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Project No. PRO1285

Hwy 16
East Gate – Km 0.8
Jasper East Gate

Jasper National Park

Parks Canada Agency

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Communications Horizontal Cablings

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SPECIFICATIONS
JASPER EAST GATE
Jasper, Alberta**

for:

Parks Canada

Issued for IFT
Project Number: PRO 1285

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Reference Documents:

1. Standard CMS Translations Rev 1 Nov 2016
2. Construction Signage Translation Rev 1 Nov 2016
3. ATCO Proposal
4. Geotechnical Report – December 19, 2016

01 11 00 SUMMARY OF WORK

Part 1 General

1.1 PRECEDENCE

- .1 For Federal Government projects, Division 1 Sections take precedence over technical specification sections in other Divisions of this Project Manual.

1.2 DEFINITIONS

- .1 British Columbia Ministry of Transportation and Infrastructure is referred to as "MoTI".
 - .1 BC MoTI specifications specified for the work can be found at the following website address:
<http://www2.gov.bc.ca/gov/content/transportation/transportation-infrastructure/engineering-standards-guidelines/standard-specifications-for-highway-construction>
- .2 Alberta Transportation is referred to as "AT".
 - .1 AT specifications specified for the work can be found at the following AT website address:
http://www.transportation.alberta.ca/images/Standard_Specifications_for_Highway_Construction_2013.pdf
- .3 Changes in Definition, - The following changes in definitions have been made to the "BC MoTI Specifications":
 - .1 Ministry Representative – The word "Ministry Representative" shall mean Parks Canada Departmental Representative or their duly appointed representative.
 - .2 Ministry – The word "Ministry" shall mean Parks Canada Agency.
- .4 Changes in Definition, - The following changes in definitions have been made to the "AT Specifications":
 - .1 Consultant – The word "Consultant" shall mean Departmental Representative or their duly appointed representative.
 - .2 Department – The word "Department" shall mean Parks Canada Agency.
- .5 Jasper National Park of Canada is referred to as "JNP".
- .6 Parks Canada Agency is referred to as "PCA".
- .7 Canadian Pacific Railway is referred to as "CP Rail".
- .8 Environmental Surveillance Officer is referred to as "ESO".
- .9 Site means the areas on or within the limits of Construction as referenced on the Drawings and/or described in the Contract Documents.
- .10 Work means the provision of all labour, services, material, and equipment as necessary, for the Contractor to complete and perform its obligations in accordance with the Contract.

1.3 PROJECT LOCATION

- .1 The project is located in Jasper National Park, Alberta. Construction work is on Highway 16 at the East Gate (Km 0.8). The following are key locations relative to the project:

- .1 Hwy 16 km 0 – JNP East Boundary
- .2 Hwy 16 km 0.8 – JNP East Gate
- .3 Hwy 16 km 7.8 – Miette Road Intersection
- .4 Hwy 16 km 36.86 – Airport Road Intersection
- .5 Hwy 16 km 40.1 – Palisades Access
- .6 Hwy 16 km 42.7 – Transfer Station Access
- .7 Hwy 16 km 46.6 – Maligne Road Intersection
- .8 Hwy 16 km 48.46 – Connaught Drive Intersection
- .9 Hwy 16 km 51.4 – Hazel Avenue Intersection
- .10 Hwy 16 km 52.62 – Hwy 93N Intersection
- .11 Marmot Pit: 8.3 km South of Hwy 16 / Hwy 93N Intersection
- .12 8 Mile Pit: 12.4 km South of Hwy 16 / Hwy 93N Intersection

1.4 WORK COVERED BY CONTRACT DOCUMENTS

- .1 The project work consists of the construction of a new bypass and ticketing lane at the Jasper National Park east gate, as well as the erection of a new kiosk building. The new lanes will include an overhead variable message sign board, precast concrete barriers, and rigid concrete pavement. The existing lanes will also be rehabilitated by milling and placing new asphalt.
- .2 All requirements noted within the Contract Documents shall be completed by the Contractor unless specifically stated otherwise.
- .3 Without limiting the scope of work, the work of this Contract generally comprises the following, as directed by the Departmental Representative:
 - .1 The installation of a stopping concrete pad at the kiosk in accordance with Section 03 10 00, Section 03 20 00, and Section 03 30 00.
 - .2 The construction of the new kiosk and the related landscaping in accordance with Section 13 34 00 – Kiosk Construction and Landscaping. At least one indigenous Contractor, mentioned in Section 13 34 00, shall be engaged for landscaping portion of this work item.
 - .3 Clearing and grubbing of areas designated in the Contract documents and in accordance with Section 31 11 00 – Clearing and Grubbing. At least one indigenous Contractor, mentioned in Section 31 11 00, shall be engaged for this work item.
 - .4 Stripping of organic material designated in the Contract documents and in accordance with Section 31 24 13 – Roadway and Drainage Excavation.
 - .5 Installation and maintenance of temporary barriers and supply and installation of temporary traffic control and other temporary construction facilities required for completion of the Work of the Project.
 - .6 Removal of existing asphalt by milling and stockpiling material in accordance with Section 02 41 13 – Asphalt Pavement Removal.
 - .7 Excavating all types of material from the right-of-way cuts, hauling and placing this material in embankments or in stockpiles designated in the Contract documents and in accordance with Section 31 24 13 – Roadway and Drainage Excavation.

- .8 Supply and install Corrugated Steel Pipe (CSP) culverts at locations designated in the Contract documents and in accordance with Section 33 42 13 – Pipe Culverts
- .9 Supply, load, haul and place base course materials in accordance with Section 32 11 24 – Granular Base Course. AT Designation 2 Class 40 Base Course Aggregate to be supplied by the Contractor.
- .10 Supply, load, haul and place base course materials in accordance with Section 32 11 24 – Granular Base Course. AT Designation 2 Class 20 Base Course Aggregate to be supplied by the Contractor.
- .11 Supply and install geogrid pavement reinforcement in accordance with Section 31 32 19.
- .12 Perform mix design AT Mix Type H1 (16mm) Asphalt Concrete Pavement using 150-200A asphalt binder. AT Designation 1 Class 16 Asphalt Aggregate is to be supplied by the Contractor.
- .13 Use of processed Reclaimed Asphalt Pavement (RAP) material in hot mix asphalt construction is permitted to maximum 10% in accordance with AT Standard Specifications for Highway Construction Section 3.50 (latest edition) and as accepted by the Departmental Representative.
- .14 Purchase asphalt binder 150-200A, mix with aggregate, haul and place AT Mix Type H1 (16mm) Asphalt Concrete Pavement as directed by the Departmental Representative.
- .15 Installation of Riprap for headwalls and various drainage features.
- .16 Screening stripped material and placing it on finished slopes in accordance with Section 32 91 19. At least one indigenous Contractor, mentioned in Section 32 91 19, shall be engaged for this work item.
- .17 Supply and installation of hydroseeding on finished slopes in accordance with Section 32 92 22. At least one indigenous Contractor, mentioned in Section 32 92 22, shall be engaged for this work item.
- .18 Supply and installation of modified British Columbia Ministry of Highways Precast Concrete Traffic Barriers as shown on the IFC Drawings and as directed by the Departmental Representative.
- .19 Supply and install permanent delineators as shown on the IFC Drawings and as directed by the Departmental Representative.
- .20 Supply and paint temporary roadway paint markings during construction as required.
- .21 Permanent line markings to be installed at the completion of the work as shown on the IFC Drawings and as directed by the Departmental Representative
- .22 Supply and install regulatory signs.
- .23 Traffic signage, control and other traffic accommodations in accordance with Section 01 35 31.
- .24 Supply and install of guide posts in accordance with Section 32 17 31 – Guide Posts.
- .25 Supply and install W-Beam guardrail as shown on the IFC Drawings and as directed by the Departmental Representative.
- .26 Design and build of an overhead variable message sign in accordance with Section 35 10 01 – Overhead Variable Message Sign.

- .27 Miscellaneous Additional Work as directed by the Departmental Representative.
- .4 The Contractor will not be permitted to set up a crushing plant in the National Park.
- .5 The Contractor will not be permitted to set up a Mobile Asphalt Plant or use a Stationary Asphalt Plant in the National Park for this Project.
- .6 Water is available from Compound Road. The Contractor is responsible for sourcing water required for the Works and may be required to obtain it from outside of the National Parks. Accessing local water sources from other Parks facilities can be coordinated through the Departmental Representative but will require the Contractor to obtain a Restricted Access Permit and to adhere to all conditions contained therein. No water may be sourced from the submerged water table within the National Parks.
- .7 In preparation for and during construction of this project, an “Environmental Protection Plan” (EPP) is to be prepared by the Contractor to meet the requirements of Section 01 35 43 – Environmental Procedures to ensure the desired minimal adverse effects are achieved. The Contractor’s EPP must be approved by Parks Canada Agency prior to the commencement of construction. The Departmental Representative and Parks Canada’s environmental surveillance officer (ESO) will refer to the approved EPP in determining compliance with the plan and Contract specifications. The EPP will form part of the Contract.
- .8 Where material and construction specifications for work covered under the Contract, including any Change Orders are not available, **AT - Standard Specifications for Highway Construction (latest edition)** shall apply unless directed otherwise by the Departmental Representative.

1.5 CONTRACT METHOD

- .1 Construct Work under combined price Contract.

1.6 WORK BY OTHERS

- .1 The Contractor is advised that the following Work and anticipated completion in the vicinity has been or will be contracted by Parks Canada:
 - .1 Hwy 16 Passing Lanes: km 35 to km 38.7. Fall 2018
 - .2 Hwy 16 Intersection Works: km 36.85. Fall 2018
 - .3 Hwy 16 Paving: Km 30.76 to Km 34. Fall 2018
 - .4 Hwy 16 Intersection Works, km 40.1, km 42.8, and km 46.6, Spring 2017
 - .5 Hwy 16 Intersection Works, km 51.4, km 52.6, and km 46.6, Spring/Summer 2018.
 - .6 Hwy 16 Paving, km 39-41, km 45.8-48.1, and km 71 to West Gate, Spring/Summer 2018.
 - .7 Hwy 16 Meadow Creek Bridge Rehabilitation, Fall 2019
 - .8 Hwy 93A Road Rehabilitation, Fall 2018
 - .9 Hwy 16 Rock Scaling, km 61-66.5, Spring/Summer 2018.
 - .10 Line painting at various locations. Spring 2018
 - .11 Other projects and maintenance work may occur along Highway 16 in 2018 and 2019.
- .2 Where it is necessary that work is to proceed in areas of this project common to both the Contractor and forces of others, the Contractor shall cooperate with the other Contractors and the PCA Departmental Representative in reviewing their construction

schedules and sharing their work space, and shall coordinate their operations with the other Contractors, including traffic management and construction staging.

- .3 The Contractors shall coordinate all work on this project with other Contractors including Site Safety and Traffic Control.
- .4 The pits mentioned in the Contract Documents are operational pits and are used by many contractors and Parks Canada. The Contractor shall cooperate with the other users of the pits.

1.7 WORK SEQUENCE

- .1 Schedule work progress to allow Owner / Departmental Representative unrestricted access to inspect all phases of the Work.
- .2 Maintain fire and emergency access on the roadways at all times.
- .3 Co-ordinate Work with other Contractors / Departmental Representatives doing maintenance, survey / testing work.
- .4 The Contractor shall prepare a meaningful bar chart or network diagram showing the proposed schedules of major work, which shall be submitted to the Departmental Representative in accordance with 01 32 16 Construction Progress Schedules.
- .5 The Contractor shall:
 - .1 Complete all clearing, brushing, and grubbing before **April 14, 2018**.
 - .2 Obtain the Interim Certificate (Substantial Performance) by **October 20, 2018**.
 - .3 Complete all of the Work by **October 27, 2018** (Contract Completion Date).

1.8 CONTRACTOR USE OF PREMISES

- .1 Contractor has unrestricted use of site subject to Section 01 14 00 and Section 01 29 01, until Contract Completion date. The Contractor's use of the site is not exclusive of other contractors or work zones within the limits of this Contract.
- .2 Contractor shall limit use of premises for Work, for storage, and for access, to allow:
 - .1 Owner occupancy.
 - .2 Work by other Contractors.
- .3 Coordinate use of premises under direction of the Departmental Representative.
- .4 Obtain and pay for use of additional storage or work areas needed for operations under this Contract.
- .5 The Contractor and any subcontractors shall obtain a business license and vehicle work passes in accordance with 01 35 43 Environmental Procedures.

1.9 OWNER OCCUPANCY

- .1 Owner will occupy premises during entire construction period for execution of normal operations.
- .2 Cooperate with Owner in scheduling operations to minimize conflict and to facilitate Owner usage.
- .3 Contractor must allow access to the Work Site for other Contractors and PCA. It is up to the Contractor to plan their work accordingly.

1.10 OWNER FURNISHED ITEMS

- .1 None

1.11 CONSTRUCTION SIGNAGE

- .1 To be in accordance with Section 01 35 31 Special Procedures for Traffic Control.
- .2 Signage shall be coordinated with other Contractors.
- .3 No signs or advertisements, other than warning signs, are permitted on site.

1.12 SETTING OUT OF WORK

- .1 Departmental Representative will establish control points and provide:
 - .1 Detailed cross-section templates showing design centreline and shoulder grades.
 - .2 Complete set of construction Drawings.
 - .3 Alignment notes showing curve data and control point coordinates.
 - .4 Provide a list of control monuments including coordinates and elevations on request.
 - .5 Measurements for review (Quantity Surveys) and volumes by the surface to surface prismatic method for roadway and drainage excavation and neat line for all surfaces above the excavated surface at 20m intervals.
- .2 Contractor shall:
 - .1 Not permanently mark any infrastructure or feature during their setting out of the work. They shall fully remove any set out marks, markers, or other identifiers that they installed, prior to demobilizing from the Work Sites.
 - .2 Set additional control points as necessary.
 - .3 Set all work stakes necessary to complete work.
 - .4 Mark the extent of the construction footprint with survey stakes for the duration of the project.
 - .5 Allow sufficient time for Departmental Representative to take measurements for review.
 - .6 Not damage geodetic benchmarks or control monuments unless authorized by Departmental Representative
 - .7 Measurements for Payment (Quantity Surveys) and volumes by the surface to surface prismatic method for roadway and drainage excavation and neat line for all surfaces above the excavated surface at 20m intervals. Quantities to be verified and approved by the Departmental Representative.
- .3 No separate payment for setting out work, unless changes are made and approved by the Departmental Representative and additional survey costs are incurred.

Part 2 Products

- .1 To be in accordance with AT - Standard Specifications for Highway Construction (latest edition).

Part 3 Execution

- .1 To be in accordance AT - Standard Specifications for Highway Construction (latest edition).

END OF SECTION

01 14 00 WORK RESTRICTIONS**Part 1 General****1.1 ACCESS AND EGRESS**

- .1 All existing CP Rail accesses are to be maintained or relocated as required. Location and details of any proposed relocation to be approved by both CP Rail and PCA.
- .2 Provide for pedestrian, cyclist, and vehicular traffic for the duration of the construction.
- .3 Construction operations shall be conducted to cause minimal inconvenience to the public and to owners of adjoining property. Existing access to property shall be maintained as far as possible and if new access must be provided, every effort shall be taken to provide the new access before the existing access is removed. Contractor will be responsible for repairing any damage incurred, at the Contractor's cost.
- .4 The Contractor is responsible for the development and supply of construction access to the Work as approved by the Departmental Representative.

1.2 USE OF THE SITE AND FACILITIES

- .1 The Work Sites specified in the Contract shall only be used for the purposes of the Work.
- .2 The Work Site (limits shown on the Drawings) will be specified by Parks Canada and shall only be used for the purposes of the Work. The Work Site will be made available by Parks Canada to the Contractor for its non-exclusive use for the duration of the Work, unless otherwise provided in the Contract Documents.
- .3 The Contractor will not be permitted to set up a camp in the National Parks. PCA regulations prohibit anyone working within the Park from using public campground facilities.
- .4 Office-tool trailer may also be set up within the limits of the Contracts works. See Section 01 35 43 and Section 01 29 01.
- .5 The Contractor may laydown or park equipment along the Highway Right of Way outside the clear zone within the limits of the works.
- .6 Contractor shall maintain adequate drainage at the Work Site.
- .7 The Contractor shall keep the Work Site clean and free from accumulation of waste materials and rubbish regardless of source. Snow shall be removed by the Contractor as necessary and at their cost for the performance and inspection of the Work.
- .8 The Contractor shall provide sanitary facilities for work force in accordance with governing regulations and 01 35 43 Environmental Procedures. The Contractor shall post notices and take such precautions as required by local health authorities and keep area and premises in sanitary condition.
- .9 Any damage to the Work Site caused by the Contractor shall be repaired by the Contractor at their expense.
- .10 Pets shall not be brought to or maintained at the construction site.

1.3 WORKING TIMES

- .1 Work in JNP is permitted during daylight hours from 06:00 to 22:00, Monday to Sunday unless stipulated otherwise in the Contract documents.

- .2 The Contractor will not be permitted to work during the period of any Alberta or British Columbia statutory holiday long weekend. The Contractor will not be permitted to work during the following Civic Holidays or long weekends unless prior written approval is granted by the Departmental Representative:
- .3 Statutory and Civic Holidays (2018)
 - .1 BC Family Day weekend: From 19:00 Thursday February 8, 2018 to 07:00, Tuesday February 13, 2018.
 - .2 AB Family Day weekend: From 19:00 Thursday, February 16, 2018 to 07:00, Tuesday February 24, 2018.
 - .3 Good Friday weekend: From 22:00 Thursday, March 28, 2018 to 06:00 Monday, April 2, 2018.
 - .4 Victoria Day Weekend: From 22:00 Friday May 17, 2018 to 06:00 Tuesday, May 22, 2018.
 - .5 Canada Day weekend: From 22:00 Friday June 29, 2018 to 06:00 Tuesday, July 3, 2018.
 - .6 Heritage Day weekend: From 22:00 Friday August 3, 2018 to 06:00 Tuesday August 7, 2018.
 - .7 Labour Day long weekend: From 22:00. Friday, August 29, 2018 to 06:00 Tuesday, September 4, 2018.
 - .8 Thanksgiving Day weekend: From 22:00 Friday, October 5, 2018 to 06:00 Tuesday, October 10, 2018.
 - .9 Remembrance Day Weekend: From 22:00 Friday, November 9, 2018 to 06:00 Monday, November 13, 2018.
- .4 Variance of the Working Times and any others are provided on the strict condition of satisfactory performance in all requirements as determined at the Departmental Representative's discretion and may be revoked at any time for any reason. It is provided on the presumption that no additional costs or any delay will be attributed to Parks Canada in relation to conducting Works in accordance with the Variance and if that is not the case, the Contractor shall not commence work under the Variance. No claims for additional costs, delays, schedule impacts, loss of productivity or other extra Works resulting from this Variance will be entertained.

1.4 WORK CONDUCTED OVER OR ADJACENT TO WATERWAYS

- .1 All components of the Work shall be conducted in accordance with Section 01 35 43 – Environmental Procedures and the Environmental Protection Plan prepared for the project.
- .2 All components of the Work shall be conducted without equipment entering into wetlands, water bodies, or streams.
- .3 All waste materials from the Work shall be contained and collected in a manner to prevent any contact with the river valleys and waterways. All collected waste materials shall be disposed of in accordance with Section 01 35 43 – Environmental Procedures and the Environmental Protection Plan prepared for the project.

1.5 UTILITIES

- .1 The Contractor shall become familiar with all utilities and services adjacent to the Work and shall be responsible for cost of repair of any damage resulting from their operations.

- .2 The Contractor shall establish and maintain direct and continuous contact with the owners or operators of any Utilities which may interfere with the Work. The Contractor shall co-operate with them at all times and in all places of Work. The Contractor shall keep the Departmental Representative informed of all communications with the Utility companies and authorities.
- .3 The Drawings include indicative utility details from within the area for reference however the Contractor remains fully responsible for determining the full and accurate extent of utilities within the area of their Works.
- .4 The Contractor shall notify the Departmental Representative and the Utility companies at least seven (7) days in advance of any activities which may interfere with the operation of such Utilities.
- .5 Whenever working in the vicinity of Utilities, the Contractor shall locate such Utilities and expose those that may be affected by the Work, using hand labour as required.
- .6 The Contractor shall assess the possible impact of its operations on all Utilities that may be affected by its operations, and shall, in consultation with Utility owner(s), protect, divert, temporarily support or relocate, or otherwise appropriately treat such Utilities to ensure that they are preserved.
- .7 The Contractor shall maintain all services to the existing kiosks so that they can remain open at no additional cost to the Owner including the provision of temporary service connections if necessary.
- .8 The Contractor shall immediately report any damage to Utilities to the Departmental Representative and to the Utility company or authority affected, and shall promptly undertake such remedial measures as are necessary at no additional cost to the Owner.

1.6 SURVEY OF EXISTING CONDITIONS

- .1 Submission of tender is deemed to be confirmation that the Contractor has inspected the Site and is conversant with all conditions affecting execution and completion of work.
- .2 The Contractor shall regularly monitor the condition of the Work Site and of property on and adjoining the Work Site throughout the construction period, and shall immediately notify the Owner if any deterioration in condition is detected. Such monitoring shall cover all pertinent features and property including, but not limited to, buildings, structures, roads, walls, fences, slopes, sewers, culverts and landscaped areas.
- .3 The Departmental Representative may, but shall not be obligated to, survey and record the condition of the Work Site and of property on or adjoining the Work Site prior to the commencement of construction by the Contractor. If requested, the Departmental Representative will provide a copy of the survey records to the Contractor for reference.
- .4 Whenever supplied with survey records, the Contractor shall satisfy itself as to the accuracy and completeness of the survey records provided by the Departmental Representative for any area before commencing construction in that area.
- .5 Commencement of construction in any area shall be interpreted to signify that the Contractor has accepted such survey records as being a true record of the existing conditions prior to construction.
- .6 The provision of the records of a survey of existing conditions by the Departmental Representative shall in no way limit or restrict the Contractor's responsibility to exercise proper care to prevent damage to all property within or adjacent to the Work Site, whether all such property is covered by the survey or not.

1.7 ARCHAEOLOGICAL RESOURCES

- .1 The Contractor shall undertake the Works in accordance with the Best Management Practices as described in Section 01 35 43 Environmental Procedures.
- .2 Contractor is to adhere to the Accidental Finds Protocol.

1.8 FISH HABITAT ASSESSMENTS

- .1 Work within a 30m buffer of watercourses requires the close oversight of a Qualified Environmental Professional (QEP) supplied by the Contractor.

1.9 PROTECTION OF PERSONS AND PROPERTY

- .1 The Contractor shall comply with all applicable safety regulations of the Workers Compensation Act of British Columbia and Alberta including, but not limited to, Occupational Health and Safety Regulations and General Safety Regulations. Within the Site, the Contractor has all the responsibilities of an “employer” under the Workers Compensation Act and the Occupational Health and Safety Regulation and is designated as the “Prime Contractor”.
- .2 Prime Contractor must comply with Workers Compensation Act and Occupational Health and Safety Regulation Section 20.3 Coordination of multiple employer workplaces.
- .3 Comply with all applicable safety regulations of the Workers’ Compensation Board of British Columbia and Alberta (WCB) including, but not limited to, WCB’s Industrial Health and Safety Regulations, Industrial First Aid Regulations, and Workplace Hazardous Materials Information System Regulations, when working in that province.
- .4 Comply with Canada Labour Code, Canada Occupational Safety and Health Regulations.
- .5 The Contractor shall take all necessary precautions and measures to prevent injury or damage to persons and property on or near the Work Site.
- .6 The Contractor shall promptly take such measures as are required to repair, replace or compensate for any loss or damage caused by the Contractor to any property or, if Parks Canada so directs, shall promptly reimburse to Parks Canada the costs resulting from such loss or damage.

1.10 USE OF PUBLIC AREAS

- .1 Off-road construction equipment will not be allowed on the existing highway except at designated areas where the existing highway is scheduled for re-construction in this Contract, material loading areas, or alternate sites as designated and approved by the Departmental Representative. Steel tracked equipment with cleats will not be allowed on pavement designated for future use. If or when crossing asphalt designated for future use, rubber mats must be used under the tracks to protect the asphalt. Asphalt, granular, embankment and excavation materials may be hauled on existing highway but this shall be by standard highway trucks not exceeding legal highway load limits unless accepted in writing by the Departmental Representative.
- .2 Flag persons shall be provided when vehicles are entering or exiting Work Site access points and when vehicles are entering or exiting gravel pits in the park. Pit access gates must remain closed at all times or have a gate person monitoring the opening for wildlife.

- .3 The Contractor shall ensure that its vehicles and equipment do not cause nuisance in public areas. All vehicles and equipment leaving the Work Site and entering public roadways shall be cleaned of mud and dirt clinging to the body and wheels of the vehicle. All vehicles arriving at or leaving the Work Site and transporting materials shall be loaded in a manner that will prevent dropping of materials or debris on the roadways and, where contents may otherwise be blown off during transit, such loads shall be covered by tarpaulins or other suitable covers. Spills of materials in public areas shall be removed or cleaned immediately by the Contractor at no cost to the Owner. All activities shall be in accordance with Section 01 35 43 – Environmental Procedures and the Environmental Protection Plan prepared for the project.
- .4 Construction areas and construction crossings shall be flood-lit for night operations.

1.11 USE OF PITS AND QUARRIES

- .1 The Contractor is not approved to use any existing pits or quarries within the National Parks unless otherwise specified in the Contract Documents.

1.12 USE OF PITS, QUARRIES, AND DISPOSAL SITES, OUTSIDE OF THE NATIONAL PARKS

- .1 When the Contractor is supplying material from a pit or quarry outside of the National Parks the Contractor is responsible for all permits and approvals. Pit or quarry development and reclamation must be in accordance with local and Provincial regulatory agency requirements.
- .2 When the Contractor is disposing of; stripping, unsuitable, or surplus material in a pit or other disposal sites outside of the National Parks the Contractor is responsible for all permits and approvals. Disposal site or pit development and reclamation must be in accordance with local and Provincial regulatory agency requirements.
- .3 The Contractor shall bear and pay all costs, fees, and royalties for pits, quarries, or disposal sites, outside of the National Parks.
- .4 Material supplied from pits and quarries outside of the National Parks must be clean of all, seeds, organics, top soil, or contaminants. No additional payment will be made for cleaning or washing material supplied from pits and quarries outside of the National Parks.
- .5 Material supplied from pits and quarries outside of the National Parks must meet the Contract Specifications.

