence of such standing to the satisfaction of the Consultant.

1.10 WASTE MANAGEMENT AND DISPOSAL

.1 Separate and recycle waste materials in accordance with Section 01 74 21 - Construction Waste Management and Disposal.

Part 2 Products

2.1 MATERIALS

.1 Water: potable and free of minerals which may be detrimental to plant growth.

.2 Stakes: T-bar steel stakes 40 x 40 x 5 x 2440 mm or wood 30 x 38 x 2400 mm and as noted on deciduous tree planting detail.

.3 Rails & post – Pressure treated wood; 75-100 diam. x 2000 long posts; 38 x 140 rails.

.4 Cables and accessories: factory galvanized cables, wire tighteners, eyebolts and turnbuckles. Use turnbuckles with 150 mm long eyebolts and 10 mm diameter threaded opening for tightening. Use approved horticultural guy wire tightener as shown on details.

.5 Guy wires: steel wire stand to CSA G4-M1977 at following sizes.

.1 Shrubs and trees under 75 mm calliper use 2.5 mm wire.

.2 Trees 75 to 150 mm calliper use 3 mm wire.

.3 Trees 150 to 500 mm calliper use 3 strands of 4 mm wire twisted together or Grade 110, 8 mm 7 strand cable.

.4 Trees 500 to 750 mm calliper use Grade 110, 10 mm 7 strand cable.

.5 Trees over 750 mm calliper use Grade 160, 10 mm 7 strand cable.

.6 Eyebolts: coarse threaded galvanized steel at following sizes:

.1 Trees 150 – 500 mm calliper use 10 mm diameter.

.2 Trees 500 – 750 mm calliper use 12 mm diameter.

.3 Trees over 750 mm calliper use 15 mm diameter.

.7 Tree rings: fabricated from 3 mm galvanized wire encased in two ply reinforced 12 mm diameter rubber garden hose or equivalent.

.8 Arbortape: 19 mm flat, woven polypropylene tree tie material.

.9 Tree wrapping material: new clean, plain burlap minimum 2.5 kg/m2 mass and 150 mm wide.

.10 Anchors: T-bar steel stakes 40 x 40 x 5 x 500 mm long or wood stakes 38 x 38 x 500 mm long.

.11 Anti-desiccant: wax-like emulsion to provide film over plant surfaces reducing evaporation but permeable enough to permit transpiration. Product to be a horticulturally accepted one, and one approved by Consultant.

.12 Wound dressing: horticulturally accepted non-toxic, non-hardening emulsion.

.13 Rodent guard: horticulturally accepted plastic / vinyl wrap with ventilation holes, or approved equivalent.

2.2 PLANT MATERIAL

.1 Quality and source to comply with latest edition of the “Canadian Standards for Nursery Stock”, by the Canadian Nursery Landscape Association, referring to size and development of plant material and root ball. Measure plants when branches are in their natural position. Height and spread dimension refer to main body of plant and not from branch tip to branch tip. Use plant material of No. 1 grade. Conifers from Christmas tree lots are unacceptable.

.2 Plants shall be true to type and species shown on the project plans and at least one plant in each group of plants of the same species delivered to the project shall be tagged with a weatherproof label stating both the botanical and common name of the plants in the group.

.3 Plant material shall be of the species and size indicated.

.4 Additional plant material requirements.

.1 Use trees and shrubs with strong fibrous root systems; free of disease, insects, defects or injuries; and structurally sound. Use trees with straight trunks, well and characteristically branched for species. Plants must have been root pruned regularly, but not later than one growing season prior to arrival on site.

.2 Trees over 50 mm caliper must have been half root pruned during each of two successive growing seasons, the latter at least one growing season prior to arrival on site.

.3 Plant material that has come out of dormant stage and is too far advanced will not be accepted unless prior approval is obtained.

.4 Cold storage: approval shall be required for plant material which has been held in cold storage.

.5 Container-grown stock: acceptable if containers are large enough for root development. Trees and shrubs must have grown in container for minimum of one growing season but not longer than two. Root system must be able to "hold" soil when removed from container. Plants that have become root bound are not acceptable. Container stock must have been fertilized with slow releasing fertilizer.

.6 Balled and burlapped stock: coniferous and broad-leafed evergreens must be dug with soil ball. Deciduous trees in excess of 3 m height must have been dug with large firm ball. Root balls must include 75% of fibrous and feeder root system. This excludes use of native trees grown in light sandy or rocky soil. Secure root balls with burlap, heavy twine and rope. For large trees: wrap ball in double layer of burlap and drum lace with minimum 10 mm diameter rope. Protect root balls against sudden changes in temperature and exposure to heavy rainfall.

.7 Tree spade dug material: dig plant material with mechanized digging equipment of hydraulic spade of clam-shell type. Lift root ball from hole, place in wire basket designed for purpose and lined with burlap. Tie basket to ball with heavy rope. Take care not to injure trunk of tree with wire basket ties or rope. The following shall govern the material size allowable for transplant by tree spade method unless otherwise directed by the Consultant.

Tree Spade Size	Caliper (taken 300 mm Above ground)	Tree Height
1120 mm	Maximum 100 mm	3.0 – 3.6 m
1680 mm	Maximum 150 mm	3.6 – 4.2 m
2140 mm	Maximum 200 mm	4.2 – 4.8 m

.8 Collected or native plant material: use only native trees indigenous to area into which they are to be transplanted. Select trees from reasonably open stands. Trees must have well developed crowns and must be characteristically branched. Not more than 40% of overall tree height may be free of branches. Collected or native plant material use is acceptable only upon written approval by Consultant.

.9 Substitutions of plant material as indicated on planting plan are not permitted unless written approval has been obtained as to type, variety and size. Approved plant substitutions must be of equal size to those originally specified.

.10 In the event that discrepancies occur between the quantities of plants as indicated in the plant list and those indicated on the drawing, the plant quantities on the drawing shall govern.

.11 Rejected plant material shall be promptly removed from the project site.

Part 3 Execution

3.1 WORKMANSHIP

.1 Stake out location of trees and planting beds as per planting plan. Obtain approval prior to excavating.

.2 Apply anti-desiccant in accordance with manufacturer's instructions.

.3 Coordinate operations. Keep site clean and planting holes drained. Immediately remove soil or debris spilled onto pavement.

3.2 PLANTING TIME

.1 With the exception of container stock, plant material is to be planted only during dormant period before buds have broken, or after leaf drop in autumn, unless permission has been obtained from the Consultant. Plant material noted for spring planting only, must be planted in dormant period.

.2 Plant material imported from region with warmer climatic conditions may only be planted in early spring or late fall.

.3 When permission has been obtained to plant deciduous plant material after buds have broken, spray plants with anti-desiccant to slow down transpiration prior to transplanting.

.4 Plant balled and burlapped evergreens in spring before bud break, or after the middle of August. Apply antidesiccant to evergreens before digging.

.5 Trees, shrubs and ground covers growing in containers may be planted throughout the growing season.

.6 Bare root stock to be used only when specified by the Consultant, and to be planted only in early spring before bud break, or in fall after leaf drop.

.7 Plant only under conditions that are conducive to health and physical conditions of plants.

.8 Contractor to provide planting schedule. Extending planting operations over long period using limited crew will not be accepted.

3.3 EXCAVATION

.1 Shrub beds: excavate to minimum depth of 450 mm.

.2 Individual shrubs: excavate planting holes 450 mm deep and to a diameter twice that of the root ball or container.

.3 Perennials: excavate to minimum depth of 200 mm.

.4 Trees 50 mm cal. and less excavate holes 600 mm deep with diameter of 500 mm greater than root spread of root ball.

.5 Trees larger than 50 mm cal. excavate to depth of at least 200 mm deeper than height of root ball, with width of 750 mm greater than diameter of root ball. In heavy soils, increase planting holes by 50 mm for each 100 mm of root ball diameter.

.6 Protect bottom of excavation against freezing.

.7 Remove water which enters excavations prior to planting. Ensure source of water is not ground water.

3.4 PLANTING

.1 Planting shall not be done in soil that is excessively moist or otherwise in a condition not satisfactory for planting in accordance with accepted horticultural practice.

.2 Plants in containers shall be planted and watered the same day the container is cut or removed.

.3 Plants shall be removed from containers in such a manner that the root ball is not broken. Plants with broken root balls or with root balls that fall apart while being planted will be rejected.

.4 Scarify bottom of planting hole to depth of 150 to 200 mm. Cover bottom of each excavation with minimum of 150 mm of soil mixture. If planting pits are dug with tree spade or power auger and 'glazing' occurs, scarify sides of planting pits as well.