1.13 SUBMITTALS

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

1.14 SUPERVISORY PERSONNEL

- .1 When requesting a Preconstruction Meeting, in accordance with Section 01 31 00 Project Management and Coordination, the Contractor shall submit to the Departmental Representative confirmation of the names of the supervisory personnel and other key staff designated for assignment on the Contract.
- .2 At a minimum, the following personnel shall be included in the list:
 - .1 Contractor Manager
 - .2 Project Superintendent;
 - .3 Safety Representative;

- .4 Quality Control Manager;
- .5 Environmental Representative;
- .6 Traffic Control Representative;
- .3 The above personnel shall perform the following duties:
 - .1 Contractor Manager with full authority, as agent of the Contractor, to act on behalf of and legally bind the Contractor in connection with the Work and the Contract. The Contractor may, at its discretion, appoint one person as both Contractor Manager and Project Superintendent.
 - .2 The Project Superintendent shall be employed full time with full authority to supervise the Work, who shall be directly available to the Department Representative during all active periods of Work. Either they or their designated deputy shall be present on the Work Site each and every workday that Work is being performed, from the commencement of Work to Total Performance of the Work.
 - .3 The Project Superintendent shall nominate a Deputy Project Superintendent who shall have the authority of the Project Superintendent during the latter's absence.
 - .4 The Safety Representative shall possess a minimum of 2 years' construction safety supervisory experience. Their duties shall encompass all matters of safety activities from commencement of Work until the Total Performance of the Work.
 - .5 The Quality Control Representative shall be responsible for the development, implementation and execution of the Quality Management Plan and shall be the single point of contact for all quality related queries.
 - .6 The Traffic Control Representative shall be responsible for the development, implementation and execution of the Traffic Management Plan and shall be the single point of contact for all traffic control related queries.
 - .7 The Environmental Representative shall be responsible for the development, implementation and execution of the Environmental Protection Plan and shall be the single point of contact for all environmental related queries.

1.15 WASTE DISPOSAL

- .1 All surplus, unsuitable and waste materials shall be removed from the Work Sites to approved sites outside the National Parks. Refer to Section 01 35 43 - Environmental Procedures.
- .2 Deposit of any construction debris into any waterway is strictly forbidden.
- .3 Cost for Waste Disposal described above shall be considered incidental to the Unit Price items and no additional payment will be made.

1.16 WORK STOPPAGE

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

Part 2 Products

- .1 Not Used.

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Parks Canada Agency

Hwy 16
East Gate – Km 0.8
Jasper East Gate

Jasper National Park

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Part 3 Execution

.1 Not Used.

END OF SECTION

01 25 20 MOBILIZATION AND DEMOBILIZATIONS**Part 1 General****1.1 DESCRIPTION**

- .1 Mobilization and Demobilization consists of preparatory work and operations including but not limited to, those necessary for the movement of personnel, equipment, camp, buildings, shops, offices, supplies and incidentals to and from the project sites.
- .2 Any protective measures or movement of Contractor trailers necessitated by animal interactions and required by Parks Canada will be paid by the Departmental Representative, and are not to be anticipated in the Lump Sum Contract Price for Mobilization and Demobilization.

1.2 MEASUREMENT AND PAYMENT PROCEDURES

- .1 Mobilization and Demobilization:
 - .1 Payment will be made under “**Lump Sum Price – Mobilization / Demobilization**”.
 - .2 50% of Lump Sum Contract Price for Mobilization and Demobilization to be paid when mobilization to site is complete.
 - .3 The remainder of the Lump Sum Price for Mobilization and Demobilization to be paid when work is complete and all materials, equipment, camp, buildings, shops, offices, and other facilities have been removed from site and site cleaned and left in condition to the satisfaction of the Departmental Representative and all other Agencies having Jurisdiction.
 - .4 Payment of only **5%** of the total price tendered will be scheduled as outlined above. If the amount bid for mobilization and demobilization is greater than **5%** of the total price tendered, payment of the remainder of the amount will be authorized when the Contract has been completed.

Part 2 Products

- .1 Not Used.

Part 3 Execution

- .1 Not Used.

END OF SECTION

01 29 01 SITE OCCUPANCY

Part 1 General

1.1 DEFINITION OF OCCUPANCY

- .1 The Contractor shall be permitted to lease and occupy sites where they will be working in the National Parks, free of charge from the date of award of the Contract up to and including the specified completion date. The sites to be leased by the Contractor include all the roads and areas specified in the Contract documents and as directed by the Departmental Representative.
- .2 The Contractor's occupancy of the sites identified in Contract will be deemed to have ended, when the following conditions are met to the satisfaction of Parks Canada:
 - .1 All the work identified under this Contract, has been completed.
 - .2 All sites' have been cleaned up and any outstanding deficiencies for the work identified under this Contract have been addressed to the satisfaction of the Departmental Representative.
 - .3 Contractor has removed from the park all trailers and equipment and sites have been cleaned-up to the satisfaction of the Departmental Representative.

Part 2 Products

- .1 Not Used.

Part 3 Execution

- .1 Not Used.

END OF SECTION

01 31 00 PROJECT MANAGEMENT AND COORDINATION**Part 1 General****1.1 MEASUREMENT AND PAYMENT PROCEDURES**

- .1 This Work shall be incidental to the Contract and will not be measured for payment.

1.2 CHANGES TO DESIGN

- .1 If a change from the IFC design is accepted in writing by the Departmental Representative and agreed on by the Contractor, a design variance letter will be issued by the Departmental Representative. The design variance letter must state what changes are being made from the IFC design and what the method of measurement for payment will be, if varying from the Contract Documents.
- .2 The design variance letter must be signed by both the Contractor's Representative and the Departmental Representative prior to performing the Work.
- .3 The Departmental Representative reserves the right to use as-built survey or neat line measurements for payment if for any reason tolerances are not in accordance with the IFC design.

1.3 COORDINATION

- .1 Perform coordination of progress schedules, submittals, use of site, temporary utilities, construction facilities, and construction Work, with progress of Work of other Contractors, and Work by Owner, under instructions of the Departmental Representative.

1.4 PROJECT MEETINGS

- .1 During the course of the Work, the Contractor shall attend weekly construction meetings as scheduled, chaired, and documented by the Departmental Representative.
- .2 The agenda will include among other things, general construction, payment, scheduling, risk, quality, environmental, and safety management items as well as any other reasonably requested by the parties.
- .3 The Contractor shall provide physical space and make arrangements for meetings at or near the Work Sites for all meetings that take place in relation to the Contract from their mobilization until their demobilization.
- .4 Meetings held outside of the time noted above (before mobilization or after demobilization) will either be held in the local PCA Field Unit offices, or at the Owner's site office, as notified by the Departmental Representative.
- .5 The Contractor will attend or otherwise ensure the attendance of their staff, subcontractors, consultants, suppliers, or other key parties all other meetings identified in the Contract or reasonably requested by the Departmental Representative in an effort to resolve specific issues as they may arise.
- .6 Comply with Departmental Representative's allocation of mobilization areas off site; for field offices and sheds, for access, traffic, and parking facilities.
- .7 Comply with instructions of the Departmental Representative for use of temporary utilities and construction facilities.

- .8 Meetings will be called and chaired by the Departmental Representative as required. The Contractor shall be represented at such meetings to the satisfaction of the Departmental Representative.
- .9 As described in Section 01 35 43 – Environmental Procedures, an environmental briefing for all staff will take place before beginning work at the site.

1.5 CONSTRUCTION ORGANIZATION AND START-UP

- .1 Within seven (7) days after award of Contract, request a Preconstruction meeting of Contract Representatives to discuss and resolve administrative procedures and responsibilities. Meeting shall be chaired by the Departmental representative who will prepare the minutes of the meeting.
- .2 Senior representatives of the Owner, Departmental Representative, Contractor, major subcontractors, field inspectors and supervisors are to be in attendance.
- .3 Agenda to include following:
 - .1 Appointment of official representative of participants in Work.
 - .2 Schedule of Work, progress scheduling in accordance with Section 01 32 16.
 - .3 Schedule of submittals in accordance with Section 01 33 00.
 - .4 Requirements for temporary facilities, offices, storage sheds, utilities, fences in accordance with Section 01 52 00.
 - .5 Site safety and security in accordance with Sections 01 14 00, 01 35 29, 01 52 00 and 01 35 43.
 - .6 Quality Control in accordance with Section 01 45 00.
 - .7 Proposed changes, change orders, procedures, approvals required, mark-up percentages permitted, time extensions, overtime, and administrative requirements.
 - .8 Owner-furnished materials.
 - .9 Monthly progress claims, administrative procedures, photographs, and holdbacks.
 - .10 Closeout procedures and submittals in accordance with Sections 01 77 00 and 01 78 00.
 - .11 Insurances and transcript of policies.
 - .12 Other business.
- .4 Comply with Departmental Representative's allocation of mobilization areas of site, for field offices and sheds, and for access, traffic, and parking facilities.
- .5 During construction, coordinate use of site and facilities through Departmental Representative's procedures for intra-project communications: submittals, reports and records, schedules, coordination of Drawings, recommendations, and resolution of ambiguities and conflicts.
- .6 Comply with instructions of the Departmental Representative for use of temporary utilities and construction facilities.
- .7 Coordinate field engineering and layout work with the Departmental Representative.

1.6 ON-SITE DOCUMENTS

- .1 Maintain at job site, one copy each of the following:
 - .1 Contract Drawings if part of tender

- .2 Specifications
- .3 Addenda
- .4 Reviewed Shop Drawings and mix designs
- .5 Change Orders
- .6 Other modifications to Contract
- .7 Traffic Management Plan
- .8 Safety Plan
- .9 WHMIS
- .10 Environmental Protection Plan
- .11 Quality Control Plan and field test reports
- .12 Copy of accepted Work schedule and most recent updated schedule
- .13 Labour conditions and wage schedules
- .14 Equipment rate schedule and applicable versions of the relevant rate guides
- .15 Applicable current editions of municipal regulations and by-laws

1.7 SUBMITTAL SCHEDULE

- .1 In accordance with 01 33 00 – Submittal Procedures.
- .2 Prepare a schedule of the required submissions and the date the submissions will be made. Include columns for Actual Date of Submission, Review Comments Received, Final Submission and Final Acceptance Received. Provide this schedule to the Departmental Representative in Excel format.
- .3 The Owner will not be responsible for any construction delays resulting from delays in submission acceptance if the submittal dates shown in the Submittal Schedule are not achieved.

1.8 PROJECT SCHEDULES

- .1 In accordance with Section 01 32 16 Construction Progress Schedules.

1.9 SUBMITTALS

- .1 Submittals in accordance with Section 01 33 00.
- .2 Submit requests for payment for review, and for transmittal to Departmental Representative. Payment request on last day of the month.
- .3 Submit requests for interpretation of Contract Documents, and obtain instructions through Departmental Representative.
- .4 Process substitutions through Departmental Representative.
- .5 Process change orders through Departmental Representative.

1.10 CLOSEOUT PROCEDURES

- .1 In accordance with 01 77 00 - Closeout Procedures.

Part 2 Products

- .1 Not Used.

Part 3 Execution

.1 Not Used.

END OF SECTION

01 32 16 CONSTRUCTION PROGRESS SCHEDULES**Part 1 General****1.1 MEASUREMENT AND PAYMENT PROCEDURES**

- .1 This Work shall be incidental to Contract and will not be measured for payment.

1.2 DEFINITIONS

- .1 Activity: An element of Work performed during course of Project. An activity normally has an expected duration, and expected cost and expected resource requirements. Activities can be subdivided into tasks.
- .2 Bar Chart (Gantt Chart): A graphic display of schedule-related information. In a 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 accepted plan for Project, plus or minus accepted scope changes.
- .4 Construction Work Week: The working week as defined in these Contract Documents will 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 an activity or other Project element. Usually expressed as workdays or work weeks.
- .6 Master Plan: A summary-level schedule that identifies major activities and key milestones.
- .7 Milestone: A significant event in Project, usually completion of a major deliverable.
- .8 Project Schedule: The planned dates for performing activities and the planned dates for meeting milestones. A 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.

1.3 REQUIREMENTS

- .1 Ensure the Project Schedule is practical and remains within specified Contract duration.
- .2 Ensure all the Work required for the Contract is identified in the Project Schedule. Refer to Section 01 11 00 – Summary of Work for a potential list of activities.
- .3 Plan to complete Work in accordance with prescribed Project Schedule.
- .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.
- .5 After review, revise and resubmit schedule to comply with revised project schedule.
- .6 During progress of Work revise and resubmit as directed by the Departmental Representative.

- .7 Include the requirements of Section 01 14 00 – Work Restrictions and Section 01 35 43 – Environmental Procedures.

1.4 SUBMITTALS

- .1 Submittals in accordance with Section 01 33 00.
- .2 Submit to Departmental Representative within 10 working days of Award of Contract a Bar (GANTT) Chart as Master Plan for planning, monitoring and reporting of project progress.
- .3 Submit Project Schedule to Departmental Representative in accordance with 01 33 00 Submittal Procedures.

1.5 PROJECT MILESTONES

- .1 Project milestones form interim targets for Project Schedule.
- .2 Include in Project Schedule the Contractual dates under Section 01 11 00 Summary of Work.

1.6 MASTER PLAN

- .1 Structure schedule to allow orderly planning, organizing and execution of Work as Bar Chart (GANTT).
- .2 Revise impractical schedule and resubmit within 5 working days.
- .3 Accepted revised schedule will become Master Plan and be used as baseline for updates.

1.7 PROJECT SCHEDULE

- .1 Develop detailed Project Schedule derived from Master Plan.
- .2 Ensure detailed Project Schedule separately identifies the Work by area and station.
- .3 Ensure detailed Project Schedule includes as minimum milestone and activity types as follows:
 - .1 Contract Award
 - .2 Obtaining Permits
 - .3 Pre-mobilization Submittals
 - .4 Mobilization
 - .5 Kiosk construction and landscaping
 - .6 Clearing and Grubbing
 - .7 Stripping
 - .8 Barrier removal
 - .9 Asphalt pavement removal
 - .10 Culvert removal and replacement
 - .11 Design-build overhead variable message sign
 - .12 Road base construction
 - .13 Pavement construction
 - .14 Barrier installation
 - .15 W-beam construction
 - .16 Stopping pad construction

- .17 Guide post installation
- .18 Traffic signage
- .19 Line painting
- .20 Hydroseeding
- .21 Interim Inspection
- .22 Remediation of any noted deficiencies
- .23 Site Clean-up / Demobilization
- .24 Final Completion

1.8 PROJECT SCHEDULE REPORTING

- .1 Update Project Schedule on monthly basis or as and when requested by the Departmental Representative, reflecting activity changes and completions, as well as activities in progress.
- .2 Provide Weekly Progress Reports that identify completed work and Work planned for the following week in accordance with 01 33 00 Submittal Procedures.
- .3 Include as part of Project Schedule Update, a 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.

1.9 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 accepted dates shown on baseline schedule.
- .2 Meetings in accordance with 01 31 00 Project Management and Coordination.

Part 2 Products

- .1 Not Used.

Part 3 Execution

- .1 Not Used.

END OF SECTION

01 33 00 SUBMITTAL PROCEDURES**Part 1 General****1.1 MEASUREMENT AND PAYMENT PROCEDURES**

- .1 This work shall be incidental to the Contract and will not be measured for payment.

1.2 ADMINISTRATIVE

- .1 Submit to Departmental Representative submittals listed for review. Submit with reasonable promptness and in orderly sequence so as to not cause delay in Work. Failure to submit in ample time is not considered sufficient reason for an 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, and written acceptance of the submittal has been issued by the Departmental Representative.
- .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 Submittals must be accompanied by a completed Quality Control Checksheet in accordance with 01 45 00 prior to submission to Departmental Representative. This completed Quality Control Checksheet represents that all the necessary requirements have been met and that the 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 shall be considered rejected.
- .6 Notify Departmental Representative in writing at time of submission, identifying any deviations from requirements of Contract Documents stating reasons for deviations.
- .7 Verify field measurements and affected adjacent Work is consistent.
- .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 accepted copy of each submission on site.

1.3 "DESIGN AND BUILD", SHOP DRAWINGS, PRODUCT DATA, AND MIX DESIGNS

- .1 "Design and Build": The term "Design" refers to all detailed design activities (survey, investigation, drawings, specifications) based on general requirements contained in these specifications and shown on the drawings. "Build" refers to construction of Contractor's detailed design after design has been reviewed by the Departmental Representative. Contractor's responsibility for error and omissions in submission is not relieved by Departmental Representative's review of submittals.
- .2 The term "shop drawings" means drawings, diagrams, illustrations, schedules, performance charts, brochures and other data that are to be provided by the Contractor to illustrate details of a portion of Work.
- .3 The term "Mix Design" means an engineered design for proportioning materials in concrete or asphalt concrete pavement including all supporting test results, materials properties, that is acceptable to the Departmental Representative. **Asphalt mix design**

to be performed by a qualified member of the Association of Professional Engineers and Geoscientist who is licenced to practice in Alberta, or by a qualified technician registered in Alberta who has CCIL Asphalt Certification.

- .4 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 coordinated, regardless of section under which adjacent items will be supplied and installed. Indicate cross-references to design drawings and specifications.
- .5 Allow fourteen (14) calendar days for Departmental Representative's review of each submission.
- .6 Adjustments made on shop drawings by the Departmental Representative are not intended to change the Contract Price. If adjustments affect the value of Work, state such in writing to the Departmental Representative prior to proceeding with the Work.
- .7 Make changes in shop drawings as the Departmental Representative may require, consistent with the Contract Documents. When resubmitting, notify the Departmental Representative in writing of any revisions other than those requested.
- .8 Submit letter(s) of certification with all mix designs.
- .9 Accompany submissions with a transmittal letter containing:
 - .1 Date.
 - .2 Project title and number.
 - .3 Contractor's name and address.
 - .4 Identification and quantity of each shop drawing, mix design, product and sample.
 - .5 Other pertinent data.
- .10 Submissions shall 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 the Contract Documents.
 - .5 Details of appropriate portions of the Work as applicable:
 - .1 Fabrication,
 - .2 Performance characteristics,
 - .3 Standards.
- .11 After the Departmental Representative's review, distribute copies.
- .12 Submit one (1) electronic copy of the shop drawings or mix design for each requirement requested in the Specification Sections and as requested by the Departmental Representative.

- .13 Submit one (1) electronic copy of the product data sheets or brochures for requirements requested in the Specification Sections and as requested by the Departmental Representative where shop drawings will not be prepared due to standardized manufacture of the product.
- .14 Delete information not applicable to project.
- .15 Supplement standard information to provide details applicable to project.
- .16 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.
- .17 The review of shop drawings and mix designs by Departmental Representative is for the sole purpose of ascertaining conformance with the Contract requirements. This review shall not mean that Departmental Representative approves details of the design inherent in shop drawings, responsibility for that 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 all requirements of construction and Contract Documents. Without restricting the generality of the 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 all sub-trades.

1.4 SAMPLES

- .1 Material samples to be provided as outlined in the Contract Documents or as requested by the Departmental Representative.

1.5 MOCK-UPS

- .1 Not used.

1.6 CERTIFICATES AND TRANSCRIPTS

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

1.7 REQUIRED CONTRACTOR SUBMITTALS

.1 General

- .1 This Clause identifies the plans, programs, and documentation required prior to mobilization on site and during the construction phase.

.2 Pre-Mobilization Submittals

The Contractor shall not begin any site Work until the Departmental Representative has authorized acceptance of submittals in writing. Submit the following plans and programs to the Departmental Representative for review a minimum of twenty (20) days prior to mobilization to the project site:

- .1 Project schedule, detailing the schedule of the workdays required from Contractor, subcontractors, suppliers and consultants to complete each activity of the project by road segment or location in order to meet stages specified in Section 01 32 16. In addition, for each activity critical elements that could

- impact on the schedule are to be identified. Submission shall include both a paper copy of the schedule and an electronic copy in Microsoft Projects format
- .2 List of subcontractors, suppliers and consultants, their role and their key personnel, including names and positions, addresses, telephone and cellular telephone.
 - .3 Plan describing methods the Contractor will have to meet their responsibilities as the Prime Contractor for Safety and Traffic Control within the Work limits and to co-ordinate Work, traffic control, site access, safety, with other Contractors working in or adjacent to the Contract Work zone.
 - .4 Contractor Chain of Command, listing key Contractor personnel, including for each name, position, qualification, experience, telephone and cellular telephone. The list shall include the names and telephone/cellular telephone for contact persons who are available on a 24-hour basis in the event of emergencies.
 - .5 Work Plan, describing in detail for each activity by road segment and location, the Contractor's intended methods of construction, and materials, equipment and manpower that will be used to meet stages specified in Section 01 32 16. The Work Plan has to be linked to the Project Schedule.
 - .6 Quality Control Plan in accordance with Section 01 45 00 – Quality Control, including Quality Control checklist examples.
 - .7 Traffic Management Plan, in accordance with the requirements of Section 01 35 31 – Special Procedures for Traffic Control, and 01 35 32 - Special Procedures for Traffic Detours.
 - .8 Environmental Protection Plan (EPP) that meets the requirements of Section 01 35 43 – Environmental Procedures. Submission of EPP must allow 2 weeks for review by the Parks ESO, in accordance with Section 01 35 43 – Environmental Procedures.
 - .9 Site Access and Detour Plans shall include, but not be limited to, engineered Drawings and procedures for accessing all areas of the Work or for proposed detours.
 - .10 Survey Plan describing the Contractor's intended methods of surveying during this project.
 - .11 Contractor shall develop an "Emergency Procedures Protocol" in consultation with Parks Canada. On site Contingency and Emergency Response Plan to address standard operating procedures to be implemented during emergency situations.
 - .12 Contractor and any subcontractors to submit a copy of their valid Parks Canada Business License.
 - .13 Health and Safety Plan - The Contractor shall have a Certificate of Recognition (COR) or Registered Safety Plan (RSP) including a site-specific Health and Safety Plan acceptable to the Departmental Representative. The Contractor shall implement and maintain the Health and Safety Plan during the Work. Health and Safety Plan must include in accordance with Section 01 35 29.
 - .14 Alberta One Call and Utilities Coordination Plan, including notifications to all potentially impacted Utility Owners.
 - .15 The Contractor shall not begin any Work on the Site until the Departmental Representative has provided a Notice to Proceed.
 - .16 Submit a copy of the filed Notice of Project with Provincial authorities.

.3 Construction Phase Submittals

- .1 Monthly Progress Reports in accordance with Section 01 32 16.
- .2 Weekly Progress Reports that outline the detailed Work (Contractor, subcontractors, suppliers, consultants) completed to date as well as the anticipated Work to be performed for the following week on a day-by-day basis. Work to be linked to activities by road segment or location identified in project schedule and to provide information on materials, equipment and manpower. Also, alternate Work to be identified if Work or a portion of, proposed cannot be done due to weather, equipment breakdown, delays in delivery, etc. Weekly Progress Reports shall be submitted at the end of each week.
- .3 Quality Control Inspection Reports - The Contractor shall maintain a daily inspection report that itemizes the results of all Quality Control inspections conducted by the Contractor. The reports shall be submitted to the Departmental Representative with the Weekly Progress Report. A summary of all Quality Control inspections conducted to date shall be submitted by the Contractor with each Weekly Progress Report.
- .4 “Design and Build” documents, Shop Drawings and Mix Designs – The Contractor shall submit all design drawings, shop drawings and mix designs required to fabricate and / or conduct the work a minimum fourteen (14) days prior to fabrication / production.
- .5 Progress Photographs:
 - .1 Format:
 - .1 Electronic: .jpg files, minimum three (3) mega pixels.
 - .2 Submission requirements: one (1) set of electronic files.
 - .3 Identification: Name and number of project, description of photograph and date.
 - .4 Viewpoints: viewpoints determined by Construction Manager or Departmental Representative.
 - .5 Submission Frequency: prior to commencement of Work and weekly thereafter with progress statement, or as directed by Construction Manager or Departmental Representative.
 - .6 Submit all electronic pictures as part of closeout package.
 - .6 Submit an electronic copy of Contractor’s authorized representative’s work site health and safety inspection reports to Departmental Representative and authority having jurisdiction, weekly.
 - .7 Submit copies of reports or directions issued by Federal and Provincial health and safety inspectors immediately.
 - .8 Submit copies of incident and accident reports immediately.

.4 Project Completion Submittals

- .1 Record Drawings -The Contractor shall submit copies of all Contractor's Drawings revised as necessary to record all as-built changes to the Work and the Contractor shall submit a set of Contract Drawings clearly marked to record as-built changes to the Work.

- .2 Quality Control Records – The Contractor shall submit a .pdf electronic file containing an itemized set of project quality control documentation.
- .3 All other documents noted with the Specifications, and under Section 01 78 00.
- .5 The Contractor shall not construe the Departmental Representative's authorization of the submittals to imply approval of any particular method or sequence for conducting the Work, or for addressing health and safety concerns. Authorization of the programs shall not relieve the Contractor from the responsibility to conduct the Work in strict accordance with the requirements of Federal or Provincial regulations and this specification, or to adequately protect the health and safety of all workers involved in the project and any members of the public who may be affected by the project. The Contractor shall remain solely responsible for the adequacy and completeness of the programs and work practices, and adherence to them.
- .6 The Departmental Representative may, at their sole discretion, withhold payment from the Contractor for Work completed until acceptable submittal documents have been provided by the Contractor to the Departmental Representative.

Part 2 Products

- .1 Not Used.

Part 3 Execution

- .1 Not Used.

END OF SECTION

01 35 29 HEALTH AND SAFETY REQUIREMENTS**Part 1 General****1.1 MEASUREMENT AND PAYMENT PROCEDURES**

- .1 This work shall be incidental to Contract and will not be measured for payment.

1.2 REFERENCES

- .1 Canada Labour Code, Part 2, Canada Occupational Safety and Health Regulations.
- .2 Health Canada/Workplace Hazardous Materials Information System
 - .1 (WHMIS) Material Safety Data Sheets (MSDS).
- .3 Province of British Columbia / Alberta - Occupational Health and Safety Act, depending on the province where the Work is occurring.

1.3 SUBMITTALS

- .1 Make submittals in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Submit site-specific Health and Safety Plan in accordance with this section and 01 33 00 – Submittal Procedures.

1.4 FILING OF NOTICE

- .1 File Notice of Project with Provincial authorities prior to beginning of Work and provide a copy to the Departmental Representative. Notice of Project to be posted onsite upon mobilization and remain posted until project completion.

1.5 SAFETY ASSESSMENT

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

1.6 MEETINGS

- .1 Schedule and administer Health and Safety meeting with Departmental Representative prior to commencement of Work. This meeting may be combined with the Organization and Start-Up meeting identified elsewhere.
 - .1 At this meeting the Contractor is required to complete and sign an Attestation to certify the Contractor will comply with the requirements set out in the Attestation and the terms and conditions of the Contract
 - .2 A copy of the “Attestation and Proof of Compliance with Occupational Health and Safety (OHS)” form is part of the Invitation to Tender package.
- .2 Parks Canada recognizes that federal Occupational Health and Safety legislation places specific responsibilities upon Parks Canada as owner of the work place. In order to meet those requirements, Parks Canada has implemented a contractor safety regime to ensure roles and responsibilities assigned under Part II of the Canada Labour Code and the Canada Occupational Health and Safety Regulations are implemented and observed when involving contractor(s) to undertake work in Parks Canada work places, including on Parks Canada property.