.5 Plant trees and shrubs vertically with roots placed straight out in hole. Orient plant material to give best appearance in relation to structure, roads and walks.

.6 Place plant material to depth equal to depth they were originally growing. Confirm that final nursery planting has not buried any bark tissue.

.7 With balled and burlapped root balls, loosen burlap and cut away the top 1/3 without disturbing root ball. Do not pull burlap or rope from under root ball. With container stock, remove entire container without disturbing root ball. Non bio-degradable wrappings must be removed. When root balls are in wire baskets, cut off or fold back the top 1/3 of the basket without damaging root ball, so as to ensure that after planting no wire shall be present in the top 300 mm of soil.

.8 With frozen ball material, mulch planting pit to prevent freezing.

.9 Tree spade excavated material:

.1 Dig tree pit with same mechanical equipment as used to dig plant material. Ensure hole is upright as possible. Place in hole a mixture of planting soil, superphosphate fertilizer (0-20-2) at a rate of 0.6 kg per cubic metre, and enough water to create a soupy consistency. This will be forced up sides of ball as root ball is placed in hole.

.10 During the planting of bare-rooted stock, first shake backfill of planting soil among the roots.

.11 Tamp planting soil around root system in layers of 150 mm eliminating air voids. Frozen or saturated planting soil is not acceptable. When 2/3 of planting soil has been placed, fill hole with water. After water has completely penetrated into soil, complete backfilling.

.12 Build 100 mm deep saucer around outer edge of hole to assist with maintenance watering.

.13 Install rabbit / rodent guard to minimum height of 100cm with bottom and top snuggly secured around trunk.

.14 When planting is completed, give surface of planting saucer dressing of organic 10-6-4 fertilizer at rate of 12 kg/100 m^2 for shrub beds or 40 to 50 g/mm of caliper for trees. Mix fertilizer thoroughly with top layer of planting soil and water in well.

3.5 TREE SUPPORT

.1 Tree support is shown on planting details.

.2 Install Arbortape using Arborknot techniques per manufacturer's instructions.

.3 Staking for trees up to 3 m and evergeens up to 2 m in height: Backfill planting hole 2/3, drive T-rail stake 900 mm into bottom of pit, taking care not to damage main roots. Fasten trunk to stake or anchor with tree ring. Different methods of fastening tree trunk to stake or anchor are acceptable if no damage to bark of tree will occur. Obtain approval prior to use other methods.

.4 Guy wires for trees up to 150 mm caliper:

.1 For deciduous trees taller than 3 m and evergreens taller that 2 m, fasten three wires to tree where a branch will prevent wires from slipping down. Use rubber hose to prevent abrasion of bark.

.2 Fasten guy wires to anchors at distance from tree base equal to height of where wire is attached to trunk. Break wires, install wire tighteners and tighten slightly.

.3 Where guy wires are used close to pedestrian traffic ways, fasten approved flags to wire or paint turnbuckles orange to make them clearly visible.

.4 Use sufficient number of guy wires to support large shrubs.

.5 Guy wires for trees over 150 mm caliper:

.1 Maintain tree in correct position with 4 guys spaced at equal intervals.

.2 Fix guys at 2/3 height of evergreens, above bottom branches of deciduous trees or at least half tree height.

.3 Secure guys to anchors at 45^0 angle to trunk of tree.

.4 Position each anchor at right angles to trunk in pit 1200 mm deep. Tamp planting soil around root system in 150 mm layers to eliminate air voids.

.5 Secure guys to trees with four eyebolts spaced at vertical intervals of 150 mm minimum by drilling trunk same diameter as eyebolt. Use nuts and washers. Dress ends with wound dressing.

.6 Secure cable ends with cable splicing bolts.

.7 Where guy wires are used close to pedestrian traffic ways, fasten approved flags to wires or paint turnbuckles orange to make them clearly visible.

3.6 PRUNING

.1 Prune trees and shrubs after planting, as indicated, to compensate for loss of roots suffered during transplanting. Postpone pruning, of those trees where heavy bleeding may occur, until in full leaf. Employ clean sharp tools and make cuts flush with main branch, smooth and sloping as to prevent accumulation of water. Remove projecting stumps on trunks or main branches. Remove dead and injured branches and branches that rub causing damage to bark. Trim out crown of trees and shrubs without changing their natural shape. Do not damage lead branches or remove smaller twigs along main branches. Treat cuts in excess of 40 mm diameter and damaged parts with application of wound dressing.

3.7 MAINTENANCE

.1 Water once a week for first 4 weeks and then sufficiently thereafter to maintain optimum growing conditions. Ensure adequate moisture in root zone at freeze-up.

.2 Keep soil, within confines of planting saucer around trees and planting beds, shallowly cultivated and free from weeds.

.3 Spray plants to combat pests and diseases. Do not use DDT or sprays prohibited by Agriculture Canada.

.4 Keep tree guards, guy wires and rodent guard in proper repair.

.5 Provide adequate protection against winter damage including damage caused by rodents.

.6 Maintain plant material from date of planting up to end of warranty period.

.7 Remove truck wrapping, trees stakes, guy wires, and eyebolts at end of warranty period.

.8 Provide landscape maintenance as outlined in Section 32 93 20.

END OF SECTION

Part 1 General

1.1 WORK INCLUDED

.1 Supply and installation of mulches.

1.2 RELATED WORK

.1 Section 32 91 21 - Topsoil and Finish Grading

.2 Section 32 93 10 - Planting

.3 Section 32 93 20 - Landscape Maintenance

1.3 LAYING OUT WORK

.1 Lay out work and be responsible for accuracy. Provide the necessary personnel to assist the Consultant in checking the work.

1.4 WASTE MANAGEMENT AND DISPOSAL

.1 Separate and recycle waste materials in accordance with Section 01 74 21 - Construction Waste Management and Disposal.

Part 2 Products

2.1 WOOD MULCH

.1 Untreated shredded fibres produced by mills in Northern Saskatchewan. Submit sample, to Consultant for approval, prior to incorporation into the work.

2.2 ROCK MULCH

.1 Type A: Washed, round rock; well-graded mix of 400+ mm diameter stones. Submit representative sample, to Consultant for approval, prior to incorporation into the work.

.2 Type B: Washed, angular rock; well graded mix of 10 – 20 mm diameter stones submit one (1) litre sample, to Consultant for approval, prior to incorporation into the work.

2.3 LANDSCAPE FABRIC

.1 Geotex 601 Landscape Fabric, or approved equivalent.

Part 3 Execution

3.1 WOOD MULCH

.1 Rough grade to finish grade. Ensure positive drainage. Eliminate rough areas and compact as required for proper installation of wood mulch.

.2 Carefully place landscape fabric with minimum 150 mm overlap on parallel seams. Pin fabric securely in place. Wrap fabric as noted in detail.

.3 Carefully cut holes in landscape fabric in plant locations.

.4 After plant material is installed, distribute wood mulch evenly over areas indicated. Install mulch to a minimum uniform compacted depth 50mm (100mm loose) in watering saucers of trees in grass area and planting beds as noted.

.5 Taper mulch to base of trees and shrubs ensuring that mulch does not touch base. Spray with water to settle mulch in place.

.6 Ensure no fabric is visible upon completion.

3.2 ROCK MULCH

.1 Rough grade to finish grade. Ensure positive drainage. Eliminate rough areas and compact as required for proper installation of rock mulch.

.2 Carefully place landscape fabric with minimum 150 mm overlap on parallel seams. Pin fabric securely in place. Wrap fabric as indicated in details.

.3 Carefully cut holes in landscape fabric in plant locations.

.4 After plant material is installed, distribute stones as indicated. Place stones carefully to ensure that stones do not damage plant material located in stone mulch areas.

.5 Ensure no fabric is visible upon completion.

END OF SECTION

Part 1 General

1.1 WORK INCLUDED

.1 Maintenance of turf areas, mulched areas, planting beds, irrigation system and plant material from the start of the work until two years past the date of substantial performance, concurrent with the warranty.

.2 In general, annual maintenance is expected to occur from 01 May to 31 October. Site and weather conditions may extend or shorten the maintenance period.

1.2 RELATED WORK

.1 All landscape development sections.

1.3 COORDINATION & MANAGEMENT

.1 Coordinate maintenance operations with the Owner and any other contractors who may be working on site.

.2 Written guidelines are no substitute for on site observations. Modify maintenance procedures as required to provide the best care while adhering to sound horticultural principles.

1.4 WASTE MANAGEMENT AND DISPOSAL

.1 Separate and recycle waste materials in accordance with Section 01 74 21 - Construction Waste Management and Disposal.