1.7 REGULATORY REQUIREMENTS

- .1 Do Work in accordance with National Parks Act.

1.8 PROJECT / SITE CONDITIONS

- .1 Work at site will involve contact with British Columbia / Alberta Occupational Health and Safety, depending on which province the Work is occurring in.

1.9 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.

1.10 RESPONSIBILITY

- .1 The Contractor shall act as the Prime Contractor in all matters relating to Occupational Health and Safety. They shall conduct their work and make all such arrangements necessary to allow them to be accepted as such by the relevant Provincial Authorities.
- .2 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.
- .3 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.

1.11 COMPLIANCE REQUIREMENTS

- .1 Comply with Occupational Health and Safety Act, General Safety Regulation, British Columbia / Alberta, depending on which province the Work is occurring in.
- .2 Comply with Canada Labour Code, Canada Occupational Safety and Health Regulations.

1.12 UNFORESEEN HAZARDS

- .1 When unforeseen or peculiar safety-related factor, hazard, or conditions 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.

1.13 HEALTH AND SAFETY REPRESENTATIVE

- .1 Employ and assign to Work, competent and authorized representative as Health and Safety Coordinator. Health and Safety Co-ordinator must:
 - .1 Have minimum 2 years' site-related working experience specific to activities associated with roadway construction.
 - .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 and report directly to and be under direction of site supervisor.

1.14 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.

1.15 CORRECTION OF NON-COMPLIANCE

- .1 Immediately address health and safety non-compliance issues identified by authority having jurisdiction or by Departmental Representative.
- .2 Provide Departmental Representative with written report of action taken to correct non-compliance of health and safety issues identified.
- .3 Departmental Representative may stop Work if non-compliance of health and safety regulations is not corrected.

1.16 BLASTING

- .1 Blasting or other use of explosives is not permitted without prior receipt of written approval by the Departmental Representative.
- .2 Production of blasting powder must be done in accordance with Section 01 35 43 – Environmental Procedures.
- .3 Do blasting operations in accordance with Section 31 24 13 – Roadway and Drainage Excavation.

1.17 POWDER ACTUATED DEVICES

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

1.18 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.

Part 2 Products

- .1 Not used.

Part 3 Execution

- .1 Not used.

END OF SECTION

01 35 31 SPECIAL PROCEDURES FOR TRAFFIC CONTROL**Part 1 General****1.1 MEASUREMENT AND PAYMENT PROCEDURES**

- .1 Cost of Traffic Control, including temporary pavement marking, described in this Section 01 35 31, shall be considered incidental to **“Lump Sum Price – Traffic Accommodation”**, and no additional payment will be made for the duration of the Contract.
- .2 The Contractor shall receive payment for traffic management on a monthly basis prorated by the number of months working on site divided by the number of months on site identified on Contractor schedule, not to exceed the total lump sum bid price for Traffic Management.
- .3 Payment for traffic control will commence once the Contractor has implemented their accepted Traffic Management Plan and setup is accepted by the Departmental Representative.
- .4 Cost of keeping the existing roadway within the Work limits, clean, free of pot holes while Contractor is on site shall be considered incidental to **“Lump Sum Price – Traffic Accommodation”**, and no additional payment will be made for the duration of the Contract.
- .5 The cost of snow removal required by the Contractor to complete the work identified in the Contract shall be considered incidental to **“Lump Sum Price – Traffic Accommodation”**, and no additional payment will be made for the duration of the Contract.
- .6 The Contractor shall not be responsible for the snow removal required for general highway road maintenance operations within the limit of construction so long as the roadway has been left in a condition deemed suitable, by Departmental Representative, for maintenance crews to safely complete the work.

1.2 REFERENCES

- .1 The Contractor shall provide traffic control in accordance with:
 - .1 British Columbia - Traffic Control Manual for Work on Roadways (1999)
 - .2 AT – Traffic Accommodation in Work Zones (latest edition)
 - .3 AT – Traffic Control Standards (latest edition)
 - .4 Manual of Uniform Traffic Control Devices for Canada, (MUTCD) distributed by Transportation Association of Canada. (latest edition)

1.3 QUALITY CONTROL

- .1 All Quality Control by the Contractor.

1.4 GENERAL

- .1 The Contractor will not be permitted to remove the temporary pavement marking until the final pavement markings have been installed to the satisfaction of the Contract and Departmental Representative.

- .2 At all work sites, the Contractor shall mark **accurately**, at regular intervals, the location and type of existing painted lines prior to their removal or covering, including start and ends of passing lanes and intersections, with a stake at the side of the roadway and make a written record of markings in a book, in order that painted lines can be accurately re-established after work is completed. If no lines are present the Contractor shall mark **accurately (+ or – 20 mm)** and at regular intervals in accordance with the Section 2.2.1 of the **“BC MoTI - Traffic Control Manual for Work on Roadways, 1999”**.
- .3 The Contractor shall develop and implement a Traffic Management Plan in accordance with AT – Traffic Accommodation in Work Zones (latest edition), except where specified otherwise in these specifications. The Traffic Management Plan will include plans specific to each roadway for this project.
- .4 The Traffic Management Plan must duly consider the traffic volumes associated with the direction volume increases typically experienced on the lead up to weekends and/or special events. Adjustments to the TMP may be required at the request of the Departmental Representative to mitigate delays in excess of the stipulated maximum 20 minutes.
- .5 The Contractor shall design, supply, erect, move and maintain all traffic control devices, signs, temporary pavement marking, other safety measures and provide staff to ensure safe passage of all traffic from commencement of site work to date of acceptance by the Departmental Representative.
- .6 The Contractor shall supply, install and maintain flashing arrow boards (FAB), as required for the Works, in accordance with the accepted TMP. All FAB shall be as per MUTCD (latest edition). Exact installation locations of FABs to be agreed on site with the Departmental Representative. All cost associated with the supply, installation, maintenance and removal of FABs will be incidental to **“Lump Sum Price – Traffic Accommodation”**. Removal will only be permitted upon completion of the Works.
- .7 The Contractor shall supply, install and maintain two portable Changeable Message Signs (CMS) to inform the traffic of construction delays. All CMS shall be as per MUTCD (latest edition). All CMS shall be in both English and French with equal space allotted to each. Exact installation locations of the CMS to be agreed on site with the Departmental Representative. All cost associated with the supply, installation, maintenance and removal of the two CMS will be incidental to **“Lump Sum Price – Traffic Accommodation”**. Removal of the two CMS will only be permitted upon completion of the Works.
- .8 The Contractor shall supply, install and maintain speed reader boards (SRB), as required for the Works. Exact installation locations of SRBs to be agreed on site with the Departmental Representative. All cost associated with the supply, installation, maintenance and removal of SRBs will be incidental to **“Lump Sum Price – Traffic Accommodation”**. Removal will only be permitted upon completion of the Works.
- .9 All traffic and warning signs shall be either bilingual or of a symbolic or pictorial type. All signs are to be selected from the Construction Signage Translation Database provided in the Reference Documents.
- .10 All Changeable Message Sign (CMS) messages are to be selected from the preapproved database provided and are to be bilingual as shown.
- .1 Any signage requiring translation that is not shown in the standard translation reference documents must be approved by Parks Canada prior to fabrication.

- .11 All speed limits, traffic control and warning signs shall have an “NPC” adhesive sticker added to bottom right-hand corner. These stickers will be supplied by Parks Canada following the acceptance by the Departmental Representative of the Contractor’s traffic management plan.
- .12 Temporary pavement marking used shall be acceptable to the Departmental Representative and in accordance with Section 2.2.1 of the BC MoTI Traffic Control Manual for Work on Roadways, 1999. Spacing between temporary line markings to not exceed 10m.
- .13 All temporary pavement markings will be removed at the Contractor’s expense prior to the completion of the Contract.
- .14 Temporary lane markings that are not consistent with the final geometric design layout shall be removed using eradication or water blasting to the satisfaction of the Departmental Representative. Blackout painting of existing lines will not be permitted. No additional payment will be made for removal of existing paint lines.
- .15 Contractor shall have appropriate traffic control measures in place so that one lane of highway traffic is maintained in each direction through the work zone at all times throughout the construction.
- .16 The Contractor shall coordinate traffic management procedures with other Contractors working in the immediate vicinity as well as collaborate with the Departmental Representative in respect to Traffic Management restrictions on the Highway Network. In consideration of the number of grading, paving and bridge construction projects in the corridor the Contractor must make a concerted effort to coordinate their traffic management strategies with other stakeholders. The Contractor must also be prepared to attend traffic management and construction staging coordination meetings as requested by the Departmental Representative.
- .17 The Contractor is responsible for keeping the roadway, within the Construction Limits, clean at all times. Sweeping, grading and/or dust control to the acceptance of the Departmental Representative is considered incidental to the Contract and no additional payment will be made.

1.5 PROTECTION OF PUBLIC TRAFFIC

- .1 Comply with requirements of Acts, Regulations and By-Laws in force for regulation of traffic or use of roadways upon or over which it is necessary to carry out Work or haul materials or equipment.
- .2 Carry out traffic regulation in accordance with AT – Traffic Accommodation in Work Zones (latest edition), except where specified otherwise.
- .3 When working on existing travelled way:
 - .1 Place equipment in a position presenting a minimum of interference and hazard to traveling public.
 - .2 Keep equipment units as close together as working conditions permit and preferably on same side of travelled way.
 - .3 Do not leave equipment on travelled way overnight.
- .4 The Contractor shall develop and have in place a completed Traffic Management Plan taking into account all hazards associated with construction operations on a busy highway and minimize risks to motorists prior to beginning Work. This plan shall be updated regularly in response to any incidents or changes in conditions, be they weather, work, traffic, or otherwise.

- .5 The Contractor shall submit a Traffic Management Plan prior to commencement of work. Short closures may be allowed by the Departmental Representative for some activities such as asphalt removal as long as the delay to motorists does not exceed **20 minutes**.
- .6 Do not close any lanes of road without approval of Departmental Representative. Before re-routing traffic erect suitable signs and devices in accordance with the requirements of the AT – Traffic Accommodation in Work Zones (latest edition), except where specified otherwise.
- .7 Regardless of type of traffic control being used, maximum period of delay to public traffic shall be 20 minutes. Emergency vehicles (i.e., ambulance, RCMP, Park Warden) must be granted immediate passage at all times. The Departmental Representative reserves the right to reduce delay time for public traffic at times when specified delay results in excessive backup of public traffic.
- .8 The Contractor shall provide competent supervision and/or contact personnel as required during non-working hours to ensure that safety flares, flashing beacons, signs, lights, etc., are in proper working order.
- .9 Traffic control measures will be monitored by the Departmental Representative, who may require modifications of these measures from time to time to achieve satisfactory traffic flow, safety of traveling public and coordination with adjacent contracts.
- .10 The Contractor shall maintain a dust free construction zone by means of cleaning and watering when required.

1.6 INFORMATIONAL AND WARNING DEVICES

- .1 Provide and maintain signs, flashing warning lights and other devices required to indicate construction activities or other temporary and unusual conditions resulting from Project Work that requires road user response.
- .2 Supply and erect signs, delineators, barricades and miscellaneous warning devices as specified in the Traffic Management Plan submitted by the Contractor and approved by the Departmental Representative. **All temporary signs that are used for longer than one day shall be mounted on wood or steel posts installed in the shoulder areas at locations accepted by the Departmental Representative.**
- .3 At each end of the Work site, supply, install and maintain a portable electronic sign with a minimum of three (3) lines with 8 characters for the duration of the project.
- .4 Place signs and other devices to standards and in locations recommended in AT – Traffic Accommodation in Work Zones (latest edition). Provide intermittent signage if work zones exceed 2.0 km in length.
- .5 All construction signs shall be installed to prevent incidental blow down or displacement and must remain in service throughout the construction period. Construction signage heights to be minimum 1.5m from ground to the bottom of the sign, or as per AT – Traffic Accommodation in Work Zones (latest edition), whichever is higher.
- .6 As situation on site changes, Contractor to update their Traffic Management Plan outlining signs and other devices required for the project and submit for the acceptance of the Departmental Representative.
- .7 Continually inspect and maintain traffic control devices in use by:
 - .1 Checking signs daily for legibility, damage, suitability, location and height.

- .2 Cleaning, repairing or replacing signs as required ensuring clarity and reflectance.
- .3 Removing or covering signs that do not apply to conditions existing from day to day or time to time.

1.7 CONTROL OF PUBLIC TRAFFIC

- .1 Contractor shall provide competent flag persons, trained in accordance with, and properly dressed and equipped as specified in AT – Traffic Accommodation in Work Zones (latest edition).
 - .1 When public traffic is required to pass working vehicles or equipment, that block all or part of travelled roadway.
 - .2 When vehicles are entering or exiting Work Site access points.
 - .3 When vehicles are entering or exiting gravel pits in the park.
 - .4 When it is necessary to institute one-way traffic system through construction area or other blockage where traffic volumes are heavy, approach speeds are high and traffic signal system is not in use.
 - .5 When workmen or equipment are employed on travelled way over brow of hills, around sharp curves or at other locations where oncoming traffic would not otherwise have adequate warning.
 - .6 Where temporary protection is required while other traffic control devices are being erected or taken down.
 - .7 For emergency protection when other traffic control devices are not readily available.
 - .8 In situations where complete protection for workers, working equipment and public traffic is not provided by other traffic control devices.
 - .9 At each end of restricted sections where pilot cars are required.
- .2 Delays to public traffic due to Contractor's operations: **maximum 20 minutes**.
- .3 During hours of darkness, Contractor shall determine requirements but as a minimum, flag persons shall be additionally equipped with a red signal hand-light of sufficient brightness to be clearly visible to approaching traffic and flagging stations shall be illuminated by overhead lighting. Signs indicating hazardous conditions and signs requiring increased attention shall be marked with flashers.
- .4 No stoppage of traffic will be allowed for the periods specified in Section 01 14 00, Work Restrictions, pertaining to Statutory Holiday or long weekend.
- .5 If night shift operations are implemented on 2-lane undivided sections, the public traffic must be escorted through the work zone by pilot cars in both directions.

1.8 OPERATIONAL REQUIREMENTS

- .1 Maintain existing conditions for traffic throughout period of Contract except that, when required for construction under Contract and when measures have been taken as specified herein and approved by Departmental Representative to protect and control public traffic, existing conditions for traffic to be restricted as follows:
 - .1 Speed limit reduced to 50 km/h or the posted speed if the posted speed is less than 50 km/h in work zones in non-work periods.
 - .2 Speed limit reduced to 30 km/h in work zones in work periods.
 - .3 Speed limit reduced to 30 km/h on detours at all times.

- .4 From April 1 to June 23 and from September 11 to November 15 the Contractor shall adhere to the following:
 - .1 The Contractor shall maintain one lane of traffic westbound and one lane eastbound from 06:00 Monday to 14:00 Friday.
 - .2 From Friday 14:00 to Monday 06:00 the Contractor shall:
 - .1 Maintain two lanes westbound and one lane eastbound.
 - .2 Not impede traffic.
- .5 From June 24 to September 10 the contractor shall adhere to the following:
 - .1 Maintain two lanes westbound and one lane eastbound.
 - .2 Not impede traffic.
- .6 The delay due to single lane alternating traffic shall not exceed 20 minutes.
- .7 A schedule for all full work zone closures required longer than 30 minutes must be provided to the Departmental Representative at least one (1) week in advance of the planned closure.
- .8 There may be restrictions to accommodate special events within the National Parks. PCA will provide two (2) weeks' notice of any upcoming restrictions.
- .9 The Departmental Representative reserves the right to stop work in the case of excessive traffic delays.
- .10 Maintain existing conditions for traffic crossing right-of-way.
- .11 Provide the Departmental Representative with construction advisories for posting to the Official Alberta Traffic Advisor website (<http://511.alberta.ca/>) and update advisories regularly to reflect the current and planned construction activities and highway closures. A minimum of 4 days notice is required for changes to the accepted TMP.
- .12 Emergency vehicles are to be directed through the Work Site immediately once conditions are safe.
- .13 No stoppage of traffic shall be allowed during inclement weather conditions.
- .2 Maintain existing conditions for traffic crossing right-of-way.
- .3 No stoppage of traffic shall be allowed during inclement weather conditions.

Part 2 Products

- .1 Not used.

Part 3 Execution

- .1 Not used.

END OF SECTION

01 35 43 ENVIRONMENTAL PROCEDURES**Part 1 General****1.1 MEASUREMENT AND PAYMENT PROCEDURES**

- .1 Preparation and implementation of an Environmental Protection Plan (EPP) in accordance with this Section 01 35 43 – Environmental Procedures, including certification by a registered Qualified Environmental Professional (QEP), will not be measured separately for payment and will be considered incidental to the Work.
- .2 The cost of environmental and aesthetic protection in accordance with this Section 01 35 43 – Environmental Procedures will not be measured separately for payment and will be considered incidental to the Work.

1.2 REFERENCES

- .1 Parks Canada National Best Management Practices
- .2 Direction for Permitted Users conducting water-related activities in BNP

1.3 SUBMITTALS

- .1 The Contractor is required to prepare an Environmental Protection Plan in accordance with this Section 01 35 43 – Environmental Procedures and 01 33 00 – Submittal Procedures. The EPP document will be reviewed and accepted for use on the project by the Departmental Representative.

1.4 NATIONAL PARK REGULATIONS

- .1 The Contractor shall ensure that all work is performed in accordance with the ordinances, laws, rules and regulations set out in the Canada National Parks Act and Regulations.
- .2 The Contractor and any sub-contractors shall obtain a business license from a Parks Canada Administration Office, prior to commencement of the Contract. The business license must be valid for the Park in which the Work is occurring.
- .3 All Contractor's vehicles are required to display a vehicle work pass from PCA. These permits may be obtained free of charge from the PCA Administration Office once a business permit has been obtained.

1.5 CANADIAN ENVIRONMENTAL ASSESSMENT ACT (CEAA)

- .1 Execution of the work is subject to the provisions within the *Canadian Environmental Assessment Act* (CEAA) Guidelines Order of 2003 and subsequent amendments.
- .2 Refer to the PCA Best Management Practices (BMPs) for the Work included with this tender. The Contractor is required to implement all recommendations and mitigations, and follow all procedures and processes whether supply, construction, administration or otherwise as described in the BMPs.
- .3 The Contractor shall prepare their Environmental Protection Plan (EPP) to implement the mitigations identified in the BMPs as a minimum but shall ensure that all environmental requirements under the Contract and associated with the Works are appropriately managed through their EPP processes.

- .4 Where there is a discrepancy or inconsistency between the BMPs and other documents, the BMPs takes precedence over other documents.
- .5 Failure to comply with or observe environmental protection measures as identified in these specifications may result in the work being suspended pending rectification of the problems.

1.6 START-UP AND ENVIRONMENTAL BRIEFING

- .1 **All staff employed at the construction site will be required to attend an approximate one (1) hour environmental briefing presented by PCA prior to their commencement of work on site.** It is recognized that new employees may join the Contractors' work force after the initial round of "environmental briefing". In that case and as required, subsequent "environmental briefings" can be presented as numbers warrant, by arrangement with the ESO through the Departmental Representative. Also, some sub-trades may be present at the site for a short time, to perform once-only duties. In these cases, the "environmental briefing" will be replaced by the Contractor explaining the environmental sensitivity of the work location to the sub-trade worker(s), and reviewing highlights of personal conduct expected, with reference to a one-page briefing summary to be provided to the Contractor by the ESO. A copy of this summary will be provided to each sub-trade worker joining the work force at the site.
- .2 Parks Canada will have an ESO attending the site to inspect the construction activity for conformance with the EPP. The ESO or alternate designated Parks Canada staff member will present the "environmental briefing". The ESO's main duties are to inspect the progress of the construction on an on-going basis to ensure compliance with environmental protection measures, and to provide guidance through the Departmental Representative, in the event of unanticipated environmental problems. Although the ESO has authority to enforce National Parks Act violations, direction to the Contractor will be the duty of the Departmental Representative.
- .3 The ESO is not to act as daily environmental monitor, but shall check activities with the approved EPP to ensure compliance, at their discretion. The Contractor's QEP shall be responsible for ensuring all activities are conducted in accordance with the approved environmental documents.

1.7 ENVIRONMENTAL PROTECTION PLAN

- .1 The EPP is to be prepared and certified by a Qualified Environmental Professional. Certification by a QEP is considered incidental to the Works and no additional payment will be made.
- .2 Changes and/or revisions to the EPP may be required by the Departmental Representative as the Work progresses and more information becomes available. No additional payment will be made for changes and/or revisions to the EPP.
- .3 The Contractor's EPP will detail how the work limits shall be marked and what procedures will be employed to ensure trespass outside these limits does not occur, to the satisfaction of the Departmental Representative.
- .4 The EPP will include how the Contractor will manage all environmental risks and specify site-specific details for implementing mitigation or achieving mitigation outcomes identified in the BMPs.
- .5 Spill Response and Erosion and Sedimentation Management Plans are to be included in the EPP, in accordance with this Section.

- .6 QEP resumes are to be included in the EPP for Departmental Representative.
- .7 The Contractor shall submit the EPP in accordance with 01 33 00 – Submittal Procedures, yet **allow no less than 2 weeks for the review of their EPP** and shall address and respond to all comments raised during the review within a maximum of 2 weeks.

1.8 RESTRICTED ACTIVITY PERMITS

- .1 Prior to commencing any activity, the Contractor may be required to first obtain a Restricted Activity Permit (RAP) in consultation with PCA and Departmental Representative.
- .2 Prior to mobilization, Contractor is to establish what RAPs are required for the Works, for the duration of the project. Include, in the project schedule, the acquisition of the application for RAPs, allowing no less than 2 weeks for review and acceptance by the Departmental Representative.
- .3 Contractor shall list RAPs they require in the EPP.
- .4 The Contractor is required to submit an application form to the Departmental Representative for each required RAP.
- .5 RAP application details include, but are not limited to: Name of activity, start and end date of activity, location of Work, Contractor company name and address, Contractor contact name, phone number and email address and vehicle information.
- .6 Following the application submission, the Contractor may be required to provide further details regarding the Work to PCA.
- .7 Submission of a RAP application to the Departmental Representative does not permit the Contractor to commence the restricted activity.

1.9 CONSTRUCTION SITE ACCESS AND PARKING

- .1 Points of access from the existing roadway to the various construction sites will be required. The Contractor shall review both short and long-term construction access requirements with the Departmental Representative, both at start-up and on an ongoing basis. In consultation with the Departmental Representative, the Contractor shall formulate an agreement for worker transportation to and from the work sites and where workers shall park their private vehicles.
- .2 The Contractor shall ensure that the environment beyond the work limits is not negatively impacted or damaged by workers' vehicles or construction machinery and shall instruct workers so that the "footprint" of the project is kept within defined boundaries.

1.10 ACCIDENTAL FINDS

- .1 It is possible that a scattering of historic objects will be found within the Project limits. If significant features are encountered, stop Work in the immediate area, notify the Departmental Representative, take photographs of the findings and a GIS location reading.
- .2 Significant features include items such as:
 - .1 Structural remains, high artifact concentrations, tent platforms, log cribbing retaining features, human remains, marked trees and other various items.
 - .2 If unsure, contact the Departmental Representative immediately.

- .3 The Departmental Representative will notify the Contractor when Works can resume in the area.
- .4 Should any process or requirements regarding archeological matters listed in this Section contradict the BMPs, the BMPs shall take precedence.

1.11 MISCELLANEOUS SITE MANAGEMENT CONTINGENCIES

- .5 A RAP application will be required for any permitted Work camps or off-highway operation of a motor vehicle.
- .6 A Contractor's office and work headquarters material laydown, equipment parking and storage area will be permitted in accordance with this Section and Section 01 14 00 - Work Restrictions.
- .7 Removal and storage of snow shall be in accordance with 01 35 31 Special Procedures for Traffic Control. If coordination is required, the Contractor shall coordinate through the Departmental Representative.
- .8 The Contractor shall control blowing dust and debris generated from the construction site by means such as covering or wetting down dry materials and rubbish. Dust generated during the grade construction and or utilization of any temporary access roads must be kept at a reasonable level so as not to impart any hazard to the public traffic. Control measures must be initiated as and when required and may require increased vigilance at the discretion of the Departmental Representative.

1.12 SPECIFIC CONCERNS RELATIVE TO EROSION CONTROL AND SEDIMENTATION

- .1 The Contractor's QEP shall prepare an Erosion and Sedimentation Management Plan (ESMP) for the components of the Contract that are undertaken in proximity to watercourses, wetlands or riparian environments. The plan shall be included in the EPP and prepared to the satisfaction of the Departmental Representative.
- .2 The ESMP shall be prepared so as to ensure that there is no release into watercourses of sediments in levels that are deleterious to fish or that would harmfully alter, disrupt, or destroy fish habitat. Similarly, there is to be no sediment release into areas of vegetation growth or sensitive areas of sediments in levels that would adversely alter growing or hydraulic conditions. The target is 0 mg/L of TSS over background levels. The threshold is a maximum instantaneous increase of 25 mg/L over background levels when background levels are <250 mg/L, or a maximum instantaneous increase of 10% over background levels when background levels are >250 mg/L. This threshold shall not be exceeded.
- .3 If necessary, on-site sediment control measures shall be constructed and functional prior to initiating construction activities.
- .4 The regular monitoring and maintenance of all erosion control measures shall be the responsibility of the Contractor. If the design of the control measures is not functioning effectively they are to be repaired. The Departmental Representative also will monitor erosion control performance.
- .5 The site will be secured against erosion during any periods of construction inactivity or shutdown.