Part 2 Products

2.1 CHEMICALS

.1 Insecticides, herbicides, fungicides, and other chemicals intended for use in the landscape shall be in accordance with Regina Public schools Municipal, Provincial and Federal regulations.

.2 Chemicals to be applied by a licensed applicator for the specific product.

2.2 EQUIPMENT AND TOOLS

.1 Equipment and tools shall be suitable for the work and in good working order.

.2 Mowers: size suitable to the work to be performed, in good working order and with sharp blades.

Part 3 Execution

3.1 WORKMANSHIP

.1 Program timing of operations to growth and weather conditions.

.2 Do each operation promptly, continuously and complete within reasonable time period.

.3 Do not store equipment and materials on-site without Owner approval.

.4 Collect and dispose of debris, refuse and excess material, from landscape areas, on daily basis.

.5 Operations and procedures shall be discussed with, and approved by, the Owner or his representative prior to commencement of work. Operations to be coordinated with work that may be undertaken by the Owner or others.

.6 Keep a maintenance logbook of work performed, date, time and personnel performing task. Provide a copy of monthly logs with monthly invoice.

.7 Conduct soil analysis in spring. Review fertilizer recommendations and compare with amounts recommended in this document; adjust as required.

3.2 TURF MAINTENANCE

.1 General

.1 Maintain existing turf including mowing, fertilizer and weed control.

.2 Remove weeds, including their roots.

.3 Report vandalism and site maintenance problems and issues to the Owner.

.2 Spring Clean-up and Preparation:

.1 Remove all weeds and volunteer plants from turf areas.

.3 Watering:

.1 Ensure turf is watered twice per week or per irrigation schedule. A minimum moisture penetration of 100 - 150 mm is required. Specific site conditions may require adjustments to watering program in order to appropriately meet the turf water requirements.

.4 Mowing:

.1 Mow at regular intervals (minimum weekly or more frequent following fertilization) to keep grass length at 60 mm. Maximum recommended grass length is 75 to 90mm before cutting.

.2 Evenly distribute (do not remove) grass clippings throughout the turf areas.

.3 Maintain sharpened mower blades.

.5 Turf Fertilizing Guidelines:

.1 Apply a balanced fertilizer (such as 14-14-0) two times a year (May and August), as per manufacturer's directions. If growing problems are evident, apply a fertilizer that will eliminate soil deficiencies determined by soil analysis.

.2 Apply fertilizer when turf is dry and humidity is low. Use liquid fertilizer in areas of sub-surface irrigation. Water immediately after application.

.3 Uniformly apply to turf at the rate recommended by soil tests.

.6 Herbicides and Pesticides:

.1 Avoid the use of chemical control whenever possible.

.2 Use in accordance with the manufacturer's recommendations and in conformance with applicable regulations.

.7 Fall/Winter Preparation:

.1 Ensure turf is watered once every two to three weeks in the fall to harden off the lawn.

.2 Rake fallen leaves and remove from site

3.3 PLANT MATERIAL MAINTENANCE

.1 General:

.1 Maintain existing trees, shrubs and perennials including fertilizer, weed control and pruning.

.2 Remove weeds, including their roots, from planting beds.

.2 Spring Clean-up and Preparation:

.1 Remove all weeds and volunteer plants from planting beds.

.2 Hose down coniferous trees and shrubs to wash off winter grime.

.3 Remove and dispose of any trash or detritus found in planting beds.

.4 Cultivate tree wells. Place additional mulch where settling has occurred. Use mulch to match original installation.

.5 Tighten or adjust tree staking and guying (remove or install as necessary).

.6 Review pruning needs. Prune all dead or damaged branches from plants. Remove spent flowers, stems and leaves from perennials.

.3 Watering Program:

.1 Review soil moisture conditions during regular maintenance to ensure root systems are receiving an adequate supply of water. Around perennial and groundcovers, ensure top 50mm of soil below mulch is moist.

.4 Cultivation:

.1 Cultivate tree wells and planting beds once each month during the growing season to control weed growth and keep mulch from matting. Avoid damage to roots.

.2 Maintain depth of tree watering saucers at 100 to 150 mm.

.5 Pruning:

.1 Do not prune coniferous trees and shrubs unless limbs have been broken or extend into pedestrian traffic routes.

.2 Prune deciduous trees and shrubs as follows:

.1 Remove broken branches.

.2 Thin out the canopy by removing dead, dying, crossed, rubbing or weaker branches.

.3 Treat all cuts and scrapes 25 mm or larger with a horticulturally accepted non-toxic, non-hardening emulsion.

.3 Cut off spent flower and seed stalks below foliage levels when and as required for orderly appearance.

.6 Soil Fertilizing Guidelines:

.1 Fertilize trees and shrubs in May or June.

.2 Use a low-analysis or slow release fertilizer; formulation and application rates based on soil analysis, or as follows:

.1 For shrubs 1800 mm or taller: 0.5 - 2.5 kg fertilizer per year.

.2 For shrubs 1200 - 1800 mm high: 0.5 kg. fertilizer per year.

.3 For shrubs 1200 mm or shorter: 0.2 kg. fertilizer per year.

.4 Apply 0.2 kg. fertilizer for each 25 mm caliper as measured 300 mm above ground level.

.3 Apply liquid fertilizer on the ground or injected into the ground, extending to the edge of the tree canopy.

.7 Mulch:

.1 Maintain a uniform compacted mulch depth. Remove weeds and turf from mulched areas.

.2 Clean up any mulch that may have been displaced from planting beds and islands.

.8 Herbicides and Pesticides:

.1 Avoid the use of chemical control whenever possible.

.2 Use in accordance with the manufacturer's recommendations.

.9 Fall/Winter Preparations:

.1 Ensure plants are watered every three to four weeks in the fall to harden off trees and shrubs. As leaves drop off, if soil is moist, watering may be stopped until freeze-in. Be responsible for supply of water after irrigation system has been blown out.

.2 Cultivate shrub beds to loosen mulch. Foliage on perennials should be left for spring removal to assist in plant identification. Mulch perennial beds, if required.

.3 Rake fallen leaves from plant beds and remove from site.

3.4 PEST CONTROL

.1 Be responsible for control of destructive and invasive pests including, but not necessarily limited to, domestic animals, wild animals, birds, insects and rodents.

.2 Repair damage caused by pests; replace products as required to maintain vigorous landscape.

3.5 REPLACEMENTS

.1 Products and materials damaged by accidental causes or vandalism, after the date of Substantial Performance of the work, shall be promptly replaced as an additional service.

.2 Obtain Owner approval for additional charges prior to undertaking replacements.

3.6 MAINTENANCE MANUALS

.1 Submit four (4) copies of a landscape maintenance manual to Consultant for review. Prepare in accordance with Close-Out Procedures. Include brief statements on the following aspects of work: mowing and care of turf; fertilizing; weed and disease control; watering; care of plant material; and pruning.

3.7 CONTRACTOR RESPONSIBILITY

.1 Prior to warranty expiration, ensure that the Owner is prepared to carry out maintenance operations. Familiarize grounds keeping staff with proper maintenance practices, in addition to the written instructions.

END OF SECTION

Approved: 2011-06-30

Part 1 General

1.1 RELATED REQUIREMENTS

.1 Section 31 37 00 Rip-Rap.

1.2 REFERENCES

.1 ASTM International

.1 ASTM C14M, Standard Specification for Nonreinforced Concrete Sewer, Storm Drain and Culvert Pipe (Metric).

.2 ASTM C76M, Standard Specification for Reinforced Concrete Culvert, Storm Drain and Sewer Pipe (Metric).

.3 ASTM C117, Standard Test Method for Material Finer Than 0.075 mm (No. 200) Sieve in Mineral Aggregates by Washing.

.4 ASTM C136, Standard Test Method for Sieve Analysis of Fine and Coarse Aggregates.

.5 ASTM C144, Standard Specification for Aggregate for Masonry Mortar.

.6 ASTM C443M, Standard Specification for Joints for Concrete Pipe and Manholes, Using Rubber Gaskets (Metric).

.7 ASTM D698, Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft^3 (600 kN-m/m^3)).

.8 ASTM D1248, Standard Specification for Polyethylene Plastics Extrusion Materials For Wire and Cable.

.9 ASTM F667, Standard Specification for Large Diameter Corrugated Polyethylene Pipe and Fittings.

.2 Canadian General Standards Board (CGSB)

.1 CAN/CGSB-8.1, Sieves, Testing, Woven Wire, Inch Series.