1.13 POLLUTION CONTROL

- .1 The Contractor shall prevent any deleterious and objectionable materials from entering streams, rivers, wetlands, water bodies or watercourses that would result in damage to aquatic and riparian habitat. Hazardous or toxic products shall be stored no closer than 100 metres from watercourses.
- .2 A Spill Response Plan will be prepared by the Contractor's QEP as part of the EPP and shall detail the containment and storage, security, handling, use and disposal of empty containers, surplus product or waste generated in the application of these products, to the satisfaction of the Departmental Representative and PCA and in accordance with all applicable federal and provincial legislation. The EPP shall include a list of products and materials to be used or brought to the construction site that are considered or defined as hazardous or toxic to the environment. Such products include, but are not limited to, waterproofing agents, grout, cement, concrete finishing agents, hot poured rubber membrane materials, asphalt cement and sand blasting agents.
- .3 The containment, storage, security, handling, use, unique spill response requirements and disposal of empty containers, surplus product or waste generated in the use of any hazardous or toxic products shall be in accordance with all applicable federal and provincial legislation. Hazardous products shall be stored no closer than 100 metres from watercourses.
- .4 An impervious berm shall be constructed around fuel tanks and any other potential spill area. The berms shall be capable of holding 110% of tank storage volumes and shall be to the satisfaction of the Departmental Representative before start-up. Measures such as collection / drip trays and berms lined with occlusive material such as plastic and a layer of sand, and double-lined fuel tanks can prevent spills into the environment.
- .5 The Contractor shall prevent blowing dust and debris by covering and/or providing dust control for temporary roads and on-site work by methods that are accepted by the Departmental Representative.
- .6 The Contractor shall provide spill kits at re-fuelling, lubrication, and repair locations that will be capable of dealing with 110% of the largest potential spill and shall be maintained in good working order on the construction site. The Departmental Representative prior to project start-up must approve these spill kits. The Contractor and site staff shall be informed of the location of the spill response kit(s) and be trained in its use.
- .7 Timely and effective action shall be taken to stop, contain and clean-up all spills as long as the site is safe to enter. Parks Canada Dispatch shall be notified immediately of any spill immediately and can be contacted at a phone number provided in the Preconstruction Meeting. Following notification of Parks Canada Dispatch, the Departmental Representative shall be notified. Spill response cards will be distributed during the initial Environmental Briefing with basic instructions and phone numbers.
- .8 In the event of a major spill, all other work shall be stopped and all personnel shall be devoted to spill containment and clean-up.
- .9 The costs involved in a spill incident (the control, clean up, disposal of contaminants and site remediation to pre-spill conditions), shall be the responsibility of the Contractor. The site will be inspected to ensure completion to the expected standard and to the satisfaction of the Departmental Representative.

1.14 EQUIPMENT MAINTENANCE, FUELLING AND OPERATION

- .1 The Contractor shall ensure that all soil, seeds and any debris attached to construction equipment to be used on the project site shall be removed (e.g. power washing) outside the National Parks and be approved for entry by the Departmental Representative before delivery to the work site.
- .2 Equipment fuelling sites will be identified by the Contractor and accepted by the Departmental Representative. Except for chain saws, any fuelling closer than 100 metres any streams, wetlands, water bodies or waterways shall require the authorization and oversight of the Departmental Representative.
- .3 Diesel and gasoline delivery vehicles, including bulk tankers shall be parked more than 100 metres from any streams, wetlands, water bodies or watercourses. Gravity fed fuel systems are not allowed. Manual or electric pump delivery systems shall be used. Fuelling personnel shall maintain presence at and immediate attention to the fuelling operation.
- .4 Mobile fuel containers (e.g. slip tanks, small fuel carboys) shall remain in the service vehicle at all times. Protection and containment of approved fuel storage sites is addressed above.
- .5 Equipment used on the project shall be fuelled with E10, and low sulfur diesel fuels and shall conform to local emission requirements. The Contractor is to ensure that unnecessary idling of vehicles is avoided.
- .6 Oil changes, lubricant changes, greasing and machinery repairs shall be performed at locations approved by the Departmental Representative. Waste lubrication products (e.g. oil filters, used containers, used oil, etc.) shall be secured in spill-proof containers and properly recycled or disposed of at an approved facility. No waste petroleum, lubricant products or related materials are to be discarded, buried or disposed of in borrow pits, turnouts, picnic areas, viewpoints, etc., anywhere within the National Parks.
- .7 The Contractor shall ensure that all equipment is inspected daily for fluid/fuel leaks and maintained in good working order.
- .8 Fuel containers and lubricant products shall be stored only in secure locations specified by the Departmental Representative. Fuel tanks or other potentially deleterious substance containers shall be secured to ensure they are tamperproof and cannot be drained by vandals when left overnight the National Parks. Alternatively, the Contractor may hire a security person employed to prevent vandalism in accordance with 01 52 00 Construction Facilities.

1.15 OPERATION OF EQUIPMENT

- .1 Equipment movements shall be restricted to the 'footprint' of the construction area. The work limits shall be identified by stake and ribbon or other methods approved by the Departmental Representative. Unless authorized by the Departmental Representative, activities beyond the work limits are not permitted. No machinery will enter, work in or cross over streams, rivers, wetlands, water bodies or watercourses, nor damage aquatic and riparian habitat or trees and plant communities. Some of the construction shall require working close to watercourses or water bodies. In these instances, the Contractor is to describe measures to be employed to ensure fugitive materials (e.g. rocks, soil, branches) and especially deleterious substances (e.g. chemicals) do not enter any watercourses, to the satisfaction of the Departmental Representative.

- .2 The Contractor shall instruct workers to prevent pushing, placement, raveling, storage or stockpiling of any materials (e.g. slash, rock, fill or topsoil) in the trees bordering the right-of-way or into watercourses or water bodies.
- .3 When, in the opinion of Parks Canada, negligence on the part of the Contractor results in damage or destruction of vegetation, or other environmental or aesthetic features beyond the designated work area, the Contractor shall be responsible, at his or her expense, for complete restoration including the replacement of trees, shrubs, topsoil, grass, etc., to the satisfaction of the Departmental Representative.
- .4 Restrict vehicle movements to work limits.
- .5 Workers private vehicles are to remain within the construction footprint.

1.16 FIRE PREVENTION AND CONTROL

- .1 A fire extinguisher shall be carried and available for use on each machine and at locations within the plant in the event of fire. Basic firefighting equipment recommended (e.g. a water truck; minimum 500 Imperial gallons with 500 feet of fire hose and a pump capable of producing 45 psi water pressure at the nozzle, three shovels, two pulaskis, and two five-gallon backpack pumps) shall be maintained at the construction site at a location known and easily accessible to all the Contractors' staff.
- .2 A water truck may be necessary and will depend on the timing of the Contract (e.g. not required during winter or snow-covered conditions).
- .3 Construction equipment shall be operated in a manner and with all original manufacturers' safety devices to prevent ignition of flammable materials in the area.
- .4 Care shall be taken while smoking on the construction site to ensure that the accidental ignition of any flammable material is prevented. Fires or burning of waste materials is not permitted.
- .5 In case of fire, the Contractor or worker shall take immediate action to extinguish the fire provided it is safe to do so. Parks Canada Dispatch shall be notified immediately of any fire immediately and can be contacted at a phone number provided in the Preconstruction Meeting. Following notification of Parks Canada Dispatch, the Departmental Representative shall be notified.
- .6 Fires or burning of waste materials is not permitted.

1.17 WILDLIFE

- .1 During the Environmental Briefing all personnel shall be instructed by the ESO on procedures to follow in the event of wildlife appearance near or within the work site and any other wildlife concerns.
- .2 Avoid or terminate activities on site that attract or disturb wildlife and vacate the area and stay away from the immediate location if bears, cougars, wolves, elk or moose display aggressive behaviour or persistent intrusion. Extra care to control materials that might attract wildlife (e.g. lunches and food scraps) must be exercised at all times.
- .3 Notify the Departmental Representative, who will notify the ESO, immediately about dens, litters, nests, carcasses (road kills), bear activity or encounters on or around the site or crew accommodation. Other wildlife-related encounters are to be reported within 24 hours. If the Departmental Representative is not available, Parks Canada Dispatch will be contacted at a phone number provided in the Preconstruction Meeting.

1.18 RELICS AND ANTIQUITIES

- .1 Artifacts, relics, antiquities and items of historical interest such as cornerstones, commemorative plaques, inscribed tablets and similar objects found on the work site shall be reported to the Departmental Representative immediately. The Contractor and workers shall wait for instructions before proceeding with their work.
- .2 All historical or archaeological objects found in the National Parks are protected under the National Parks Act and Regulations and are the property of Parks Canada. The Contractor and workers shall protect any articles found and request direction from the Departmental Representative.

1.19 WASTE MATERIALS STORAGE AND REMOVAL

- .1 The Contractor and workers shall dispose of hazardous wastes in conformance with the Environmental Contaminants Act and applicable provincial regulations while observing the Code of Good Practice for Management of Hazardous and Toxic Wastes at Federal Establishments.
- .2 All wastes originating from construction, trade, hazardous and domestic sources, shall not be mixed, but will be kept separate.
- .3 Construction, trade, hazardous waste and domestic waste materials shall not be burned, buried or discarded at the construction site or elsewhere in the National Parks. These wastes shall be contained and removed in a timely and accepted manner by the Contractor and workers, and disposed of at an appropriate waste landfill site located outside the park. Construction waste storage containers, provided by the Contractor, shall be emptied by the Contractor when 90% full. Waste containers will have lids, and waste loads shall be covered while being transported.
- .4 A concerted effort shall be made by the Contractor and workers to reduce, reuse and recycle materials.
- .5 All efforts to prevent wildlife from obtaining food, garbage or other domestic wastes shall be made by the Contractor and Contract staff while undertaking their work in the National Parks. Such wildlife attractants shall not be stored at the work site overnight. Lunches, coolers and food products, including waste food products, shall be securely stored away from access by animals. Daily removal of food scraps, food wrappers, pop cans or other attractive products to bear proof containers is mandatory. It is incumbent on the Contractor to notify Parks Canada and make specific arrangements to have garbage collected by Parks Canada when using existing Parks Canada receptacles.
- .6 The Contractor and workers shall immediately report any circumstances related to food/garbage (e.g. overflowing container or strong smell) and wildlife to the Departmental Representative, who will notify the ESO. If the Departmental Representative cannot be reached, the Contractor/worker shall immediately contact Parks Canada Dispatch at the phone number provided in the Preconstruction Meeting and report the details.
- .7 Sanitary facilities, such as a portable container toilet, shall be provided by the Contractor and maintained in a clean condition.

1.20 MEASURES TO AVOID CAUSING HARM TO FISH AND FISH HABITAT

- .1 The Contractor shall adhere to the mitigation techniques outlined in this section.
- .2 Project Planning

.1 Timing

- .1 Time work in water to respect timing windows to protect fish, including their eggs, juveniles, spawning adults and/or the organisms upon which they feed.
- .2 Minimize duration of in-water work.
- .3 Conduct instream work during periods of low flow, or at low tide, to further reduce the risk to fish and their habitat or to allow work in water to be isolated from flows.
- .4 Schedule work to avoid wet, windy and rainy periods that may increase erosion and sedimentation

.2 Site Selection

- .1 Design and plan activities and works in waterbody such that loss or disturbance to aquatic habitat is minimized and sensitive spawning habitats are avoided.
- .2 Design and construct approaches to the waterbody such that they are perpendicular to the watercourse to minimize loss or disturbance to riparian vegetation.
- .3 Avoid building structures on meander bends, braided streams, alluvial fans, active floodplains or any other area that is inherently unstable and may result in erosion and scouring of the stream bed or the built structures.
- .4 Undertake all instream activities in isolation of open or flowing water to maintain the natural flow of water downstream and avoid introducing sediment into the watercourse.

.3 Contaminant and Spill Management

- .1 Design and plan activities and works in waterbody such that loss or disturbance to aquatic habitat is minimized and sensitive spawning habitats are avoided.
- .2 Design and construct approaches to the waterbody such that they are perpendicular to the watercourse to minimize loss or disturbance to riparian vegetation.
- .3 Avoid building structures on meander bends, braided streams, alluvial fans, active floodplains or any other area that is inherently unstable and may result in erosion and scouring of the stream bed or the built structures.
- .4 Undertake all instream activities in isolation of open or flowing water to maintain the natural flow of water downstream and avoid introducing sediment into the watercourse.

.3 Erosion and Sediment Control

- .1 Develop and implement an Erosion and Sediment Control Plan for the site that minimizes risk of sedimentation of the waterbody during all phases of the project. Erosion and sediment control measures should be maintained until all disturbed ground has been permanently stabilized, suspended sediment has resettled to the bed of the waterbody or settling basin and runoff water is clear. The plan should, where applicable, include:

- .1 Installation of effective erosion and sediment control measures before starting work to prevent sediment from entering the water body.
 - .2 Measures for managing water flowing onto the site, as well as water being pumped/diverted from the site such that sediment is filtered out prior to the water entering a waterbody. For example, pumping/diversion of water to a vegetated area, construction of a settling basin or other filtration system.
 - .3 Site isolation measures (e.g., silt boom or silt curtain) for containing suspended sediment where in-water work is required (e.g., dredging, underwater cable installation).
 - .4 Measures for containing and stabilizing waste material (e.g., dredging spoils, construction waste and materials, commercial logging waste, uprooted or cut aquatic plants, accumulated debris) above the high-water mark of nearby waterbodies to prevent re-entry.
 - .5 Regular inspection and maintenance of erosion and sediment control measures and structures during the course of construction.
 - .6 Repairs to erosion and sediment control measures and structures if damage occurs.
 - .7 Removal of non-biodegradable erosion and sediment control materials once site is stabilized.
- .4 Shoreline Re-vegetation and Stabilization
- .1 Clearing of riparian vegetation should be kept to a minimum: use existing trails, roads or cut lines wherever possible to avoid disturbance to the riparian vegetation and prevent soil compaction. When practicable, prune or top the vegetation instead of grubbing/uprooting.
 - .2 Minimize the removal of natural woody debris, rocks, sand or other materials from the banks, the shoreline or the bed of the waterbody below the ordinary high-water mark. If material is removed from the waterbody, set it aside and return it to the original location once construction activities are completed.
 - .3 Immediately stabilize shoreline or banks disturbed by any activity associated with the project to prevent erosion and/or sedimentation, preferably through re-vegetation with native species suitable for the site.
 - .4 Restore bed and banks of the waterbody to their original contour and gradient; if the original gradient cannot be restored due to instability, a stable gradient that does not obstruct fish passage should be restored.
 - .5 If replacement rock reinforcement/armouring is required to stabilize eroding or exposed areas, then ensure that appropriately-sized, clean rock is used; and that rock is installed at a similar slope to maintain a uniform bank/shoreline and natural stream/shoreline alignment.
 - .6 Remove all construction materials from site upon project completion.
- .5 Fish Protection
- .1 Ensure that all in-water activities, or associated in-water structures, do not interfere with fish passage, constrict the channel width, or reduce flows.

- .2 Retain a qualified environmental professional to ensure applicable permits for relocating fish are obtained and to capture any fish trapped within an isolated/enclosed area at the work site and safely relocate them to an appropriate location in the same waters. Fish may need to be relocated again, should flooding occur on the site.
- .3 Screen any water intakes or outlet pipes to prevent entrainment or impingement of fish. Entrainment occurs when a fish is drawn into a water intake and cannot escape. Impingement occurs when an entrapped fish is held in contact with the intake screen and is unable to free itself.
 - .1 In freshwater, follow these measures for design and installation of intake end of pipe fish screens to protect fish where water is extracted from fish-bearing waters:
 - .1 Screens should be located in areas and depths of water with low concentrations of fish throughout the year.
 - .2 Screens should be located away from natural or artificial structures that may attract fish that are migrating, spawning, or in rearing habitat.
 - .3 The screen face should be oriented in the same direction as the flow.
 - .4 Ensure openings in the guides and seals are less than the opening criteria to make “fish tight”.
 - .5 Screens should be located a minimum of 300 mm (12 in.) above the bottom of the watercourse to prevent entrainment of sediment and aquatic organisms associated with the bottom area.
 - .6 Structural support should be provided to the screen panels to prevent sagging and collapse of the screen.
 - .7 Large cylindrical and box-type screens should have a manifold installed in them to ensure even water velocity distribution across the screen surface. The ends of the structure should be made out of solid materials and the end of the manifold capped.
 - .8 Heavier cages or trash racks can be fabricated out of bar or grating to protect the finer fish screen, especially where there is debris loading (woody material, leaves, algae mats, etc.). A 150 mm (6 in.) spacing between bars is typical.
 - .9 Provision should be made for the removal, inspection, and cleaning of screens.
 - .10 Ensure regular maintenance and repair of cleaning apparatus, seals, and screens is carried out to prevent debris-fouling and impingement of fish.
 - .11 Pumps should be shut down when fish screens are removed for inspection and cleaning.
- .6 Operation of Machinery
 - .1 Ensure that machinery arrives on site in a clean condition and is maintained free of fluid leaks, invasive species and noxious weeds.

- .2 Whenever possible, operate machinery on land above the high-water mark, on ice, or from a floating barge in a manner that minimizes disturbance to the banks and bed of the waterbody.
- .3 Limit machinery fording of the watercourse to a one-time event (i.e., over and back), and only if no alternative crossing method is available. If repeated crossings of the watercourse are required, construct a temporary crossing structure.
- .4 Use temporary crossing structures or other practices to cross streams or waterbodies with steep and highly erodible (e.g., dominated by organic materials and silts) banks and beds. For fording equipment without a temporary crossing structure, use stream bank and bed protection methods (e.g., swamp mats, pads) if minor rutting is likely to occur during fording.
- .5 Wash, refuel and service machinery and store fuel and other materials for the machinery in such a way as to prevent any deleterious substances from entering the water.

1.21 BEST MANAGEMENT PRACTICES FOR ROADWAY, HIGHWAY, PARKWAY, AND RELATED INFRASTRUCTURE

- .1 The Contractor shall adhere to all the mitigation and submittals in this section.
- .2 General Activities Mitigations
 - .1 Work Site Conditions/Staging/Laydown
 - .1 Minimize vegetation-clearing activities and ground disturbance by staging on existing hardened areas wherever possible.
 - .2 Delineate the work zone; clearly mark the limits to active construction and the access and egress locations.
 - .2 Equipment Operations
 - .1 Ensure machinery arrives on site in a clean condition and is maintained free of fluid leaks, invasive species, noxious weeds and soils from off-site.
 - .2 Operate machinery on land above the high-water mark, on ice, or in another manner that minimizes disturbance to the banks and bed of any water body.
 - .3 Fuel Storage and Refueling/Emergency Plans
 - .1 Hazardous or toxic products shall be stored no closer than 100 metres from streams, wetlands, water bodies or waterways.
 - .4 Site Clean Up/Waste Disposal
 - .1 Clean tools and equipment off-site to prevent the release of wash water that may contain deleterious substances.
 - .2 Where possible, sweep up loose material or debris. Any material thought to pose a risk of contamination to soils, surface water or groundwater should be disposed of appropriately off-site.
- .3 Asphalt Production and Handling Mitigations
 - .1 Timing of Works

- .1 Asphalt works are preferably undertaken during periods of dry weather as this allows easier control of contaminated runoff and sediment.
- .2 If the work schedule requires working in the rain, the area of work must be isolated and appropriate sediment controls must be installed to prevent the release of sediment-laden water or any other deleterious substances into surface waters, particularly for surface repair works requiring the application of patching and sealing compounds, tar, asphalt, and chemical surface sealants.
- .2 Operations of Asphalt Plants
 - .1 Spoil piles and stock piles will be at least 30 meters from the edge of any water body.
 - .2 Excess hot mix or reject new asphalt shall be temporarily stored in the containment area sufficient to prevent runoff of petroleum into soils or surface waters as directed by the Departmental Representative, and removed from the Parks Canada protected heritage place, prior to project completion.
 - .3 Every effort will be made to recycle waste asphalt, either as a base course, or by recycling waste asphalt through the asphalt plant according to engineering specifications. Old cured ground asphalt material shall be removed, recycled, or stored for future recycling at an approved operational gravel pit. Stockpiles must be further than 30 metres from any surface waters.
 - .4 Asphalt to be removed must be sampled and analyzed to determine possible lead contamination. Contaminated asphalt will be transported to an approved waste disposal facility. A receipt of delivery is to be provided to the Departmental Representative.
- .3 Gravel Crushing and Washing
 - .1 Where possible within engineering constraints, asphalt materials should be recycled to reduce the need for new gravel.
 - .2 Gravel will be obtained from an approved operational borrow pit only.
 - .3 For waste removed from the park a detailed receipt of delivery to an approved facility will be provided to the Departmental Representative.
- .4 Oiling of Truck Boxes
 - .1 Trucks for hauling asphalt mixture shall have tight, clean, smooth metal beds that have been sprayed with a minimum amount of thin fuel oil to prevent the mixture from adhering and causing waste asphalt.
 - .2 Truck boxes may be oiled only when absolutely necessary.
 - .3 Oiling will take place in a bermed area, consisting of a plastic underlay with 15 centimetres overlay of clean gravel. Oil contaminated gravel will be hand collected (so as to prevent tearing of the plastic) from the bermed area daily, and put through the asphalt plant.

- .4 Vehicle covers shall be securely fastened.
- .5 Disposal and Clean Up of Other Waste Products
 - .1 To ensure regular clean-up of waste asphalt and petroleum spills, a defined clean up schedule will be established during the preconstruction meeting.
 - .2 Leaks will be collected in drip trays, the collected material will either be removed from the park, or recycled back through the Asphalt Plant. For any material removed outside the park to an approved facility, a detailed receipt will be provided to the Departmental Representative.
 - .3 Used oil, filters, grease cartridges, oil cans and other waste products of plant servicing will be collected and disposed of at the nearest industrial waste facility.
- .4 Concrete Handling Mitigations
 - .1 Onsite Temporary Concrete Washout Facility
 - .1 Temporary concrete washout facilities shall be located a minimum of 30m from storm drain inlets, open drainage facilities, and watercourses.
 - .2 Temporary concrete washout facilities shall be temporary pit or bermed areas constructed and maintained in sufficient quantity and size to contain all liquid and concrete waste generated by washout operations.
 - .3 Straw bales, wood stakes, and sandbag materials can be used to construct temporary containment walls or “barriers”.
 - .4 Plastic lining material shall be a minimum of 10-mil polyethylene sheeting and shall be free of holes, tears or other defects that compromise the impermeability of the material.
 - .5 The soil base shall be prepared free of rocks or other debris that may cause tears or holes in the plastic lining material.
 - .6 Perform washout of concrete mixer trucks in designated areas only.
 - .7 Wash concrete from mixer truck chutes into approved concrete washout facility or collect in an impermeable bag for disposal.
 - .8 Pump excess concrete in concrete pump bin back into concrete mixer truck.
 - .9 Concrete washout from concrete pumper bins can be washed into concrete pumper trucks and discharged into designated washout area or properly disposed offsite.
 - .10 Once concrete wastes are washed into the designated area and allowed to harden, the concrete shall be broken up, removed, and disposed of per federal and provincial regulations.
 - .2 Maintenance and Inspection of Temporary Concrete Washout Facilities
 - .1 Temporary concrete washout facilities shall be maintained to provide adequate holding capacity with a minimum freeboard of

100 mm (4 inches) for above grade facilities and 300 mm (12 inches) for below grade facilities.

- .2 Maintaining temporary concrete washout facilities shall include removing and disposing of hardened concrete and returning the facilities to a functional condition.
- .3 Existing facilities must be cleaned, or new facilities must be constructed and ready for use once the washout is 75% full.
- .4 Temporary concrete washout facilities shall be inspected for damage (i.e. tears in PVC liner, missing sand bags, etc.).
- .5 Onsite concrete waste storage and disposal procedures should be monitored at least weekly or as directed by the Departmental Representative.

.3 Removal of Temporary Concrete Washout Facilities

- .1 Holes, depressions or other ground disturbance caused by the removal of the temporary concrete washout facilities shall be backfilled and restored.

.4 Onsite Concrete Management

- .1 Rolling concrete mixers with surplus concrete in amounts less than one cubic metre of wet concrete may waste this concrete in the grade right-of-way as directed by the Parks Canada Representative in areas that drain well away from watercourses. Surplus amounts in excess of one cubic metre are to be returned to the batching yard.
- .2 Water contaminated in the placing of cement and curing of concrete shall be contained and removed from the site to an approved disposal facility.
- .3 The concrete batching plant must be operated pursuant to applicable dust, air emission, and water quality control regulations.
- .4 Waste, solidified concrete from rolling concrete mixers in amounts less than 1 cubic meter and waste solidified concrete from construction pour shall be buried in the grade within 48 hours of the pour, subject to approval and direction from the Departmental Representative

.5 Paving, Resurfacing, Grading Mitigations

.1 Timing of Works

- .1 Works are preferably undertaken during periods of dry weather (e.g., summer) as this allows easier control of contaminated runoff and sediment.
- .2 If the work schedule requires working in the rain, the area of work must be isolated and appropriate sediment controls must be installed to prevent the release of sediment-laden water or any other deleterious substances into surface waters, particularly for surface repair works requiring the application of patching and sealing compounds, tar, asphalt, and chemical surface sealants.

.2 Grading

- .1 During grade construction conducted close to any watercourse, water body or wetland ensure materials are not pushed, fall or are eroded into the water or wetlands.
 - .2 No grade building shall occur outside of the delineated work area or within 1 metre of the drip line of existing forest. Any material inadvertently falling outside the work limits will be removed promptly in a manner that does not damage trees or vegetation.
 - .3 Materials shall be placed at storage sites or on the grade without spillage outside the work limits. Any material inadvertently falling outside the work limits will be removed promptly in a manner that does not damage trees or vegetation.
 - .4 Retain a 30 metre vegetated buffer around water bodies or install runoff management structures.
 - .5 If possible grade roads early in the spring before vegetation develops seed heads or late in season after vegetation has set seed and is dormant to minimize non-native vegetation propagation.
 - .6 Ensure gravel or road bed material is free of weeds and comes from an approved operational gravel source free of other contaminates.
- .3 Paving and Resurfacing
- .1 Minimize changes to the surface that could affect infiltration and runoff characteristics and maintain effective surface drainage to limit direct runoff into surface waters.
 - .2 Minimize application of seal coats in wet conditions. Attempt to apply only to dry surfaces and not prior to (within 24 hrs.) or during rainfall. If unforeseen rain arrives ensure runoff from recently seal coated surfaces are prevented from entering surface waters.
 - .3 For asphalt handling and management see the Asphalt Mitigation Module of the BMP.
- .4 Pavement Marking and Barrier and Guardrail Reinstatement
- .1 Minimize changes to the surface that could affect infiltration and runoff characteristics and maintain effective surface drainage to limit direct runoff into surface water Pavement marking shall be undertaken pursuant to standard methods applied in National Parks for control of paint products, both in transport and handling. The Contractor shall present a description of methods to be employed for transporting and controlling paint and hazardous products, application of paint, cleaning of equipment, containment and disposal of waste paint and cleaning products, etc. to the satisfaction of the Departmental Representative.
 - .2 Where concrete barriers or guard rails are temporarily removed, for highway improvements, temporary glow posts shall be installed, at 20.0 m intervals on straight sections and at 10.0 m intervals on curves and shall remain in place until permanent barrier system has been installed.

.6 Barriers and Guardrails Mitigations

.1 Timing of Works

- .1 Where excavation is required, schedule work to avoid wet, windy and rainy periods that may increase erosion and sedimentation.
- .2 If the work schedule requires working in the rain, appropriate sediment controls must be installed to prevent the release of sediment-laden water or any other deleterious substances into surface waters.

.2 Repairs, Replacement and Upgrades

- .1 An Erosion and Sedimentation Management Plan shall be prepared for the components of the work undertaken within 100m of watercourses, wetlands or riparian environments. If sediment ponds are required, they shall be designed to settle all sediment particles 0.02 mm or larger.
- .2 Where use of concrete is required for guardrail post holes, Concrete Handling Mitigations apply.
- .3 If vegetation removal is required for barrier or guardrail works, Vegetation Removal Mitigations apply.
- .4 Where concrete barriers or guardrails are temporarily removed, temporary glow posts shall be installed, at 20.0 m intervals on straight sections and at 10.0 m intervals on curves and shall remain in place until permanent barrier system has been installed.

.7 Vegetation Removal Mitigations

.1 Timing Windows

- .1 Vegetation clearing can negatively impact nesting birds and/or bats in spring and summer. Avoid all vegetation removal during this time. If vegetation removal is scheduled to occur within these times a qualified professional biologist/ecologist should further clarify the species presence and timing particular to the work site and any occupied bird nests, eggs, or nests of species protected under the Migratory Bird Convention Act (MBCA). See appendix on regulatory guidance for further detail on the MBCA and SARA.
- .2 If a nest is found during the pre-work surveys, the vegetated area will be left intact with a suitable sized buffer of shrubs/trees around it until the young have fledged and left the nest. Size of buffer species dependent, to be determined in consultation with professional biologist or park ecologist.
- .3 Grass mowing and trimming should not occur during peak spring or fall reptile/amphibian migrations and hatching. Consult a local biologist/ecologist for site and species specific timing windows.

.2 Vegetation Removal Mitigations

- .1 Vegetation removal should be limited to the minimum Clear Zone Distance dependent on type and size of road and maximum height needed to meet the road safety objectives.
- .2 Minimize full removal and retain vegetation when possible to reduce erosion.

- .3 Prior to the commencement of any vegetation removal, the worksite must be surveyed for species at risk. If species at risk are found, work must be stopped until site-specific mitigations to address potential adverse effects are developed.
 - .4 Survey vegetation for non-native species, clear vegetation areas with non-native vegetation in spring and early summer to avoid further spread and development of the non-native seed bank.
 - .5 Clearing activities shall be avoided during nesting seasons for birds, reptiles and amphibian species in the project area.
 - .6 If wildlife is observed during work, if possible, give animals the opportunity to escape the work area to the surrounding forest or elsewhere to seek new shelter.
 - .7 Avoid ground vegetation removal during dry, windy periods to prevent erosion of topsoil and reduction of air quality with dirt/dust.
 - .8 Retain 30 metre vegetated buffer around water bodies, where disturbance is necessary and unavoidable restoration is required.
 - .9 Debris will not be deposited in water bodies.
 - .10 Ensure tree limbs/stumps are flush cut as close to the ground or stem as possible.
 - .11 Logs and other salvage materials are to be conveyed to and placed at a storage site without spread of debris or damage to other standing trees or landscape resources outside the marked clearing or storage limits. They shall not be skidded through wetlands, waterways or water bodies.
 - .12 During the grubbing component, stumps, roots, imbedded logs and other non-soil debris shall be pulled and shaken free of loose soil and rocks before transport to a designated pit.
 - .13 Where possible preserve identified wildlife trees by limbing or topping if they are not assessed as hazard trees.
- .3 Disposal of Vegetation Debris
- .1 All vegetation debris must be removed as soon as possible from the right-of-way, either by transporting off-site for disposal or piling and burning on-site.
 - .2 All vegetation containing non-native species will be piled and burnt or bagged and removed off site to disposal facility.
 - .3 Piles will be made where trees are felled, piles will be 1.2-1.8 (4 to 6 feet) in diameter and no more than 1.2 m (4 feet) high (approximately 1 to 3 trees per pile) or as instructed by local fire and vegetation specialists.
 - .4 Piles are to be located so that they do not scorch surrounding live trees and measures must be in place to ensure that fires do not spread (i.e., conduct burning on snow or on mineral soil).
 - .5 Piles will be left until fall for burning to allow for curing of green fuels.

- .6 Provincial regulations for air quality must be met.
- .7 Where fire fuel loading is not a concern vegetation debris of limited amounts will be dragged in the forest to mimic natural tree fall.
- .8 If removal or burning are not feasible a chipper may be used for less than 50 boles per hectare. Chip depth is to be a maximum of 5 cm (2 inches), spread over area no greater of 5m x 5m per hectare so as to not cover underlying vegetation, prevent new native seedlings from sprouting, and cause soil/seed bank sterilization. Spreading of chips may extend beyond these parameters with permission from Parks Canada.
- .9 To facilitate chipping of woody debris, all trees/shrubs/vines can be left temporarily along the road shoulders and laid facing the same direction.
- .10 In some cases, logs from newly cut trees may be set aside for use elsewhere as directed by local park site managers and the ESO.
- .11 Store removed vegetation on already disturbed areas to minimize disturbance area.
- .12 In appropriate areas re-establish native vegetation where it has been completely removed/damaged.
- .4 Integrated Pest Management
 - .1 A Field Unit Integrated Pest Management Plan (IPMP) must be completed and approved prior to the use of herbicides to ensure the most effective and least harmful substances are properly used.
- .8 Excavations, Soil Stripping and Overburden Removal Mitigations
 - .1 Timing of Works
 - .1 Schedule work to avoid wet, windy and rainy periods that may increase erosion and sedimentation.
 - .2 If the work schedule requires working in the rain, appropriate sediment controls must be installed to prevent the release of sediment-laden water or any other deleterious substances into surface waters.
 - .2 Excavation
 - .1 Materials shall be placed at storage sites or on the grade without spillage outside the working limits. Any material inadvertently falling outside the work limits is to be removed promptly in a manner that does not damage trees or vegetation.
 - .2 All sediment control measures must be in place before starting work in the vicinity of rivers, water bodies, watercourses, and wetlands.
 - .3 Special precautions may have to be taken during excavation in the vicinity of intermittent or active drainage channels.
 - .4 Excavation plans must be compared to local archaeological resource inventories, if available. If no archaeological information is available for the work area, an Archaeological Overview

Assessment (AOA) may be required to determine the archaeological potential of the work area. Based on the results from the AOA, an Archaeological Impact Assessment might be required. It would be time and cost efficient to refer the plan to Parks Canada's Terrestrial Archaeology section before conducting any excavation to determine the appropriate course of action.

- .5 If cultural resources (eg. archaeological resources) are discovered, immediately cease work, and alert SO.
- .6 Minimize changes to the ground surface that affects its infiltration and runoff characteristics and maintain/re-establish effective surface drainage on completion of the project
- .7 Backfill and compact excavations as soon as possible. Optimize degree of compaction to minimize erosion and allow for re-vegetation.
- .8 All trenches or ditches left unattended overnight must be fenced or covered to prevent wildlife entrapment.

.3 Soil Stripping

- .1 Strip topsoil under dry conditions, whenever possible.
- .2 No stripping shall occur outside of the delineated work area or within 1 metre of the drip line of existing forest.
- .3 In the event of a work program shutdown during inclement weather (e.g. winter conditions unfavorable for construction, heavy rain events, construction delays, etc.) erosion control of bared soils or excavated material stockpiles is required.
- .4 Stripping close to any watercourse, water body or wetland shall employ methods to ensure materials are not pushed, do not fall or erode into the water or wetlands.
- .5 Work within a 100 metre buffer from the high-water mark of waterways or wetlands will require a site-specific sediment and erosion control plan.
- .6 An erosion control plan is also needed to control dust generated from the construction site.

.4 Topsoil Salvage

- .1 Salvage topsoil at all excavation sites for reclamation purposes.
- .2 Usually the upper 15 cm of soil, below the sod layer if present, is considered topsoil, where depths exceed 15cm salvage the entire depth of topsoil.
- .3 Remove stumps and woody debris from topsoil, wherever possible.

.5 Excavated Material Storage

- .1 Allow space for separate storage of topsoil and spoil; where space is available separate stored topsoil from spoil by at least 1 m. Use appropriate material (e.g., geo-textile) to separate soil components where space is limited.

- .2 Topsoil may be stored on hardened surfaces, geo-textile material or directly on undisturbed vegetation. If storage occurs on vegetation, material recovery by hand may be required.
- .3 Cover all stockpiled material with heavy-duty plastic or filter cloth to prevent erosion during precipitation events.
- .4 Topsoil should be stockpiled on the uphill side of the disturbance on sloped terrain.
- .5 Construct barricades to prevent losses on steep terrain ($>18^\circ$, 3:1) and within 100m of watercourses.
- .6 Excess Materials and Waste (Overburden Removal)
 - .1 Remove excess excavated material from site where it cannot be used for the final grading of the area. Site specific arrangements must be made for disposal locations and procedures of overburden.
 - .2 Surplus excavated material may be used to fill depressions around the project site providing topsoil is stripped before filling, with approval from the Departmental Representative.
- .9 Soil and Vegetation Restoration Mitigations
 - .1 Timing Windows
 - .1 Develop restoration plan as part of the project scoping and specifications prior to project approvals.
 - .2 Vegetation restoration is most effective if seeded in the fall, this allows for full scarification of the seed over the winter and adequate moisture available. Spring and early summer will also work, consider using seed that requires shorter scarification times for these applications. Transplants will do best in the spring and summer and will require adequate watering.
 - .3 Topsoil Replacement
 - .4 Implement restoration plan for the disturbed area immediately following completion of construction.
 - .5 Replace topsoil to all areas immediately following fine grading.
 - .6 Do not compact topsoil.
 - .7 Where insufficient topsoil is available imported soil may be used as a last resort. Imported topsoil must be certified completely free of non-native seeds and compost developed from sewage treatment plants. Methods of improving vegetation succession using locally sourced, weed and contaminant free materials are preferred.
 - .8 Slopes to be seeded should be no steeper than 2 horizontal to 1 vertical (2:1) and covered with a minimum of 5 cm (2 inch) of topsoil. Finish grading should always follow top soil placement.
 - .9 Where remaining soils are unstable due to steepness or soil characteristics, immediate installation of sod or erosion control blanket is required.

- .10 Methods of bioengineering such as terracing, willow staking, live pole drain systems should be assessed as solutions where soils are steeper or remain unstable.
- .2 Soil Amendments
 - .1 Fertilizer Application
 - .1 Avoid use of fertilizer to limit non-native vegetation growth and allow for local species to use available nutrients.
 - .2 If needed use locally sourced mycorrhizae compost teas to improve vegetative success.
 - .2 Topsoil substitute
 - .1 Apply an organic cellulose only amendment as a soil substitute if reclamation standards are not being met within the defined time frame.
 - .2 Determine the type of organic amendment based on the site-specific requirements (e.g., peat moss, compost).
- .3 Seedbed Preparation
 - .1 The seedbed will be scarified by hand or, with the approval of the SO, by machine on large areas (i.e., roadbeds) where it is accessible and appropriate.
 - .2 The seedbed will be scarified if seeding takes place more than 7 days after final grading or if there has been a rainfall between final grading and the seeding date.
 - .3 The cleats of a tracked vehicle or a harrow device will be used, where possible, to prepare an adequate seedbed with seedling safe-sites (microsites) substantially free of soil crusts.
 - .4 Align cleat marks at right angles on slopes to trap seed and sediment and reduce erosion.
- .4 Species Selection
 - .1 When selecting species and varieties:
 - .1 Use species of local native plant communities.
 - .2 Species viability in proposed environment and climatic conditions.
 - .3 Capability to effectively control erosion, where required.
 - .4 Adaptation to the variable site conditions of undulating topography.
 - .5 Consider palatability of some species to herbivores and avoid growing attractants in areas of increased risk to wildlife and visitors.
 - .6 Variable life expectancy to produce variable, delayed die-out of seeded species and replacement with indigenous native plants.
- .5 Seed Lot Selection
 - .1 Select seed lots based on indigenous species variety and quality (guaranteed weed seed free content and highest purity and

germination), consult with vegetation restoration specialist or fire/vegetation ecologist.

- .2 Reject any seed lots containing any seed of undesirable crop or weed species.

.6 Seed Mixture Composition

- .1 The proportion of each species should be calculated to provide an adequate quantity of pure live seed (PLS) per unit area of each key component.
- .2 Aim for density of about 140 seedlings/m² at the end of the first growing season to provide adequate ground cover and allow native species to re-colonize the site over time.
- .3 Consider that parameters such as seed lot purity, seed germination, seedling establishment, seed size and seeding method affect the final stand composition.
- .4 Seed mixture to be approved by the ESO prior to ordering. Written approval must be given from the ESO before the Contractor orders the seed.

.7 Seeding

- .1 Use approved native seed mixes developed for site-specific conditions for various elevations.
- .2 Seed and stabilize (e.g. mulch/tackifier) bare areas as soon as possible after disturbance, preferably as soon as a significant area is graded and finished and before the next rain event. If there is a risk of seedling mortality as a result of fall frost stabilize until appropriate growing conditions exist.
- .3 Use sod in high traffic areas or places that need extra erosion control. Source sod grown from native species (often called fescue sod) and ensure adequate anchoring and watering is in place.
- .4 Use temporary seeding when outside the seeding dates for permanent vegetation
- .5 Apply a seed mixture which is appropriate for the climate, soil, and drainage conditions of the site.
- .6 Apply seed at a rate appropriate to the seed mixture, seeding method and existing vegetation conditions.
- .7 Conduct broadcast seeding under calm wind conditions. Hydro-seeding is acceptable where access is available.
- .8 Do not exceed 30 kg/ha for the broadcast method, ensure seed is integrated with the soil by light rake or harrow. Broadcast method seeding rate is 25 kg/ha (2.5g/m²) (e.g., 1x25 kg bag will cover 10,000m² or 1 hectare).
- .9 For hydro-seeding do not exceed 75 kg/ha with light mulch rates (500 kg/ha- of mulch with hydro-seeding) and 150 kg/ha with heavy mulch rates (1500 kg/ha of mulch with hydro-seeding).
- .10 Do not increase the seeding rate to compensate for poor seedbed conditions.

- .11 Monitor temporary erosion control measures to prevent seed loss.
- .12 Some seeding procedures may have to be completed or repeated in subsequent years.
- .8 Alternatives to Seeding
 - .1 Use topsoil seed bank in small areas when there is no risk of erosion or competition from invasive species (i.e., natural regeneration).
 - .2 Use native transplants in areas where conventional seeding applications are not applicable or where slope stability is an issue.
 - .3 Use conventional forestry planting methods for container grown transplants, see website for guidance.
- .9 Reclamation Standards
 - .1 Minimum standard for plant density is 25 plants/m², with 90% frequency.
 - .2 Minimum standard for plant cover is 80% ground cover, with 90% frequency.
 - .3 Minimum standard for plant community composition standard is 50% cover and 90% frequency of native species.
 - .4 Exclude species designated as weeds in the work sites from the plant density standard consult local vegetation ecologist for current site specific non-native vegetation management program.
 - .5 Rock, plant litter and non-vascular species are included in the cover standard.
 - .6 Remaining plant cover of seeded native species is acceptable.
- .10 Reclamation Plot Evaluation
 - .1 Select any site within reclamation area measuring 10 x 10 m, providing 100 plots of 1 square meter.
 - .2 Measure the plant density, cover and composition in each of the 100 square meter plots.
 - .3 The reclamation standard will have been met if 90 of the 100 plots match or exceed the criteria.
 - .4 No fertilizer will be applied one year before the reclamation standard is evaluated.
- .11 Time Limits
 - .1 Inspect site annually during the growing season.
 - .2 Minimum reclamation standard, as above, to be met within one season post planting.
 - .3 Apply amendments annually, depending on reclamation progress.
 - .4 Re-seed site if the plant density standard is not expected to be achievable within 5 years.
 - .5 A new restoration plan will be prepared and implemented when reclamation standards have not been met after 5 years.
- .10 Drainage Structures Mitigations

.1 Timing of Works

- .1 Time work in water to respect timing windows to protect fish, including their eggs, juveniles, spawning adults and/or the organisms upon which they feed. Contact your local aquatics specialists and DFO offices for further information on timing windows in your region.
- .2 Conduct in-stream work during periods of low flow, or at low tide, to further reduce the risk to fish and their habitat or to allow work in water to be isolated from flows.
- .3 Schedule work to avoid wet, windy and rainy periods that may increase erosion and sedimentation.
- .4 If the work schedule requires working in the rain, the area of work must be isolated and appropriate sediment controls installed to prevent the release of sediment-laden water or any other deleterious substances into surface waters.

.2 Drainage Structures

- .1 Isolate your work area from any flowing water that may be present. Ensure any flows are temporarily diverted around the portion of the ditch or watercourse where you are working.
- .2 Select appropriate equipment and work access routes to reduce damage to riparian vegetation and watercourse banks when using earth-moving equipment.
- .3 For smaller scale debris and sediment removal activities, remove materials by hand.
- .4 To assist with bank stability and invasive plant prevention, leave topsoil and root systems intact on channel banks surrounding your work area.
- .5 Ensure any works to repair damaged structures retain the pre-repair channel conditions (e.g., streambed profile, substrate, channel cross section) and do not constrict the stream width.
- .6 Maintain effective sediment and erosion control measures until complete re-vegetation of disturbed areas is achieved.

.11 Culverts Mitigations

.1 Culvert Installation

- .1 It may be necessary to exclude fish from the immediate construction site while a culvert is being installed. If this practice is necessary, fish shall be salvaged by a qualified aquatic professional from within the exclusion area.
- .2 Maintain effective sediment and erosion control measures until complete re-vegetation of disturbed areas is achieved.
- .3 Remove any old structures to a suitable upland disposal facility away from the riparian area and floodplain to avoid waste material from re-entering the watercourse

.2 Wildlife Considerations for Culverts

- .1 At times, culverts are placed along portions of highways that bisect wetlands or specific habitats that support an abundance of wildlife. Consider building natural rock ledges through culverts to allow for small and medium-sized animals to walk on during periods of high flow.
- .12 Water Withdrawal and Dewatering Mitigations
 - .1 Timing Windows
 - .1 As a general guide to prevent taking more water than aquatic system can support, limit total take of water to less than 5 successive days and less than 10 days in any period of 30 days.
 - .2 Avoid water withdrawal during breeding seasons of amphibians and reptiles to avoid destruction of egg masses, consult local aquatics ecologist for site specific guidance.
 - .2 Water Withdrawal
 - .1 Water should not be withdrawn from a wetland or stream less than 5 metres wide at the surface or a lake less than one hectare in area.
 - .2 Water withdrawal should follow the 10/90 rule which allows for up to 10% of the stream flow to be withdrawn, as long as the stream flow does not fall below the 90% exceedence flow (eg.1 in 10 chance in a given year).
 - .3 No permanent or semi-permanent works for water withdrawal should be placed in the stream channel.
 - .4 Screen any water intakes or outlet pipes to prevent entrainment or impingement of fish, amphibians and/or reptiles. Entrainment occurs when a fish or amphibian is drawn into a water intake and cannot escape. Impingement occurs when an entrapped fish, reptile or amphibian is held in contact with the intake screen and is unable to free itself.
 - .3 Pump Screens
 - .1 In freshwater, fish-bearing waters design and installation of intake end-of-pipe fish screens:
 - .2 Locate screen in areas and depths of water with low concentrations of fish throughout the year away from natural or artificial structures that may attract fish that are migrating, spawning, or in rearing habitat.
 - .3 Orient the screen face in the same direction as the flow of water.
 - .4 Ensure openings in the guides and seals are less than the opening criteria to make “fish tight”.
 - .5 Screens should be located a minimum of 300 mm (12 in.) above the bottom of the watercourse to prevent entrainment of sediment and aquatic organisms associated with the bottom area.
 - .6 Provide structural support to the screen panels to prevent sagging and collapse of the screen. Large cylindrical and box type screens should have a manifold installed to ensure even water velocity distribution across the screen surface. The end of the structure

should be made of solid materials and the end of the manifold capped.

- .7 Heavier cages or trash racks can be fabricated out of bar or grating to protect the finer fish screen, especially where debris loading (woody material, leaves, algae mats, etc.) is a concern. A 150 mm (6 in.) spacing between bars is typical.
- .8 Provision should be made for the removal, inspection, and cleaning of screens.
- .9 Ensure regular maintenance and repair of cleaning apparatus, seals, and screens to prevent debris fouling and impingement of fish.
- .10 Pumps must be shut down when fish screens are removed for inspection and cleaning.

.4 Dewatering

- .1 A site specific dewatering plan is required be provided before commencing a pump-out sump to dewater excavation sites with specific details on how and where the water will be discharge.
- .2 Site specific mitigations may be required depending on the conditions of the discharge area, freezing conditions operation, overflow avoidance, decanting and settlement pond reclamation.
- .3 Water containing suspended materials shall not be pumped into watercourses, drainage systems or on to land, except with the permission of the SO.
- .4 Soil and vegetation erosion protection is required for water pumped on to land.

1.22 JASPER NATIONAL PARK FRONT COUNTRY MITIGATIONS

- .1 The Contractor shall adhere to all the mitigations in this section.
- .2 To ensure there is minimal adverse modifications to surface drainage patterns the Contractor shall:
 - .1 Determine if the project can be resigned to avoid the feature.
 - .2 Locate staging areas away from drainage features.
- .3 To ensure that changes in groundwater flow patterns are kept to a minimum the Contractor shall:
 - .1 Avoid intercepting aquifers when drilling or excavating.
 - .2 Pipes to be abandoned must be pressure tested for leaks and sealed with no part of the line exposed above the surface.
- .4 To ensure that changes in slopes, landforms, and landscape are kept to a minimum the Contractor shall:
 - .1 Assess slope stability (based on slope length, soil texture, steepness, soil depth). Adjust activities to avoid these areas if possible (particularly where slopes are 15 degrees or greater and where soils are shallow and
 - .2 likely to move with disturbance)."

- .3 Hand clear on steep slopes that do not require grading. Wait to clear steep slopes until immediately before scheduled construction and reclaim immediately afterwards.
- .4 Use appropriate geo-technical control measures to stabilize slopes.
- .5 To ensure that damage of vegetation on the site is kept to a minimum the Contractor shall:
 - .1 Careful machine operation is required to ensure damage to surrounding vegetation does not occur.
 - .2 Cut trees so that they fall within the cleared perimeter
 - .3 During grubbing and stripping, minimize damage to trees and roots on the edges of the cleared area.
 - .4 Ensure excavated material does not damage or bury plant material that is to be retained on the site or in adjacent areas; use filter cloth to separate. Store excavated soils and construction materials in a well-defined area. Use tarps and/or snow fences to limit damage to vegetation.
 - .5 Fencing around trees to be retained must be installed beyond the tree's dripline.
 - .6 Identify and avoid areas with rare plants or valued vegetation features.
 - .7 Install fencing around trees to be retained beyond the trees' drip line.
 - .8 Maintain surface drainage, ponding, existing soil and groundcover conditions in groundwater recharge areas
 - .9 Minimize area cleared. Clearly mark area to be cleared with flagging tape and/or temporary fencing
 - .10 Operate Machines carefully to avoid damaging surrounding vegetation
 - .11 Removal of Douglas fir trees should be done in consultation with Parks Canada staff
 - .12 Salvage and replant shrubs and small trees.
 - .13 Salvage trees, shrubs and groundcover where possible for use in other projects
 - .14 Strategic vegetation clearing (e.g. removal of buffalo berries) should be considered in areas with high human/bear conflict.
- .6 To ensure that the ambient air quality remains at a high quality the Contractor shall:
 - .1 Cover and contain fine particulate materials during transportation to and from the site and during storage.
 - .2 Identify energy and water conservation opportunities for building design(low flow fixtures, low energy heating and lighting) and outdoor requirements (yard lighting, drip irrigation).
 - .3 Minimize use of propane for thawing by scheduling activities for spring/summer/fall.
 - .4 Minimize vehicle traffic on exposed soils.
 - .5 Unnecessary idling of equipment, including trucks will not be permitted
 - .6 Wet down exposed soil and dry areas.
- .7 To decrease the chances of wildlife mortality the Contractor shall:
 - .1 Consider posting wildlife signs to reduce vehicle speeds and increase driver awareness near construction areas where wildlife are present

- .2 Educate crews that feeding/harassing wildlife is not permitted. Food and garbage must be stored in wildlife proof containers.
- .3 Fence excavations to prevent injury to wildlife.
- .4 Investigate for presence of amphibians in manholes/trenches before commencing work.
- .5 Minimize the time boreholes or test pits remain open in order to reduce small terrestrial wildlife mortality. Properly seal boreholes and fit PVC pipes.
- .6 Observe local speed limits. Drive during daylight hours.
- .8 To decrease the disruption to park visitors, residents and businesses due to increased noise and traffic, changes in air, water quality and aesthetics the Contractor shall:
 - .1 A communications plan will be developed as needed to keep all stakeholders informed about the project.
 - .2 Evaluate site layout, access routes and construction activities to minimize their visual impact
 - .3 Heavy equipment operated on paved surfaces should be equipped with street pads or some kind of barrier to protect pavement.
 - .4 The proponent is responsible for site security at all times
 - .5 Time construction activities to minimize vehicle conflicts
 - .6 Use appropriate signage for closed facilities (trails, pullouts, picnic areas) and identify detours/alternatives.
 - .7 Develop and implement a communications plan to keep all stakeholders informed about the project.
 - .8 Limit noise producing activities to daylight hours
 - .9 Outline traffic control measures and assess the need for flagging personnel
 - .10 Store materials within the confines of the work site.
- .9 To ensure that ground subsidence or heaving from soil thaw or poor excavation or backfilling is kept to a minimum the Contractor shall:
 - .1 Backfilling should be allowed to settle to prevent subsidence
 - .2 Ensure backfilling is undertaken using suitable materials free of ice and frozen soils and that adequate soil compaction is conducted to avoid ground subsidence
 - .3 In areas with high groundwater levels, ensure that soils susceptible to frost heave (generally fine sands to silty soils) are not used for backfill.
 - .4 Provide additional backfill where subsidence has occurred.
- .10 To decrease Impeded/altered wildlife movement due to encroachment on wildlife movement corridors, creation of barriers to wildlife movement, habitat fragmentation the Contractor shall:
 - .1 Construct fences and orient in such a manner to reduce impacts on wildlife movement. Consult with Parks Canada Wildlife Conflict Specialist to determine appropriate fence design and location.
 - .2 Evaluate the need for all fences
 - .3 Minimize barriers to movement including equipment and human presence during daylight hours.