.2 CAN/CGSB-8.2, Sieves, Testing, Woven Wire, Metric.

.3 CSA International

.1 CSA A3000, Cementitious Materials Compendium.

.2 CSA A257 Series, Standards for Concrete Pipe and Manhole Sections.

.3 CAN/CSA G401, Corrugated Steel Pipe Products.

.4 U.S. Environmental Protection Agency (EPA) / Office of Water

.1 EPA 832/R-92-005, Storm Water Management for Construction Activities: Developing Pollution Prevention Plans and Best Management Practices.

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 pipes and backfill and include product characteristics, performance criteria, physical size, finish and limitations.

.3 Certification: to be marked on pipe.

1.4 DELIVERY, STORAGE AND HANDLING

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

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

.3 Storage and Handling Requirements:

.1 Store materials in accordance with manufacturer's recommendations.

.2 Store and protect pipes from damage.

.3 Replace defective or damaged materials with new.

.4 Packaging Waste Management: remove for reuse and return by manufacturer of pallets, crates, padding, packaging materials.

Part 2 Products

2.1 CORRUGATED STEEL PIPE

.1 Corrugated steel pipe: to CAN/CSA-G401.

.2 Prefabricated end sections wing walls: as indicated.

2.2 GRANULAR BEDDING AND BACKFILL

.1 Granular bedding and backfill material to the following requirements:

.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-8.1 CAN/CGSB-8.2.

.2 Table:

Sieve Designation	% Passing
19 mm	-100
12.5 mm	-
9.5 mm	-
4.75 mm	25-85
2.00 mm	-
0.425 mm	5-30
0.180 mm	-
0.075 mm	0-10

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 pipe culvert installation in accordance with manufacturer's written instructions.

.1 Inform Consultant of unacceptable conditions immediately upon discovery.

.2 Proceed with installation only after unacceptable conditions have been remedied.

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 construction until permanent vegetation has been established.

.3 Remove erosion and sedimentation controls and restore and stabilize areas disturbed during removal.

3.3 TRENCHING

.1 Obtain Consultant's approval of trench line and depth prior to placing bedding material or pipe.

3.4 BEDDING

.1 Dewater excavation, as necessary, to allow placement of culvert bedding in dry condition.

.2 Place 200 mm minimum thickness of approved granular material on bottom of excavation and compact to 95% minimum of corrected maximum dry density.

.3 Shape bedding to fit lower segment of pipe exterior so that width of at least 50% of pipe diameter is in close contact with bedding and to camber as indicated or as directed by Consultant, free from sags or high points.

.4 Place bedding in unfrozen condition.

3.5 LAYING CORRUGATED STEEL PIPE CULVERTS

.1 Begin pipe placing at downstream end.

.2 Ensure bottom of pipe is in contact with shaped bed or compacted fill throughout its length.

.3 Lay pipe with outside circumferential laps facing upstream and longitudinal laps or seams at side or quarter points.

.4 Lay paved invert or partially lined pipe with longitudinal centre line of paved segment coinciding with flow line.

.5 Do not allow water to flow through pipes during construction except as permitted by Consultant.

3.6 JOINTS: CORRUGATED STEEL CULVERTS

.1 Corrugated steel pipe:

.1 Match corrugations or indentations of coupler with pipe sections before tightening.

.2 Tap couplers firmly as they are being tightened, to take up slack and ensure snug fit.

.3 Insert and tighten bolts.

.4 Repair spots where damage has occurred to spelter coating by applying two coats of zinc rich epoxy paint.

3.7 BACKFILLING

.1 Backfill around and over culverts as indicated or as directed by Consultant.

.2 Place granular backfill material, in 150 mm layers to full width, alternately on each side of culvert, so as not to displace it laterally or vertically.

.3 Compact each layer to 95 % corrected maximum dry density taking special care to obtain required density under haunches.

.4 Protect installed culvert with minimum 600 mm cover of compacted fill before heavy equipment is permitted to cross.

.5 Place backfill in unfrozen condition.

3.8 FLUMING

.1 Assemble and install fluming as indicated.

.2 Set top edges of fluming flush with side slope.

3.9 CLEANING

.1 Progress Cleaning:

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

.2 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment.

.3 Waste Management: separate waste materials for reuse or recycling.

.1 Remove recycling containers and bins from site and dispose of materials at appropriate facility.

END OF SECTION