- .11 To ensure injuries to public and workers arising from a change in the environment are kept to a minimum the Contractor shall:
 - .1 All road signage must be in accordance with provincial standards
 - .2 All trenches or ditches left unattended overnight must be fenced
 - .3 All workers must have the required protective equipment for the job and be trained in accordance with the provisions included in the Alberta Occupational Health and Safety Act and Workers Compensation Board.
 - .4 Call utility companies to identify buried resources/lines.
 - .5 First Aid kits must be available on all job sites.
- .12 To ensure the loss of topsoil, topsoil and subsoil mixing, soil erosion is kept to a minimum the Contractor shall:
 - .1 Delay trenching until just prior to utility installation.
 - .2 Install trench breakers of impervious material to direct groundwater seepage to the surface.
 - .3 Line steep ditches with filter fabric, rock or polyethylene lining to prevent channel erosion.
 - .4 Minimize the length of exposed trench and exposure time.
 - .5 Phase work to minimize exposure of disturbed areas.
 - .6 Soil that has been temporarily moved away from power poles will be replaced.
 - .7 Use interceptor ditches or berms upgradient of construction to divert overland flow around exposed soil surfaces.
 - .8 Assess site for erosion control requirements and implement control measures as required (e.g. tarps, straw bales, erosion blankets, silt fencing).
 - .9 Avoid equipment operation on steep or unstable slopes.
 - .10 Clear minimum area necessary. Where possible, leave stumps and roots in place.
 - .11 Create interceptor swales to divert runoff from the top of erodible slopes
 - .12 Dewater all excavations at appropriate locations
 - .13 Direct runoff and overland flow away from working areas and areas with exposed soils.
 - .14 If a prolonged period of exposure is expected, protect exposed soils with temporary cover (e.g. mulch, gravel, erosion blanket, vegetative cover).
 - .15 Keep site clearing to a minimum to maintain vegetative cover.
 - .16 Minimize the amount of time that excavations and trenches remain open
 - .17 Stabilize slopes as appropriate for local site conditions. Possible methods include: armour stones, crib walls, erosion control blankets, straw bales, sediment fencing – install prior to construction
 - .18 Store topsoil separately from subsoil and other construction materials.
 - .19 Topsoil separation (10-15 cm) is required
 - .20 Topsoil will be stored away from any slopes, subsoils, construction activities and day to day operations.
- .13 Loss or disruption of heritage, archaeological and paleontological features will be kept to a minimum by the Contractor by adhering to the following:

- .1 All buildings over 40 years old, including picnic shelters, must be reviewed by FHBRO prior to disposal or renovation
- .2 All maintenance measures should be non-abrasive, non-destructive and environmentally benign.
- .3 Consult the FHBRO Code of Practice for complete details.
- .4 Consult with the JNP Cultural Resource Specialist to determine archaeological potential at the site.
- .5 If any artefacts are uncovered, stop work until the JNP Cultural Resource Specialist or the JNP Environmental Surveillance Officer is consulted.
- .6 If the potential to disturb archaeological resources exists, ground disturbance activities should be adapted to avoid these areas if possible.
- .7 Replacement should only occur when the major part of an element is decayed beyond repair.
- .8 The design of additions or alterations to a building must respect its heritage character.
- .9 The substitution of maintenance-free materials such as aluminium, fibreglass or vinyl for existing materials is not recommended.
- .10 Where the integrity of the relationship between a building and its associated landscape is relatively unaltered, strong efforts should be made to retain this relationship and the materials that contribute to it.
- .14 To ensure that there is no reduced water quality and clarity due to increased erosion, sedimentation, transport of debris, point or non-point sources of pollution the Contractor shall:
 - .1 Apply seal coat to dry surface only and not prior to (within 24 hours) or during rainfall.
 - .2 Backfill and compact excavations as soon as possible. Optimize degree of compaction to minimize erosion and allow for revegetation
 - .3 Dewatering directly into a waterbody, sanitary or stormwater system is not permitted. Sediment must settle out or be filtered before water from an excavation is allowed to enter a drainage pathway.
 - .4 Dewatering onto vegetated areas is permitted provided that water velocity is controlled to dissipate energy, prevent soil erosion and allow for infiltration, and dewatering structures are continuously monitored to ensure no damage is being done to soil or vegetation. Water entering the watercourse should be equivalent or better than the background quality on the watercourse.
 - .5 "Do not place or allow to disperse any rock, silt, cement, grout, asphalt, petroleum product, lumber, vegetation,
 - .6 domestic waste, or any deleterious substance into any waterbody, stormwater system or sanitary sewer."
 - .7 Ensure cleared vegetation does not enter watercourses.
 - .8 Halt activity on exposed soil during events of high rainfall and runoff
 - .9 Minimize clearing, grubbing and grading near water bodies.
 - .10 Periodically inspect erosion control structures for effectiveness.

- .11 Pressure treated wood is permitted at locations >100 m from waterbodies, otherwise use green wood or cedar.
- .12 Properly seal all boreholes as per provincial standards
- .13 Store stockpiles a minimum of 2 m from embankments with containment, slumps and water bodies to prevent material loss or degradation.
- .14 To minimize site run-off, control overland flow up gradient and down gradient of exposed areas (i.e. using diversion ditches, vales, vegetative filter strips and/or sediment traps).
- .15 To reduce erosive potential of dewatering, ensure water entering a waterbody is diffused.
- .16 When constructing and/or upgrading storm sewers, install oil/contaminant sumps.
- .15 To decrease the sensory disturbance causing displacement/habitat avoidance the Contractor shall:
 - .1 Have a qualified biologist must confirm the presence of migratory birds if they are suspected in the project area. An exclusion window appropriate to the species must be applied if necessary.
 - .2 According to the wildlife that may be present, schedule high noise level activities and other intrusive construction activities to avoid critical life stages (breeding, nesting, rearing, migration).
 - .3 Limit activities during critical foraging times (dusk and dawn) particularly post hibernation when bears and cubs are leaving dens in the spring (April/May) and prior to hibernation (July to September).
 - .4 Consult with Parks Canada to discuss any localized wildlife concerns
 - .5 When working adjacent to undisturbed areas, especially wildlife movement corridors and natural wetlands, restrict activity to daylight hours (dusk and dawn are critical times for wildlife).
- .16 To reduce soil compaction and rutting the Contractor shall:
 - .1 Soil and/or poles contaminated from the use of creosote or other wood preservatives will be contained and disposed of at an appropriate facility.
 - .2 Clean up all spills immediately, as per the Spill Response Plan. If contamination is found, cease work and inform the site supervisor or environmental surveillance officer.
 - .3 Dispose of contaminated soil at provincially certified disposal sites outside of the field unit. Documentation confirming proper disposal must be provided to Parks Canada.
 - .4 Designate refuelling areas on hardened surfaces at least 100 m away from water bodies.
 - .5 Do not spray in high winds.
 - .6 Do not use oil-based dust suppressants.
 - .7 Ensure machinery is in good working order and free of leaks.
 - .8 Ensure spill containment equipment is on hand and personnel are trained in its use.

- .9 Hand painting is preferred over spray painting. Where sprayers are used, they must be properly adjusted and shielded to minimize the amounts of paint lost to overspray.
- .10 Identify and handle all toxic/hazardous materials as required under the Canadian Environmental Protection Act, Transportation of Dangerous Goods Act and Workplace Hazardous Materials Information Service
- .11 If any contamination is uncovered during excavation, investigate and identify the source, properly remove the contaminated soil and dispose of it in a certified landfill.
- .12 Paints with minimal amounts of potentially harmful substances, particularly water soluble organic chemicals, lead and other metals, are preferred. Rust inhibiting paints should be chosen over barrier types of paints do reduce the total volume of paint required over the long-term.
- .13 Prepare an appropriate Spill Response Plan and ensure spill contingency equipment and measures are in place before work begins.
- .14 Remove waste oil-based paints from the park in accordance with the federal and provincial Transportation of Dangerous Goods Act and Regulations.
- .15 Report all spills to Jasper Dispatch at (780) 852-6155.
- .16 Store fuel and hazardous materials in a berm or secondary containment designed to contain 110% of the product's volume. Ensure other materials are stored appropriately to prevent spills.
- .17 When building demolition is required, check for hazardous materials (e.g. asbestos, PCBs, etc.).
- .17 To decrease wildlife habituation/attraction to artificial food sources the Contractor shall:
 - .1 Communicate potential problem and/or habituated wildlife to Parks Canada at (780) 852-6155.
 - .2 Keep site free of garbage and dispose of garbage in wildlife proof containers or remove daily from the site.
 - .3 Store hazardous chemicals (e.g. antifreeze) that might be attractants in animal proof containers.

Part 2 Products

- .1 Not Used.

Part 3 Execution

3.1 WATER EXTRACTION AND DISTRIBUTORS

- .1 All water related activities are to be conducted in accordance with *Direction for Permitted Users conducting water-related activities in Alberta*.
- .2 Backflow prevention is required on all water trucks.
- .3 All water trucks and water extraction equipment must be thoroughly cleaned prior to entering any Park. Proof of cleaning must be provided to the Departmental Representative for verification.
- .4 Extraction of water within any National Park requires a RAP.

- .5 Care must be taken by the Contractor to ensure extracted water does not enter another water body, other than the initial source of extraction.
- .6 The Departmental Representative may require water trucks to be cleaned prior to moving between sites within the Parks to mitigate the risk of cross- contamination of water bodies.

3.2 CLEARING AND GRUBBING

- .1 Clearing, grubbing and/or tree removal is only permitted during the migratory bird least risk window, which is August 31 to April 14 in Jasper National Park. A RAP must be obtained prior to any vegetation removal.

3.3 SPECIFIC CONCERNS RELATIVE TO SENSITIVE SITES AND ACTIVITIES

- .1 Grade construction and paving activity near streams, rivers, wetlands, water bodies or watercourses must be undertaken with care to prevent damage to aquatic and riparian habitat or associated tree and plant communities. A large and mobile spill kit shall be kept at hand during construction at these sensitive sites in proximity to watercourses.\

END OF SECTION

01 45 00 QUALITY CONTROL**Part 1 General****1.1 MEASUREMENT AND PAYMENT PROCEDURES**

- .1 This work shall be incidental to Contract and will not be measured for payment.

1.2 REFERENCES

- .1 Canadian Standards Association (CSA)
 - .1 CAN/CSA-A23.2-04, Methods of Test and Standard Practices for Concrete
- .2 AT - Standard Specifications for Highway Construction (latest edition)

1.3 QUALITY CONTROL PLAN

- .1 Contractor's quality control plan shall be in accordance with AT - Standard Specifications for Highway Construction (latest edition).
- .2 Submittals in accordance with 01 33 00 – Submittals Procedures.

1.4 TESTING BY THE CONTRACTOR

- .1 Testing required to provide quality control to assure that the Work strictly complies with the Contract requirements shall include, but not be limited to:
 - .1 Testing all structural concrete, grout, reinforcing steel, asphalt concrete pavement, structural backfill, corrugated steel culverts, miscellaneous metals, concrete barriers, and all source acceptance testing; and
 - .2 All testing specified in the Contract Documents; and
 - .3 Any other testing required as a condition for deviation from the specified Contract procedures.
- .2 Testing proposed shall be based on testing requirements in the latest edition of the AT - Standard Specifications for Highway Construction in collaboration with current ASTM and CSA Standards or as stated below.
- .3 All Quality Control technicians are to be certified by Canadian Council of Independent Laboratories (CCIL) for testing asphalt, aggregates and concrete, as applicable to the testing requirements for that item of Work.
- .4 The Contractor shall be fully responsible and bear all costs for all quality control testing and shall conduct such testing in the following manner:
 - .1 Provide testing facilities and personnel for the tests and inform the Departmental Representative 3 days in advance of the tests to enable the Departmental Representative to witness the tests if it so desired;
 - .2 Notify the Departmental Representative when sampling will be conducted;
 - .3 Within one Day after completion of testing, submit test results to the Departmental Representative.
 - .4 Identify test reports with the name and address of the organization performing all tests, and the date of the tests.

- .5 Approval of tested samples will be for characteristics or use named in such approval and shall not change or modify any Contract requirements.
- .6 Testing agencies, their inspectors, and their representatives are not authorized to revoke, alter, relax, enlarge or release any requirement of the Contract Documents, nor to approve or accept any part of the Work
- .7 The minimum frequency for Quality Control testing during embankment construction will be as follows:

CONSTRUCTION TYPE	TEST TYPE	MINIMUM FREQUENCY OF TESTS
Embankment construction with fine grained or granular soil	Standard Proctor by: ASTM D698	1 per change in material or 1 per week, whichever is more frequent
	Field density by: ASTM D1556 / D1556M – Sand Cone ASTM D2167 – Balloon ASTM D6938 – Nuclear	1 per 1000 m ² per lift, spaced randomly across full width of embankment
	Proof Roll and or Rutting Test	As required by the Departmental Representative
Embankment construction with blasted rock or oversize granular	Field observation with daily field report; and a summary report signed and stamped by the Contractor's Engineer.	Full time during blasted rock placement
Road structure construction with granular materials	Standard Proctor by: ASTM D698	1 for each material type and 1 for each accepted change in material gradation.
	Field density by: ASTM D1556 / D1556M – Sand Cone ASTM D2167 – Balloon ASTM D6938 – Nuclear	3 tests per 50 m per lift; on centreline and on lt and rt fog lines
	Proof Roll and or Rutting Test	As required by the Departmental Representative
Culvert Installation	Field Density	Minimum three per 300 mm lift per culvert, spaced through the length and depth of the culvert backfill
Tests During Aggregate Production	ASTM C136 / C136M – Standard Test Method for Sieve Analysis of Fine and Coarse Aggregates Or C 117 – Standard Test Method for Materials Finer than 75-µm (No. 200) Sieve in Mineral Aggregates by Washing	- Split Stockpiles: 1 for each stockpile for every 2 hours of production. - One main stockpile: for every 300 tonnes. - Blend Sand: 1 for every 100 tonnes during stockpiling. - Natural filler: 1 for every 50 tonnes during stockpiling.
	ASTM D5821 – Standard Test Method for Determining the Percentage of Fractured Particles in Coarse Aggregate	Every second coarse aggregate sieve test
<i>(continued over page)</i>		

CONSTRUCTION TYPE (cont.)	TEST TYPE (cont.)	MINIMUM FREQUENCY OF TESTS (cont.)
Tests During Aggregate Production (cont)	C 117 Sieve Analysis of Aggregates by Washing (Modified for Field Lab)	1/shift on reduced sample obtained from combined samples from the crusher
Asphalt Products Tests	Tack and Prime	Mill certifications.
Tests during Asphalt Plant Mixing	C 136 / C 136M – Dry Sieve Analysis of Aggregate	1 of combined aggregate (off the belt) every 300 tonnes.
	D 2216 – Moisture Content	Aggregate: 2 tests/Lot Asphalt mix: 1 on first Sub-Lot and every second day.
	C 117 – Sieve Analysis of Aggregates by Washing (Modified for Field Lab)	1/shift on reduced sample obtained from combined samples from the plant cold feed.
	D 5581– Resistance to Plastic Flow Using Marshall Apparatus	One set of three briquettes for 1,200 tonnes or Lot, whichever is less.
	D 6307 – Asphalt Extraction, Ignition Method	One/Sub-Lot.
	D 5 / D 5M – 13 Penetration of Bituminous Materials	One per Manufacturer's Batch. Samples should be taken for every 3000 tonnes of mix production.
	D 2171 / D 2171M –Viscosity	Contractor's Option
	D 2041 / D 2041M – Maximum Theoretical Density	One per sub-lot
Test During Asphalt Paving for Density Testing	AASHTO T 245- Resistance to Plastic Flow Using Marshall Apparatus	One 15 kg sample for every Sub-Lot or minimum 1/day for field testing.
	Core Samples	At start, two cores for each Sub-Lot. After rolling pattern established, only one core for each Sub-Lot. All Marshall mix cores to be a minimum of 100 mm diameter, Superpave mixes shall require minimum 150 mm diameter cores.

**These are the minimum frequencies and the Contractor is responsible to assess the need to increase testing frequency, where aggregate source is not uniform or any other condition exists that may warrant it. QC frequencies may be reduced below this level, subject to the Departmental Representative's authorization, should the Contractor's QC plan be proven very effective.*

1.5 CONTRACTOR'S QUALITY CONTROL PROGRAM

- .1 The Contractor shall prepare a Quality Control Program. The purpose of the program shall be to ensure the performance of the Work in accordance with Contract requirements.
- .2 The Quality Control Program shall be described in a Quality Control Plan. The Contractor shall submit the Manual to the Departmental Representative for review in accordance with Section 01 33 00, Submittal Procedures. The Manual shall develop a logical system for tracking and documenting the Quality Control of the Work. A

systematic format and a set of procedures patterned on a recognized Quality Control Standard will be acceptable, subject to review by the Departmental Representative.

- .3 The Quality Control Plan shall include the following information:
 - .1 Distribution list, providing a list of names to whom the Manual shall be distributed;
 - .2 Title page, identifying the Contract, Contractor and copy number;
 - .3 Revision page, identifying the revision number and date of the Manual;
 - .4 Table of contents;
 - .5 Revision control, tabulating the revision number, date of revision, description of revisions and authorized signature;
 - .6 Details of measuring and testing equipment including methods and frequency of calibration;
 - .7 Purchasing details of all materials and equipment including procurement documents and vendor's Quality Control Program standards;
 - .8 Procedures for inspection of incoming items, in-process inspection and final inspection and tagging of all supply items;
 - .9 Details of special processes as identified by the Departmental Representative, including qualifications of personnel and certification;
 - .10 Procedures for shipping, packaging and storage of materials;
 - .11 Procedures for maintaining quality records and Statements of Compliance, including filing and storage of documents for a period of one year after Completion of the Works;
 - .12 Details of any non-conformance, including identification and recording of deficiencies, tagging procedures for "HOLD" or "REJECT" items, and final disposition of non-conformance forms by the Quality Control Manager;
 - .13 Inspection and test checklists, including tabulated checklists describing all manufacturing and delivery activities such as Inspection or Test, frequency of tests, description of tests, acceptance criteria of tests, such as verification, witnessing or holding tests and sign-off by the Quality Control Manager and the Departmental Representative, if the Departmental Representative witnesses the tests; and
 - .14 Forms used to ensure the application of the inspection and test checklist requirements. These forms shall be identified in the checklists and describe all testing requirements for Specification compliance.
- .4 The Contractor shall appoint a full time qualified and experienced Quality Control Manager, 100% of their time dedicated to quality matters and who will report regularly to the Contractor's management at a level that shall ensure that Quality Control requirements are not subordinated to manufacturing, construction or delivery. The Quality Control Manager shall be empowered by the Contractor to resolve quality matter and shall be onsite for the duration of the Contract.
- .5 The Quality Control Plan shall include samples of all forms to be filled in by the Quality Control Inspectors. All forms shall be signed by the Quality Control Manager and submitted promptly to the Departmental Representative who will add its review signature.

- .6 An independent check of all Work shall be performed by the Contractor. The Contractor shall appoint Quality Control Inspectors to ensure compliance of products and workmanship with Contract requirements. The same personnel may not be used to perform a given task and to check the quality and accuracy of the task.
- .7 At completion of the Work a bound and itemized copy of all Quality Control documents and reports shall be prepared by the Contractor's Quality Manager and submitted to the Departmental Representative.

1.6 INSPECTION

- .1 Allow Departmental Representative access to Work. If part of Work is in preparation at locations other than Place of Work, allow access to such Work whenever it is in progress.
- .2 Give timely notice requesting inspection if Work is designated for special tests, inspections or approvals by Departmental Representative instructions, or law of Place of Work.
- .3 If Contractor covers or permits to be covered Work that has been designated for special tests, inspections or approvals before such is made, uncover such Work, have inspections or tests satisfactorily completed and make good such Work.
- .4 Departmental Representative will order any 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.
- .5 The Departmental Representative will provide the Contractor with an Approval to Proceed document, after performing an audit and confirming all requirements are met, as stated in 01 71 00 Examination and Preparation. The Approval to Proceed must be signed by the Departmental Representative and the Contractor's representative before proceeding to the next layer.
 - .1 The Contractor shall provide a minimum of 48 hours notice to the Departmental Representative to arrange for an audit and Approval to Proceed.

1.7 INDEPENDENT INSPECTION AGENCIES

- .1 Independent Inspection/Testing Agencies will be engaged by the Departmental Representative for purpose of inspecting and/or testing portions of Work. Cost of such services will be borne by Departmental Representative.
- .2 Employment of inspection/testing agencies does not relax responsibility to perform Work in accordance with Contract Documents.
- .3 If defects are revealed during inspection and/or testing, appointed agency will request additional inspection and/or testing to ascertain full degree of defect. Correct defect and irregularities as advised by the Departmental Representative at no cost to the Departmental Representative.

1.8 ACCESS TO WORK

- .1 Allow inspection / testing agencies access to Work, including but not limited to: off site manufacturing and fabrication plants, QC testing facilities and asphalt plants.
- .2 Co-operate to provide reasonable facilities for such access.

1.9 PROCEDURES

- .1 Notify appropriate agency and Departmental Representative in advance of requirement for tests, in order that attendance arrangements can be made.
- .2 Provide labour and facilities to obtain and handle samples and materials on site.

1.10 NON-CONFORMANCES

- .1 A Non-Conformance can relate to any item within the Contract including but not limited to: materials testing, lines and levels, products, design-build items, traffic accommodation, quality control, environmental, health and safety, and other general procedural matters including communication protocols.
- .2 Contractor's Internal Non-Conformance Report (NCR):
 - .1 Should the Contractor's QC reporting indicate that the Work is not in conformance, the Contractor's QC Manager shall issue an internal Non-Conformance Report (NCR) to the Contractor, with a copy to the Departmental Representative, including a response time.
 - .2 The Contractor shall then respond to the QC Manager, with a copy to the Departmental Representative, with respect to the NCR, within the specified time, with proposed resolutions and corrective actions. The Contractor and/or the QC Manager shall consult with the Departmental Representative on the resolutions.
 - .3 The Departmental Representative will accept or reject the proposed resolution and corrective action proposal.
 - .4 Payment for the Work itself may be withheld until the NCR issue is resolved.
- .3 Owner Issued NCR:
 - .1 Should the Quality Assurance reporting indicate that the Work is not in conformance, the Departmental Representative will issue to the Contractor a NCR, including a response time.
 - .2 The Contractor shall then respond to that NCR, within the specified time, with proposed resolutions and corrective actions.
 - .3 The Departmental Representative will accept or reject the proposed resolution and corrective action proposal.
 - .4 Assurance testing and inspection will be performed to determine if the corrective action has provided an acceptable product. Acceptance and rejection will continue until the Departmental Representative determines that a quality product has been achieved.
 - .5 Payment for the Work itself may be withheld until the NCR issue is resolved.
- .4 The Completion Certificate will not be issued if there are any unresolved Non-Conformance Reports.
- .5 Appealing an NCR:
 - .1 If the Contractor disputes the validity of a finding in an NCR, the Contractor may file an appeal with the Departmental Representative. The Departmental Representative and the Contractor Representative will use all reasonable efforts to refine the area of dispute and to resolve the determination of conformance with the Contract.
 - .2 If the Departmental Representative and the Contractor Representative cannot come to a mutually agreeable resolution, the Work that is the subject of the Non-

Conformance Report shall be re-evaluated by an independent third-party, selected by the Departmental Representative in consultation with the Contractor, at a test frequency equivalent to twice that specified in the Contract or to such other frequency as may be mutually agreed between the Departmental Representative and the Contractor.

- .3 If the appeal testing confirms the non-conformance determination, all appeal testing costs will be borne by the Contractor. If the appeal testing shows that the Work did in fact meet the requirements of the Contract, all appeal testing costs will be borne by the Owner.

1.11 OPPORTUNITIES FOR IMPROVEMENT

- .1 Should the QA review indicate that the Work is not in conformance, but the variance is deemed minor by the Departmental Representative, the Departmental Representative may issue an Opportunity for Improvement (OFI) report.
- .2 The Contractor is encouraged to review the findings and undertake such modifications to the QC Plan and the work procedures as necessary to address the issue.

1.12 REJECTED WORK

- .1 Remove defective Work, whether as a result of poor workmanship, use of defective products or damage and whether incorporated in Work or not. Replace or re execute defective Work in accordance with Contract Documents, through the NCR process.
- .2 Make good other Contractor's work damaged by such removals or replacements promptly.
- .3 If in the opinion of the Departmental Representative, it is not expedient to the greater benefit of the Project to remedy defective Work or Work not performed in accordance with Contract Documents, the Owner may deduct from the Contract Price the difference in value between the Work performed and that called for by Contract Documents, the amount of which shall be determined by Departmental Representative.

1.13 REPORTS

- .1 Submit one (1) electronic copy of all inspection and test reports to Departmental Representative in accordance with Section 01 33 00 Submittals Procedures.

1.14 TESTS AND MIX DESIGNS

- .1 Furnish test results and designs as may be requested.

1.15 MILL TESTS

- .1 Submit mill test certificates as required of specification sections.

Part 2 Products

- .1 Not Used.

Part 3 Execution

- .1 Not Used.

END OF SECTION

01 52 00 CONSTRUCTION FACILITIES**Part 1 General****1.1 MEASUREMENT AND PAYMENT PROCEDURES**

- .1 All work of this section shall be incidental to Contract and will not be measured for payment.

1.2 INSTALLATION AND REMOVAL

- .1 Provide construction facilities in order to execute work expeditiously.
- .2 Remove from site all such work after use.

1.3 SITE STORAGE / LOADING

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

1.4 CONSTRUCTION PARKING

- .1 Provide and maintain adequate access and parking at the project site in areas approved by the Departmental Representative.
- .2 Build and maintain temporary roads and provide snow removal during period of Work.
- .3 If authorized to use existing roads for access to project site, maintain such roads for duration of Contract and make good damage resulting from Contractors' use of roads.

1.5 SECURITY

- .1 If required by the Contractor, provide and pay for responsible security personnel to guard site and contents of site after working hours and during holidays. For extended shut-downs, the Contractor shall provide the level of security as required to protect the Work. The Contractor is advised that some random acts of vandalism to equipment have occurred within the Park. Cost of security personnel is incidental to the Work and no additional payment will be made.
- .2 It is strongly advised that the Contractor consider the provision of security personnel.

1.6 EQUIPMENT, TOOL AND MATERIALS STORAGE

- .1 Provide and maintain, in a 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 a manner to cause least interference with work activities.

1.7 SANITARY FACILITIES

- .1 Provide sanitary facilities for work force in accordance with governing regulations, ordinances and the EPP.

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

1.8 CONSTRUCTION SIGNAGE

- .1 To be in accordance with 01 35 31 Special Procedures for Traffic Control.

Part 2 Products

- .1 Not Used.

Part 3 Execution

- .1 Not Used.

END OF SECTION

01 56 00 TEMPORARY BARRIERS AND ENCLOSURES**Part 1 General****1.1 MEASUREMENT AND PAYMENT PROCEDURES**

- .1 This work shall be incidental to Contract and will not be measured for payment.

1.2 INSTALLATION AND REMOVAL

- .1 Provide temporary controls in order to execute Work expeditiously.
- .2 Remove from site all such work after use.

1.3 HOARDING

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

1.4 GUARDRAILS AND BARRICADES

- .1 Provide secure, rigid guard rails and barricades around deep excavations.

1.5 WEATHER ENCLOSURES

- .1 Not used.

1.6 DUST TIGHT SCREENS

- .1 Not used.

1.7 ACCESS TO SITE

- .1 Provide and maintain access roads, as may be required for access to Work.

1.8 PUBLIC TRAFFIC FLOW

- .1 Provide and maintain competent signal flag operators, traffic signals, barricades and flares, lights, or lanterns as required to perform Work and protect the public in accordance with 01 35 31 Special Procedures for Traffic Control.

1.9 PROTECTION FOR OFF-SITE AND PUBLIC PROPERTY

- .1 In accordance with 01 14 00 Work Restrictions.

1.10 PRODUCTS

- .1 Not Used.

Part 2 Execution

- .1 Not Used

END OF SECTION

01 61 00 COMMON PRODUCT REQUIREMENTS**Part 1 General****1.1 MEASUREMENT AND PAYMENT PROCEDURES**

- .1 This work shall be incidental to Contract and will not be measured for payment.

1.2 REFERENCE STANDARDS

- .1 Within text of each specifications section, reference may be made to reference standards.
- .2 Conform to these reference standards, in whole or in part as specifically requested in specifications.
- .3 If there is question as to whether any product or system is in conformance with applicable standards, Departmental Representative reserves right to have such products or systems tested to prove or disprove conformance.
- .4 Cost for such testing will be borne by Departmental Representative in event of conformance with Contract Documents or by Contractor in event of non-conformance.
- .5 Conform to latest date of issue of referenced standards in effect on date of submission of Tenders, except where specific date or issue is specifically noted.

1.3 QUALITY

- .1 Products, materials, equipment and articles (referred to as products throughout specifications) incorporated in Work shall be new, not damaged or defective, and of best quality (compatible with specifications) 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 any dispute 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.

1.4 AVAILABILITY

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

1.5 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 and miscellaneous metals 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.

1.6 TRANSPORTATION

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

1.7 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 may 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.

1.8 QUALITY OF WORK

- .1 In accordance with 01 45 00 – Quality Control.
- .2 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.
- .3 Do not employ anyone unskilled in their required duties. Departmental Representative reserves right to require dismissal from site, workers deemed incompetent or careless.
- .4 Decisions as to standard or fitness of Quality of Work in cases of dispute rest solely with Departmental Representative whose decision is final.

1.9 CO-ORDINATION

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

1.10 CONCEALMENT

- .1 The Departmental Representative will inspect all work prior to any concrete pours. The Contractor shall notify the Departmental Representative 24 hours before any pour for inspection.

1.11 REMEDIAL WORK

- .1 Perform remedial work required to repair or replace parts or portions of Work identified as defective or unacceptable. Coordinate 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.

1.12 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 that cause spalling or cracking of material to which anchorage is made are not acceptable.

1.13 PROTECTION OF WORK IN PROGRESS

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

Part 2 Products

- .1 Materials shall be in accordance with AT - Standard Specifications for Highway Construction (latest edition), or as directed by the Departmental Representative.

Part 3 Execution

- .1 Work shall be completed in accordance with AT - Standard Specifications for Highway Construction (latest edition), or as directed by the Departmental Representative.

END OF SECTION

01 71 00 EXAMINATION AND PREPARATION**Part 1 General****1.1 MEASUREMENT AND PAYMENT PROCEDURES**

- .1 This work shall be incidental to Contract and will not be measured for payment.

1.2 REFERENCES

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

1.3 QUALIFICATIONS OF SURVEYOR

- .1 Qualified surveyor, licensed to practise in Place of Work, acceptable to Departmental Representative.

1.4 SURVEY REQUIREMENTS

- .1 The Departmental Representative shall identify the location of all work sites.
- .2 The Contractor shall be responsible for all other survey and layout work identified in the Contract documents and as required to complete the works including but not limited to:
 - .1 Establishing lines and levels, locate and layout, by instrumentation.
 - .2 Staking for grading, cut and fill.
 - .3 Staking for slopes and top of embankment, sub-base course, base course and centreline for paving.
 - .4 Establishing culverts, catch basin structures, invert elevations and locations.
 - .5 Layout for interim and final lane markings, including those for intersection treatments
 - .6 Re-establishing the start and finish of “No Passing Zones”, Passing Lanes or at new limits as directed by the Departmental Representative
 - .7 Re-establishing Reference Survey Control Points that are in danger of being damaged or destroyed.
- .3 Survey Accuracy:
 - .1 All survey work shall be tied into the existing Control Monument Network with grid coordinates in UTM Zone 11 NAD 83. Departmental Representative will provide information on Control Points.
 - .2 All traverses will be closed and balanced. All level loops and traverses will be tied into the Control Monument Network.
 - .3 Secondary Control Points will be tied into and relative to Control Monument Network. Accuracy for Control Point surveys shall be to second order:
 - .4 Horizontal shall be less than $r = 5(d+0.2)$ where “r” is in cm and “d” is in km
 - .5 Vertical shall be less than $0.008 \times \sqrt{k}$ where k is distance in kilometres.
- .4 Staking accuracy shall be:
 - .1 In bush areas, all elevations shall be within 100 mm of correct elevation. In open ground, all elevations shall be within 50 mm of correct elevation.

- .2 In bush areas, all horizontal locations shall be within 100 mm of Design. In open ground, all horizontal locations shall be within 50 mm of Design.
- .3 On highway surface, all elevations shall be within 100 mm of correct elevation.
- .4 All structures shall be within 20 mm of Design elevation and horizontal
- .5 The Contractor shall provide cut sheet reports to the Departmental Representative for all stages of road construction to demonstrate that the defined construction tolerances have been achieved before advancing to the next stage.
- .6 The Departmental Representative will complete quality assurance construction survey measurements to verify grades and alignment, interim survey re-measurements for excavation limits and final neat line measurements to verify payment quantities for completed works.
- .7 Contractor to provide cut sheet reports for all layers of road template to prove they meet the Contract tolerances. Departmental Representative to verify that they are correct by performing an audit.
- .1 Shots are to be taken at 10m intervals along centreline, mid-points and shoulders.
- .2 The Departmental Representative will provide the Contractor with an Approval to Proceed document in accordance with 01 45 00 Quality Control.
- .8 Contractor to provide a stake out report as requested by the Departmental Representative.

1.5 RECORDS

- .1 Maintain a complete, accurate log of control and survey work as it progresses.
- .2 Record locations of maintained, re-routed and abandoned service lines.

1.6 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 On request of Departmental Representative, submit survey data.
- .4 Submit certificate signed by surveyor certifying those elevations and locations of completed Work that conform to the Contract Documents.

Part 2 Products

- .1 Not Used.

Part 3 Execution

3.1 CROSS SECTIONS

- .1 Cross sections will be taken at a maximum of 20 metre intervals. Additional cross sections will be taken where variations occur, including but not limited to: drainage channels, structures and/or other obstructions.
- .1 Cross section intervals will be established on OG and are to be used for the duration of the project.

3.2 LAYOUT REQUIREMENTS

<u>Survey Layout</u>	<u>Maximum Interval</u>	<u>Product</u>
Right-of-way	At each point of deflection and at sufficient points between as to be continuously visible.	Stake showing station and offset, or flagging.
Clearing and Grubbing	Same as Right-of-way.	Same as Right-of-way.
Grading – Slope Stakes	10 m in rock cuts; 20 m in all other cases. (100 m for machine controlled grading)	One slope stake each side, at top of cut or bottom of fill, showing station, offset, vertical dimension to subgrade, and slope, plus cut/fill transition stake. Non-standard ditches will be staked separately. An additional slope stake, where applicable, at the top of a rock cut after the removal of overburden.
Grading – Subgrade	20 m. (100 m for machine controlled grading)	One stake at each side of the subgrade, showing station, offset and grade at the stake location, one at each break point, and one at centreline.
Top of Sub-base	20 m. (100 m for machine controlled grading)	One stake at each side of the sub-base course, showing station, offset and grade at the stake location, one at each break point, and one at centreline.
Each Base Course	20 m. (100 m for machine controlled grading)	One stake at each side of the base course, showing station, offset and grade at the stake location, one at each break point, and one at centreline.
Final Base Course only	20 m. (100 m for machine controlled grading)	One stake at each side of the base course, showing station, offset and grade at the stake location, one at each break point, and one at centreline.
Culverts	Inlet and outlet.	One stake at each end of the culvert, plus an offset line, showing invert elevation and station.
Storm Drainage, Subdrain, Watermain or Sanitary Sewer		Stakes showing locations of manholes, catch basins and other structures, and invert locations of pipe inlets and outlets, as well as stations.
Retaining Walls	Not more than 10 m, and at alignment changes.	One stake showing control line location and either the elevation at the top of the wall or the elevation at the bottom of footing excavation, as well as station.
Paving	20m.	Stake showing station and offset, reference points (eg. centerline offset, barrier, changes in paint lines etc.)
Superelevation change	At percentage change points	Stakes showing station and superelevation percentage.
Concrete Barriers	Same as paving.	Same as paving.
Signs		Stake at each sign location with stationing and sign designation.

(continued over page)

Survey Layout (cont.)	Maximum Interval (cont.)	Product (cont.)
Curb and Gutter	10 m and at alignment changes. Curb returns: 5 m or at quarter points, whichever is less.	Offset hub and nail with cut/fill to gutter grade, show stationing.
Median/Island Curb	Continuous.	Paint line at face/edge of curb
Pavement Marking	10 m, changes in line type, symbols	Paint dots and lines
Construction Footprint	At each point of deflection and at sufficient points between as to be continuously visible.	Stake or flagging.
Pavement Marking	10 m, changes in line type, symbol	Paint dots and lines

3.3 MACHINE CONTROLLED GRADING

- .1 Machine controlled grading may be used as a substitute for conventional grade staking under the following conditions:
 - .2 The equipment utilized shall be capable of meeting the Design vertical and horizontal tolerances and the use of machine controlled equipment will in now way relieve the Contractor of the requirement to meet the specified tolerances.
 - .3 The Departmental Representative may require the Contractor to revert to conventional staking methods at any point during construction if the machine controlled grading is producing unacceptable Work and the cost of doing so will be borne by the Contractor.
 - .4 The Departmental Representative may provide the Contractor the available electronic files of Design information without warrant with respect to the suitability for the purposes intended by the Contractor and the cost of making them suitable shall be borne by the Contractor. The Contractor remains responsible for completing the works as described in the Contract Documents, even in the event that the electronic Design information provided is not consistent with the Contract Documents.
- .2 As a minimum the Contractor shall provide an orientation stake every 100 metres showing station, offset and grade.

END OF SECTION

01 74 11 CLEANING**Part 1 General****1.1 MEASUREMENT AND PAYMENT PROCEDURES**

- .1 This work shall be incidental to Contract and will not be measured for payment.

1.2 PROJECT CLEANLINESS

- .1 Maintain Work in tidy condition, free from accumulation of waste products and debris, including that caused by Owner or other Contractors.
- .2 Remove waste materials from site at regularly scheduled times or dispose of as directed by Departmental Representative. Do not burn waste materials on site.
- .3 Clear snow and ice in accordance with Section 01 35 31 – Special Procedures for Traffic Control
- .4 Keep roadway clean in accordance with Section 01 35 31 – Special Procedures for Traffic Control
- .5 Make arrangements with and obtain permits from authorities having jurisdiction for disposal of waste and debris.
- .6 Contractor to provide any on-site bear proof containers they require for collection of waste materials and debris.
- .7 Remove waste material and debris from site at end of each working day.
- .8 Dispose of waste materials and debris off site.
- .9 Store volatile waste in covered metal containers, and remove from premises at end of each working day.
- .10 Provide adequate ventilation during use of volatile or noxious substances.
- .11 Use only cleaning materials recommended by manufacturer of surface to be cleaned, and as recommended by cleaning material manufacturer.
- .12 The Departmental Representative and Environmental Surveillance Officer may, at their total discretion, require the Contractor to suspend work activities until such a time as the Work Site is cleaned and debris, waste, and animal attractants are satisfactorily managed. The Contractor shall do as requested at their cost and no claim for time or additional costs will be accepted.

1.3 FINAL CLEANING

- .1 When Work is Substantially Performed, remove surplus products, tools, construction machinery and equipment not required for performance of remaining Work.
- .2 Prior to final review, remove surplus products, tools, construction machinery and equipment.
- .3 Remove waste products and debris including that caused by Owner or other Contractors.
- .4 Remove waste materials from site at regularly scheduled times or dispose of as directed by Departmental Representative. Do not burn waste materials on site.
- .5 Make arrangements with and obtain permits from authorities having jurisdiction for disposal of waste and debris.

- .6 Inspect finishes, and ensure specified workmanship and operation.
- .7 Remove dirt and other disfiguration from exterior surfaces.
- .8 Sweep and wash clean paved areas.
- .9 Remove all construction debris and accumulated dirt from completed drainage systems; manholes; catch basins; and all piping.

Part 2 Products

- .1 Not Used.

Part 3 Execution

- .1 Not Used.

END OF SECTION

01 77 00 CLOSEOUT PROCEDURES**Part 1 General****1.1 MEASUREMENT AND PAYMENT PROCEDURES**

- .1 This work shall be incidental to Contract and will not be measured for payment.

1.2 INSPECTION AND DECLARATION

- .1 Contractor's Inspection: Contractor and all subcontractors shall conduct an 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's Inspection.
- .2 Departmental Representative's Inspection: Departmental Representative and Contractor will perform inspection of Work to identify obvious defects or deficiencies. Contractor shall 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 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, and Contractor. If Work is deemed incomplete by Departmental Representative, complete outstanding items and request re-inspection.

Part 2 Products

- .1 Not Used.

Part 3 Execution

- .1 Not Used.

END OF SECTION

01 78 00 CLOSEOUT SUBMITTALS**Part 1 General****1.1 MEASUREMENT AND PAYMENT PROCEDURES**

- .1 This work shall be incidental to Contract and will not be measured for payment.

1.2 CLOSEOUT SUBMITTALS

- .1 The Contractor shall provide the following documents and information to the Departmental Representative prior to them being eligible for Final Completion as detailed in Section 01 77 00.

1.3 AS-BUILTS AND SAMPLES

- .1 In addition to requirements in General Conditions, maintain at the site for Departmental Representative one record copy of:
 - .1 Contract Drawings.
 - .2 Specifications.
 - .3 Addenda.
 - .4 Change Orders and other modifications to the 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.
- .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.

1.4 RECORDING ACTUAL SITE CONDITIONS

- .1 Record information on set of black line opaque Drawings and in copy of the Project Manual.
- .2 Record information concurrently with construction progress. Do not conceal Work until required information is recorded.
- .3 Contract Drawings and shop drawings: legibly mark each item to record actual construction, including:
 - .1 Field changes of dimension and detail.
 - .2 Changes made by change orders.
 - .3 Details not on original Contract Drawings.

- .4 References to related shop drawings and modifications.
- .4 Specifications: legibly mark each item to record actual construction, including:
 - .1 Changes made by Addenda and change orders.

1.5 FINAL SURVEY

- .1 Submit final site survey certificate in accordance with Section 01 71 00 - Examination and Preparation, certifying that elevations and locations of completed Work are in conformance, or non-conformance with Contract Documents.

1.6 WARRANTIES AND BONDS

- .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 the applicable item of work.
- .4 Except for items put into use with Owner's permission, leave date of beginning of time of warranty until the Date of Substantial Performance is determined.
- .5 Verify that documents are in proper form, contain full information, and are notarized.
- .6 Co-execute submittals when required.
- .7 Retain warranties and bonds until time specified for submittal.

Part 2 Products

- .1 Not Used.

Part 3 Execution

- .1 Not Used.

END OF SECTION

02 81 01 HAZARDOUS MATERIAL**Part 1 General****1.1 MEASUREMENT AND PAYMENT PROCEDURES**

- .1 This work shall be incidental to Contract and will not be measured for payment.

1.2 REFERENCES

- .1 Export and Import of Hazardous Waste Regulations (EIHW Regulations), SOR/92-637.
- .2 National Fire Code of Canada 1995.
- .3 Transportation of Dangerous Goods Act, 1992 (TDG Act) [1992], (c. 34).
- .4 Transportation of Dangerous Goods Regulations (T-19.01-SOR/2001-286).

1.3 DEFINITIONS

- .1 Dangerous Goods: Product, substance, or organism that is specifically listed or meets the hazard criteria established in Transportation of Dangerous Goods Regulations.
- .2 Hazardous Material: Product, substance, or organism that is used for its original purpose; and that is either dangerous goods or a material that may cause adverse impact to the environment or adversely affect health of persons, animals, or plant life when released into the environment.
- .3 Hazardous Waste: Any hazardous material that is no longer used for its original purpose and that is intended for recycling, treatment or disposal.
- .4 Workplace Hazardous Materials Information System (WHMIS): A Canada-wide system designed to give employers and workers information about hazardous materials used in the workplace. Under WHMIS, information on hazardous materials is to be provided on container labels, material safety data sheets (MSDS), and worker education programs. WHMIS is put into effect by a combination of federal and provincial laws.

1.4 SUBMITTALS

- .1 Submit product data in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Retain current Material Safety Data Sheet (MSDS) for each hazardous material required on site. Submit MSDS to Departmental Representative upon request.

1.5 STORAGE AND HANDLING

- .1 Coordinate storage of hazardous materials with Departmental Representative and abide by internal requirements for labelling and storage of materials and wastes.
- .2 Store and handle hazardous materials and wastes in accordance with applicable federal and provincial laws, regulations, codes, and guidelines.
- .3 Store and handle flammable and combustible materials in accordance with current National Fire Code of Canada requirements.
- .4 All explosives must be mixed outside of the Park and delivered to the site. No storage of explosives shall be allowed within the National Parks.
- .5 Observe smoking regulations at all times. Smoking is prohibited in any area where hazardous materials are stored, used, or handled.

- .6 Abide by the following storage requirements for quantities of hazardous materials and wastes in excess of 5 kg for solids, and 5 litres for liquids:
 - .1 Store hazardous materials and wastes in closed and sealed containers which are in good condition.
 - .2 Label containers of hazardous materials and wastes in accordance with WHMIS.
 - .3 Store hazardous materials and wastes in containers compatible with that material or waste.
 - .4 Segregate incompatible materials and wastes.
 - .5 Ensure that different hazardous materials or hazardous wastes are not mixed.
 - .6 Store hazardous materials and wastes in a secure storage area with controlled access.
 - .7 Maintain a clear egress from storage area.
 - .8 Store hazardous materials and wastes in a manner and location which will prevent them from spilling into the environment.
 - .9 Have appropriate emergency spill response equipment available near the storage area, including personal protective equipment.
 - .10 Maintain an inventory of hazardous materials and wastes, including product name, quantity, and date when storage began.
- .7 Ensure personnel have been trained in accordance with Workplace Hazardous Materials Information System (WHMIS) requirements.
- .8 Report spills or accidents immediately to Departmental Representative. Submit a written spill report to Departmental Representative within 24 hours of incident.

1.6 TRANSPORTATION

- .1 Transport hazardous materials and wastes in accordance with federal Transportation of Dangerous Goods Act, Transportation of Dangerous Goods Regulations, and applicable provincial regulations.
- .2 If exporting hazardous waste to another country, ensure compliance with federal Export and Import of Hazardous Waste Regulations.
- .3 If hazardous waste is generated on site:
 - .1 Coordinate transportation and disposal with Departmental Representative.
 - .2 Ensure compliance with applicable provincial laws and regulations for generators of hazardous waste.
 - .3 Use only a licensed carrier authorized by provincial authorities to accept subject material.
 - .4 Prior to shipping material, obtain written notice from intended hazardous waste treatment or disposal facility that it will accept material and that it is licensed to accept the material.
 - .5 Label containers with legible, visible safety marks as prescribed by federal and provincial regulations.
 - .6 Ensure that only trained personnel handle, offer for transport, or transport dangerous goods.
 - .7 Provide a photocopy of all shipping documents and waste manifests to Departmental Representative.

- .8 Track receipt of completed manifest from consignee after shipping dangerous goods. Provide a photocopy of completed manifest to Departmental Representative.
- .9 Report any discharge, emission, or escape of hazardous materials immediately to Departmental Representative and appropriate provincial authority. Take reasonable measures to control release.

Part 2 Products

2.1 MATERIALS

- .1 Only bring on site the quantity of hazardous materials required to perform Work.
- .2 Maintain MSDSs in proximity to where the materials are being used. Communicate this location to personnel who may have contact with hazardous materials.

Part 3 Execution

3.1 DISPOSAL

- .1 Dispose of hazardous waste materials in accordance with applicable federal and provincial acts, regulations, and guidelines.
- .2 Recycle hazardous wastes for which there is an approved, cost effective recycling process available.
- .3 Send hazardous wastes only to authorized hazardous waste disposal or treatment facilities.
- .4 Burning, diluting, or mixing hazardous wastes for purpose of disposal is prohibited.
- .5 Disposal of hazardous materials in waterways, storm or sanitary sewers, or in municipal solid waste landfills is prohibited.

END OF SECTION

03 10 00 CONCRETE FORMING AND ACCESSORIES**Part 1 General****1.1 MEASUREMENT AND PAYMENT PROCEDURES**

- .1 This work will not be measured for payment and shall be considered incidental to the works.
- .2 Include formwork costs in items of concrete work in Section 03 30 00 – Cast-in-Place Concrete.

1.2 REFERENCES

- .1 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.
 - .2 CSA-O86S1, Supplement No. 1 to CAN/CSA-O86-01, Engineering Design in Wood.
 - .3 CSA O121-[M1978(R2003)], Douglas Fir Plywood.
 - .4 CSA O151, Canadian Softwood Plywood.
 - .5 CSA O153-[M1980(R2003)], Poplar Plywood.
 - .6 CSA O437 Series-[93(R2006)], Standards for OSB and Waferboard.
 - .7 CSA S269.1-[1975(R2003)], Falsework for Construction Purposes.
 - .8 CAN/CSA-S269.3-[M92(R2003)], Concrete Formwork, National Standard of Canada.
- .2 Council of Forest Industries of British Columbia (COFI)
 - .1 COFI Exterior Plywood for Concrete Formwork.
- .3 AT - Standard Specifications for Highway Construction (latest edition)

1.3 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Submittals in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Submit shop drawings for formwork and falsework.
- .3 Submit drawings stamped and signed by professional engineer registered or licensed in the Province of British Columbia or Alberta, wherever the Work is occurring.
- .4 MSDS in accordance with Section 02 81 01 Hazardous Material.
- .5 Indicate method and schedule of construction, shoring, stripping, and re-shoring procedures, materials, arrangement of joints, special architectural exposed finishes, ties, liners, and locations of temporary embedded parts. Comply with CSA S269.1 for falsework drawings and CAN/CSA S269.3 for formwork drawings.
- .6 Indicate sequence of erection and removal of formwork/falsework as directed by Departmental Representative.

1.4 WASTE MANAGEMENT AND DISPOSAL

- .1 The Contractor shall separate and recycle waste materials in accordance with Section 01 35 43, Environmental Procedures.

- .2 The Contractor shall place materials defined as hazardous or toxic waste in designated containers.
- .3 The Contractor shall ensure emptied containers are sealed and stored safely for disposal away from children.
- .4 The Contractor shall use sealers, form release and stripping agents that are non-toxic, biodegradable and have zero or low volatile organic compounds (VOC's).
- .5 The Contractor shall dispose concrete waste in the roadway embankment as approved by the Departmental Representative.

Part 2 Products

2.1 MATERIALS

- .1 Formwork materials:
 - .1 Forms for unexposed surfaces are at the discretion of the Contractor subject to approval of the Departmental Representative.
 - .2 Forms for exposed surfaces including the cast in place concrete shall be new material, made of "Coated Formply", consisting of Douglas Fir substrate with resin-impregnated paper overlay and factory treated chemically active release agent.
 - .3 All form material for exposed surfaces shall be full-sized sheets, as practical. The re-use of any forms must have the acceptance of the Departmental Representative.
- .2 The minimum acceptable forming for all exposed concrete where the pour height is 1.5 m or less shall have 18 mm approved plywood, supported at 300 mm maximum on centres. Where the pour height is greater than 1.5 m the minimum acceptable forming for all exposed concrete shall have 18 mm approved plywood, supported at 200 mm maximum on centres. Strong-backs or walers placed perpendicularly to the supports shall be employed to ensure straightness of the form.
- .3 Metal bolts or anchorages within the forms shall be so constructed as to permit their removal to a depth of at least 50 mm from the concrete surface.
- .4 Break-back type form ties shall have all spacing washers removed and the tie shall be broken back a distance of at least 20 mm from the concrete surface.
- .5 All fittings for metal ties shall be of such design that, upon their removal, the cavities that are left will be of the smallest possible size. Torch cutting of steel hangers and ties will not be permitted. Formwork hangers for exterior surfaces of decks and curbs shall be an acceptable break-back type with surface cone, or removable threaded type.
- .6 Cavities shall be filled with cement mortar and the surface left sound, smooth, even and uniform in color.
- .7 Form release agent shall be non-toxic, biodegradable, low VOC.
- .8 Falsework materials shall conform to CSA-S269.1.

Part 3 Execution**3.1 FABRICATION AND ERECTION**

- .1 Verify lines, levels and centres before proceeding with formwork/falsework and ensure dimensions agree with Drawings.
- .2 Fabricate and erect falsework in accordance with CSA S269.1 and COFI Exterior Plywood for Concrete Formwork.
- .3 Do not place shores and mud sills on frozen ground.
- .4 Provide site drainage to prevent washout of soil supporting mud sills and shores.
- .5 Fabricate and erect formwork in accordance with CAN/CSA-S269.3 to produce finished concrete conforming to shape, dimensions, locations and levels indicated within tolerances required by CAN/CSA-A23.1/A23.2.
- .6 Align form joints and make watertight and keep form joints to minimum.
- .7 Use 20 mm chamfer strips on external corners and/or 20 mm fillets at interior corners, joints, unless specified otherwise.
- .8 Form chases, slots, openings, drips, recesses, expansion and control joints as indicated.
- .9 Build in anchors, sleeves, and other inserts required to accommodate Work specified in other sections.
- .10 Ensure that all anchors and inserts will not protrude beyond surfaces designated to receive applied finishes, including painting.
- .11 Clean formwork in accordance with CSA-A23.1/A23.2 before placing concrete.

3.2 REMOVAL AND RESHORING

- .1 Leave formwork in place for following minimum periods of time after placing concrete.
 - .1 Seven (7) days for slabs, decks, barriers, and other structural members.
 - .2 Three (3) days for abutments and return walls.
- .2 Remove formwork when concrete has reached 50% of its design strength or minimum period noted above, whichever comes later, and replace immediately with adequate reshoring.
- .3 Reuse formwork and falsework subject to requirements of CAN/CSA-A23.1.

END OF SECTION

03 20 00 CONCRETE REINFORCING**Part 1 General****1.1 MEASUREMENT AND PAYMENT PROCEDURES**

- .1 Measure reinforcing steel in kilograms of steel supplied and incorporated into the Work, computed from theoretical unit mass specified in CSA-G30.18 for lengths and sizes of bars as indicated or authorized in writing by Departmental Representative.
 - .1 Plain Reinforcing steel used for the installation of the foundation for the Overhead Variable Message Sign shall be incidental to **Lump Sum – Overhead Variable Message Sign (VMS) - Foundation** and shall include all labour, equipment and material to satisfactorily complete this item of work.
 - .2 Plain Reinforcing steel used for the installation of the stopping pad shall be incidental to **“Unit Price – Supply and Install Concrete – Rigid Concrete Pavement Stop Pad”** and shall include all labour, equipment and material to satisfactorily complete this item of work.
 - .3 No allowance will be made for tie wires, chairs and other material used in fastening the reinforcing steel in place.
 - .4 If bars are substituted at the Contractor’s request, and as a result more steel is used than specified, only the amount specified shall be included for payment.
- .2 Traffic Control required for this Work shall be incidental to **“Lump Sum Price - Traffic Accommodation”** and no separate payment will be made to the Contractor.
- .3 Mobilization and demobilization required for this Work shall be incidental to **“Lump Sum Price – Mobilization / Demobilization”** and no additional payment will be made for remobilization of equipment if all milling work cannot be completed at once. Environmental mitigations required in accordance with Section 01 35 43 –
- .4 Environmental Procedures, for the Work in this Section shall be incidental to the Contract and no separate payment shall be made to the Contractor.

1.2 REFERENCES

- .1 All standards listed below shall be the latest issue at the time of tender.
- .2 ASTM International
 - .1 ASTM A82/A82M, Standard Specification for Steel Wire, Plain, for Concrete Reinforcement.
 - .2 ASTM A185/A185M, Standard Specification for Steel Welded Wire Reinforcement, Plain, for Concrete.
- .3 CSA International
 - .1 CAN/CSA-A23.1/A23.2, Concrete Materials and Methods of Concrete Construction/Test Methods and Standard Practice for Concrete.
 - .2 CAN3-A23.3, Design of Concrete Structures.
 - .3 CAN/CSA-G30.18, Carbon-Steel Bars for Concrete Reinforcement.
 - .4 CAN/CSA-G40.20/G40.21, General Requirements for Rolled or Welded Structural Quality Steel/Structural Quality Steel.

- .5 CAN/CSA-G164, Hot Dip Galvanizing of Irregularly Shaped Articles
- .6 CAN/CSA W186, Welding of Reinforcing Bars in Reinforced Concrete Construction.
- .4 Reinforcing Steel Institute of Canada (RSIC)
 - .1 RSIC, Reinforcing Steel Manual of Standard Practice.

1.3 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Submit in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Prepare reinforcement drawings in accordance with RSIC Manual of Standard Practice.
- .3 Shop Drawings:
 - .1 Indicate placing of reinforcement and:
 - .1 Bar bending details.
 - .2 Lists.
 - .3 Quantities of reinforcement.
 - .4 Sizes, spacing, locations of reinforcement and mechanical splices if approved by Departmental Representative, with identifying code marks to permit correct placement without reference to structural drawings.
 - .5 Indicate sizes, spacing and locations of chairs, spacers and hangers.
- .4 Detail lap lengths and bar development lengths to CAN/CSA-A23.3 with a minimum of 32 bar diameters, unless otherwise indicated.
- .5 Provide type B unless otherwise indicated.

1.4 QUALITY CONTROL

- .1 Submit in accordance with Section 01 45 00 - Quality Control.
 - .1 Mill Test Report: provide Departmental Representative with certified copy of mill test report of reinforcing steel.
- .2 Submit in writing to Departmental Representative proposed source of reinforcement material to be supplied.

1.5 DELIVERY, STORAGE AND HANDLING

- .1 Deliver, store and handle materials in accordance with Section 01 61 00 – Common Product Requirements and with manufacturer's written instructions.
- .2 Delivery and Acceptance Requirements: deliver materials to site in original factory packaging, labelled with manufacturer's name and address.
- .3 Storage and Handling Requirements:
 - .1 Store materials off ground and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.
 - .2 Replace defective or damaged materials with new.

Part 2 Products**2.1 MATERIALS**

- .1 Substitute different size bars only if permitted in writing by the Departmental Representative.
- .2 Reinforcing steel: billet steel, grade 400W, deformed bars to CAN/CSA-G30.18M92 9R2002, unless indicated otherwise.
- .3 All steelwork shall be galvanized after complete fabrication to the requirements of CAN/CSA-G164-M and ASTM A767M. The galvanizer shall safeguard against embrittlement as required in CAN/CSA-G164-M, Appendix A. Galvanized members shall be subject, at the discretion of the Departmental Representative, to the tests for embrittlement outlined in CAN/CSA-G164-M, Section 5.5.
- .4 For steel not meeting the chemical composition requirements, special galvanizing techniques shall be developed by the galvanizer to ensure that the specified coating thickness and adherence is achieved. A detailed description of the special techniques shall be submitted to the Departmental Representative for review two (2) weeks prior to galvanizing.
- .5 Cold-drawn annealed steel wire ties: to ASTM A82/A82M.
- .6 Chairs, bolsters, bar supports, spacers: to CAN/CSA-A23.1.
- .7 Mechanical splices: subject to approval of the Departmental Representative.

2.2 FABRICATION

- .1 Fabricate reinforcing steel in accordance with CAN/CSA-A23.1/A23.2 and Reinforcing Steel Manual of Standard Practice by the Reinforcing Steel Institute of Canada, unless indicated otherwise.
- .2 All hooks and bends shall be bent using the pin diameters and dimensions as recommended in the Reinforcing Steel Institute of Canada (RSIC), Manual of Standard Practice.
- .3 Obtain the Departmental Representative's approval for locations of reinforcement splices other than those shown on placing Drawings.
- .4 Ship bundles of bar reinforcement, clearly identified in accordance with bar bending details and lists.

2.3 SOURCE QUALITY CONTROL

- .1 Provide the Departmental Representative with certified copy of mill test report of reinforcing steel, showing physical and chemical analysis, prior to commencing reinforcing work.
- .2 Inform the Departmental Representative of proposed source of material to be supplied.

Part 3 Execution**3.1 FIELD BENDING**

- .1 Do not field bend or field weld reinforcement except where indicated or authorized by the Departmental Representative.
- .2 When field bending is authorized, bend without heat, applying a slow and steady pressure.

- .3 Replace bars that develop cracks or splits.

3.2 PLACING REINFORCEMENT

- .1 Place reinforcing steel as indicated on reviewed placing Drawings and in accordance with CAN/CSA-A23.1/A23.2.
- .2 Reinforcing steel is to be placed as detailed to 10mm tolerance and is to be supported by metal or plastic supports and/or hangers in accordance with ACI 315.80.
- .3 Slab on grade concrete cover over reinforcement to be:
 - .1 Surface placed in contact with ground = 76mm
 - .2 Formed surface exposed to ground or weather = 50mm
- .4 Prior to placing concrete, obtain the Departmental Representative's approval of reinforcing material and placement.
- .5 All lifting and handling shall be done using devices that do not mark, mar, damage or distort the galvanized members and assemblies in any way.
- .6 Galvanized material shall be stacked or bundled and stored to prevent wet storage stain as per American Hot Dip Galvanizers Association (AHDGA) publication "Wet Storage Stain".
- .7 Delivery of a damaged product will be cause for rejection.
- .8 Ensure cover to reinforcement is maintained during concrete pour.
- .9 Protect coated portions of bars with covering during transportation and handling.
- .10 Existing reinforcing steel shall be electrically isolated from the new galvanized reinforcing steel.
- .11 Metal accessories such as anchor bolts, coverplates and electrical boxes that are exposed to the atmosphere shall be electrically isolated from the steel reinforcement.
- .12 Repair of galvanizing shall only be done if bare areas are infrequent, small and suitable for repair as determined by the Departmental Representative.
- .13 Repair of galvanized surfaces shall be in accordance with ASTM 780, Method A3 Metallizing. The thickness of the metallizing shall be a minimum of 180 µm, and the repair tested for adhesion. Alternatively, the galvanizing may be repaired using two coats of a one component zinc-rich coating containing >95% non-toxic electrolytic zinc powder (pure to 99.995%) in a non-toxic solvent.

3.3 CLEANING

- .1 Progress Cleaning: clean in accordance with Section 01 74 11 - Cleaning.
- .2 Leave Work area clean at end of each day.
- .3 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment in accordance with Section 01 74 11 - Cleaning.

END OF SECTION

03 30 00 CAST-IN-PLACE CONCRETE**Part 1 General****1.1 MEASUREMENT AND PAYMENT PROCEDURES**

- .1 Cast-in-place concrete for the overhead variable message sign shall be incidental to **“Lump Sum – Design-Build VMS – Foundation”** and no further payment shall be made.
- .2 Cast-in-place concrete shall be measured in cubic metres calculated from neat dimensions as indicated. Payment for cast-in-place concrete for stopping pads shall be made under **“Unit Price – Supply and Install Concrete – Rigid Concrete Pavement Stop Pad”**.
- .3 Removal and disposal of existing concrete stopping pads outside the National Park at the Contractor's cost shall not be measured for payment and will be considered incidental to **“Unit Price – Supply and Install Concrete – Rigid Concrete Pavement Stop Pad”**.
- .4 Concrete placed beyond dimensions indicated will not be measured for payment.
- .5 Supply and installation of joint fillers and joint sealers, concrete sealer, Evazote, asphalt impregnated fibre board, RPVC utility conduits, elastomer strip at approach slab seat, galvanized armour plate for CIP barrier (complete with studs), anchors rods, nuts, washers and anchor rod grouting will not be measured but considered incidental to work.
- .6 No deductions will be made for volume of concrete displaced by reinforcing steel, structural steel, ducts, voids, fillets scoring and chamfers.
- .7 No deductions will be made for volume of concrete less than 0.1 m² in cross sectional area displaced by individual drainage openings.
- .8 The unit prices bid shall include full compensation for all costs of labour, materials, equipment, tools, formwork, falsework, embedded metallic and non-metallic materials, access, concrete coring, environmental requirements, safety requirements, submittals, and associated Works required for the construction all cast-in-place concrete.
- .9 An interim payment in the amount of 80% of full value will be made if the concrete has been placed acceptably, and the 7-day test cylinder strength indicates that the concrete will reach the acceptance range of specified strength. Partial payment in advance of 28-day test results will not be deemed to constitute acceptance of the concrete. Final payment will not be made until the specified concrete finish is acceptably completed, and the 28-day strength tests show that the concrete meets the strength requirement of the specification.
- .10 Traffic Control required for this Work shall be incidental to **“Lump Sum Price - Traffic Accommodation”** and no separate payment will be made to the Contractor.
- .11 Mobilization and demobilization required for this Work shall be incidental to **“Lump Sum Price – Mobilization / Demobilization”** and no additional payment will be made for remobilization of equipment if all milling work cannot be completed at once.

- .12 Environmental mitigations required in accordance with Section 01 35 43 – Environmental Procedures, for the Work in this Section shall be incidental to the Contract and no separate payment shall be made to the Contractor.

1.2 REFERENCES

.1 Abbreviations and Acronyms:

- .1 Portland Cement: hydraulic cement, blended hydraulic cement (XXb - b denotes blended) and Portland-limestone cement.
- .2 Type GU, GUb and GUL - General use cement.
- .3 Type MS and MSb - Moderate sulphate-resistant cement.
- .4 Type MH, MHb and MHL - Moderate heat of hydration cement.
- .5 Type HE, HEb and HEL - High early-strength cement.
- .6 Type LH, LHb and LHL - Low heat of hydration cement.
- .7 Type HS and HSb - High sulphate-resistant cement.
- .8 Fly ash:
 - .1 Type F - with CaO content less than 15%.
 - .2 Type CI - with CaO content ranging from 15 to 20%.
 - .3 Type CH - with CaO greater than 20%.
- .9 GGBFS - Ground, granulated blast-furnace slag.

.2 Reference Standards

- .1 ASTM International.
 - .1 ASTM C260 Specification for Air-Entraining Admixtures for Concrete.
 - .2 ASTM C309 Specification for Liquid Membrane-Forming Compounds for Curing Concrete.
 - .3 ASTM C494 Specification for Chemical Admixtures for Concrete.
 - .4 ASTM C1017/C1017M, Standard Specification for Chemical Admixtures for Use in Producing Flowing Concrete.
 - .5 ASTM D412, Standard Test Methods for Vulcanized Rubber and Thermoplastic Elastomers-Tension.
 - .6 ASTM D624, Standard Test Method for Tear Strength of Conventional Vulcanized Rubber and Thermoplastic Elastomer.
 - .7 ASTM D2240, Standard Test Method for Rubber Property – Durometer Hardness
 - .8 ASTM D1751 Specification for Preformed Expansion Joint Fillers for Concrete Paving and Structural Construction (Non extruding and Resilient Bituminous Types).
 - .9 ASTM D1752, Standard Specification for Preformed Sponge Rubber Cork and Recycled PVC Expansion Joint Fillers for Concrete Paving and Structural Construction.
 - .10 ASTM F1554, Standard Specification for Anchor Bolts, Steel, 36, 55, and 105-ksi Yield Strength
- .2 Canadian General Standards Board (CGSB)

- .1 CAN/CGSB-51.34-M86, Vapour Barrier, Polyethylene Sheet for Use in Building Construction.
- .3 CSA International
 - .1 CAN/CSA-A3000, Cementitious Materials Compendium. (Consists of A3001, A3002, A3003, A3004 and A3005)
 - .2 CAN/CSA-A23.1/A23.2, Concrete Materials and Methods of Concrete Construction.
 - .3 CAN/CSA-A23.5-M86(R1992), Supplementary Cementing Materials.
 - .4 CAN/CSA-G40.20/G20.21, General Requirements for Rolled or Welded Structural Quality Steel / Structural Quality Steel.

1.3 ADMINISTRATIVE REQUIREMENTS

- .1 Pre-installation Meetings: in accordance with Section 01 32 16 – Construction Progress Schedules, convene pre-installation meeting one (1) week prior to beginning concrete works.
- .2 Ensure key personnel, site supervisor, Departmental Representative, speciality Contractor - finishing, forming, concrete producer and testing laboratories attend.

1.4 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Provide submittals in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Concrete pours: provide accurate records of poured concrete items indicating date and location of pour, quality, air temperature, and test samples taken as per the Contract documents.
- .3 Concrete hauling time: provide for review by Departmental Representative deviations exceeding maximum allowable time of 120 minutes for concrete to be delivered to site of Work and discharged after batching.
- .4 MSDS in accordance with Section 01 35 29 – Health and Safety Requirements and Section 01 35 43 – Environmental Procedures.

1.5 QUALITY CONTROL

- .1 In accordance with Section 01 45 00 - Quality Control.
- .2 Provide Departmental Representative with valid and recognized certificate from plant delivering concrete, in accordance with 01 33 00 – Submittal Procedures.
 - .1 Provide test data and certification by qualified independent inspection and testing laboratory that materials and mix designs used in concrete mixture will meet specified requirements.
 - .2 Ensure testing laboratory and personnel are certified to CSA A283.
- .3 In accordance with 01 33 00 – Submittal Procedures, provide proposed quality control procedures for review by Departmental Representative on following items:
 - .1 Falsework erection.
 - .2 Hot weather concrete.
 - .3 Cold weather concrete.
 - .4 Curing.

- .5 Finishes.
- .6 Formwork removal.
- .7 Joints.
- .4 Quality Control Plan: provide written report to Departmental Representative verifying compliance that concrete in place meets performance requirements of concrete as established in PART 2 - PRODUCTS.
- .5 Testing of concrete to conform to CSA A23.2 and the frequency and number of tests is not to be less than one strength, air entrainment, and slump test for slab concrete.

1.6 DELIVERY, STORAGE AND HANDLING

- .1 In accordance with 01 61 00 - Common Product Requirements.
- .2 Concrete hauling time: deliver to site of Work and discharged within 120 minutes' maximum after batching.
- .3 Do not modify maximum time limit without receipt of prior written agreement from Departmental Representative and concrete producer as described in CSA A23.1/A23.2.
- .4 Deviations to be submitted for review by Departmental Representative.
- .5 Concrete delivery: ensure continuous concrete delivery from plant meets CSA A23.1/A23.2.Products

Part 2 Products

2.1 DESIGN CRITERIA

- .1 Alternative 1 - Performance: to CSA A23.1/A23.2, and as described in MIXES of PART 2 - PRODUCTS.

2.2 PERFORMANCE CRITERIA

- .1 Quality Control Plan: ensure concrete supplier meets performance criteria of concrete as established by Departmental Representative and provide verification of compliance as described in PART 1 - QUALITY CONTROL.

2.3 MATERIALS

- .1 Portland Cement: to CSA A3001, Type GU.
- .2 Blended hydraulic cement: Type GUb to CSA A3001.
- .3 Supplementary cementing materials: with maximum 25% fly ash replacement, by mass of total cementitious materials to CSA A3001.
- .4 Water: to CSA A23.1.
- .5 Aggregates: to CSA A23.1/A23.2.
- .6 Admixtures:
 - .1 Air entraining admixture: to ASTM C260.
 - .2 Chemical admixture: to ASTM C494. Departmental Representative to approve accelerating or set retarding admixtures during cold and hot weather placing.
- .7 Shrinkage compensating grout: premixed compound consisting of non-metallic aggregate, Portland cement, water reducing and plasticizing agents to CSA A23.1/A23.2.

- .1 Compressive strength: 20 MPa at 48 hours, 45 MPa at 28 days.
- .2 Net shrinkage at 28 days: maximum 0.01 %.
- .8 Curing compound: to CSA A23.1/A23.2.
- .9 Premoulded joint fillers:
 - .1 Bituminous impregnated fiber board: to ASTM D1751.
- .10 Epoxy Grout: as indicated.
- .11 Elastomer: as indicated.
- .12 Steel Laminae: as indicated.
- .13 Anchor Rods and Anchor Bolts: as indicated.
- .14 Concrete sealers:
 - .1 Sikagard SN-40 Lo-VOC (or approved equivalent)

2.4 MIXES

- .1 Alternative 1 - Performance Method for specifying concrete: to meet Departmental Representative performance criteria to CSA A23.1/A23.2.
 - .1 Ensure concrete supplier meets performance criteria as established below and provide verification of compliance as in Quality Control Plan.
- .2 Provide concrete mix to meet following plastic state requirements:
 - .1 Uniformity: as required by CSA A23.1/A23.2.
 - .2 Workability: free of surface blemishes, loss of mortar, colour variations, and segregation.
- .3 Provide concrete mix to meet following hard state requirements:
 - .1 Durability and class of exposure: C-1.
 - .2 Compressive strength at 28 days age: 35 MPa minimum.
 - .3 Intended application: Substructure and stopping pad (slab).
 - .4 Aggregate size 20 mm maximum.
 - .5 W/C: 0.40
 - .6 Air: 5-8%
- .4 Provide quality management plan to ensure verification of concrete quality to specified performance.
- .5 Concrete supplier's certification: both batch plant and materials meet CSA A23.1 requirements.

Part 3 Execution

3.1 PREPARATION

- .1 Obtain the Departmental Representative's acceptance before placing concrete.
 - .1 Provide 24 hours' notice prior to placing of concrete.
- .2 Place concrete reinforcing in accordance with Section 03 20 00 - Concrete Reinforcing.
- .3 During concreting operations:
 - .1 Development of cold joints not allowed.

- .2 Ensure concrete delivery and handling facilitates placing with minimum of rehandling, and without damage to existing structure or Work.
- .4 Pumping of concrete is permitted only after acceptance of equipment and mix by Departmental Representative.
- .5 Ensure reinforcement and inserts are not disturbed during concrete placement.
- .6 Prior to placing of concrete obtain the Departmental Representative's acceptance of proposed method for protection of concrete during placing and curing.
- .7 Protect previous Work from staining.
- .8 Clean and remove stains prior to application for concrete finishes.
- .9 Maintain accurate records of poured concrete items to indicate date, location of pour, quality, air temperature and test samples taken.
- .10 In locations where new concrete is dowelled to existing work, drill holes in existing concrete.
 - .1 Place steel dowels of deformed steel reinforcing bars and pack solidly with epoxy grout to anchor and hold dowels in positions as indicated.
- .11 Do not place load upon new concrete until authorized by Departmental Representative.

3.2 INSTALLATION/APPLICATION

- .1 Cast-in-place concrete work in accordance with CAN/CSA-A23.1/A23.2.
- .2 Sleeves and inserts.
 - .1 Do not permit penetrations, sleeves, ducts, pipes or other openings to pass through joists, beams, column capitals or columns, except where indicated or approved by Departmental Representative.
 - .2 Where approved by Departmental Representative, set sleeves, ties, pipe hangers and other inserts and openings as indicated or specified elsewhere.
 - .3 Sleeves and openings greater than 100 x 100 mm not indicated, must be reviewed by Departmental Representative.
 - .4 Do not eliminate or displace reinforcement to accommodate hardware. If inserts cannot be located as specified, obtain written approval of modifications from Departmental Representative before placing of concrete.
 - .5 Confirm locations and sizes of sleeves and openings shown on drawings.
 - .6 Set special inserts for strength testing as indicated and as required by non-destructive method of testing concrete.
- .3 Anchor rods:
 - .1 Set anchor rods to templates in co-ordination with appropriate trade prior to placing concrete.
 - .2 Grout anchor rods in preformed holes or holes drilled after concrete has set only after receipt of written approval from Departmental Representative.
 - .1 Formed holes: 100 mm minimum diameter.
 - .2 Drilled holes: 25 mm minimum diameter larger than bolts used.
 - .3 Protect anchor rod holes from water accumulations, snow and ice build-ups.
 - .4 Set rods and fill holes with shrinkage compensating grout.

- .4 Grout using procedures in accordance with manufacturer's recommendations which result in 100% contact over grouted area.
- .5 Finishing and Curing.
 - .1 Finish concrete to CSA A23.1/A23.2 unless noted otherwise.
 - .2 Schedule:
 - .1 Stopping Pad – Floated surface finish for exposed face
 - .2 Foundation – smooth form finish.
 - .3 Use procedures as reviewed by Departmental Representative or those noted in CSA A23.1/A23.2 to remove excess bleed water. Ensure surface is not damaged.
- .6 Joint fillers:
 - .1 Furnish filler for each joint in single piece for depth and width required for joint, unless otherwise authorized by Departmental Representative.
 - .2 When more than one piece is required for joint, fasten abutting ends and hold securely to shape by stapling or other positive fastening.
 - .3 Locate and form construction and expansion joints as indicated.
 - .4 Install joint filler.

3.3 FIELD QUALITY CONTROL

- .1 Site tests: conduct tests as follows in accordance with section 01 45 00 - Quality Control and submit report as described in PART 1 - ACTION AND INFORMATIONAL SUBMITTALS.
 - .1 Concrete pours.
 - .2 Slump.
 - .3 Air content.
 - .4 Compressive strength at 7 and 28 days.
 - .5 Air and concrete temperature.
- .2 Inspection and testing of concrete and concrete materials will be carried out by testing laboratory designated by Contractor to CSA A23.1/A23.2.
 - .1 Ensure testing laboratory is certified to CSA A283.
- .3 Ensure test results are distributed for discussion at pre-pouring concrete meeting between testing laboratory and departmental representative.
- .4 Take additional test cylinders during cold weather concreting. Cure cylinders on job site under same conditions as concrete which they represent.
- .5 Non-destructive methods for testing concrete: to CSA A23.1/A23.2.
- .6 Inspection or testing by the Departmental Representative will not augment or replace Contractor quality control nor relieve Contractor of their contractual responsibility.

3.4 PROTECTION

- .1 Protection and curing for concrete placed between October 01 and May 01 shall comply with following requirements in addition to cold weather requirements of CSA A23.1/A23.2.
 - .1 Protect concrete with windproof shelter of canvas or other material to allow free circulation of inside air around fresh concrete.

- .2 Do not let walls of shelter touch formwork.
- .3 Provide sufficient space for removal of formwork for finishing.
- .4 Use heating equipment approved by Departmental Representative.
- .5 Vent products of combustion outside protective shelter: equipment to be capable of keeping inside air at constant temperature sufficiently high to maintain concrete at following curing temperatures:
- .7 For initial 3 days: minimum temperature of 15 degrees C, maximum of 27 degrees C at concrete surfaces.
- .8 For concrete abutments, and footings: cure at 10 degrees C for additional 4 days.
 - .1 Keep concrete surfaces continually moist while protected.
 - .2 Provide fogging equipment to allow for mist spray curing before start of deck pour.
- .9 Unformed surfaces: cure with burlap and water.
 - .1 Place two layers of damp burlap on surface of concrete.
 - .2 Overlap each strip by minimum 75 mm and secure against displacement by wind.
 - .3 Maintain burlap in place and keep thoroughly wet for seven days after placement.
- .10 Formed surfaces:
 - .1 No additional curing will be required if formwork is left in place for seven days or more.
 - .2 If formwork removed in less than seven days, cure in manner specified for unformed surfaces for remainder of seven (7) day period.
- .11 During curing period, only uncover areas needed for finish treatment. Re-cover and continue curing.

3.5 CLEANING

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

END OF SECTION

10 14 53 TRAFFIC SIGNAGE**Part 1 General****1.1 REFERENCES**

- .1 Parks Canada Exterior Signage Standards and Guidelines (latest edition)
- .2 ASTM A276, Specification for Stainless and Heat-Resisting Steel Bars and Shapes.
- .3 ASTM B209M, Specification for Aluminum and Aluminum-Alloy Sheet and Plate.
- .4 ASTM B210M, Specification for Aluminum-Alloy Drawn Seamless Tubes.
- .5 ASTM B211M, Specification for Aluminum and Aluminum-Alloy Bar, Rods and Wire.
- .6 CAN/CSA-G40.21, Structural Quality Steels.
- .7 CAN/CSA-G164-M92(R2003), Hot Dip Galvanizing of Irregularly Shaped Articles.
- .8 CAN/CSA-O80 Series, Wood Preservation.
- .9 CSA O121, Douglas Fir Plywood.
- .10 CSA W47.2, Certification of Companies for Fusion Welding of Aluminum.
- .11 CGSB1-GP-12c-65, Standard Paint Colours:
- .12 CAN/CGSB-1.28, Alkyd, Exterior House Paint.
- .13 CAN/CGSB-1.59, Alkyd, Exterior Gloss Enamel.
- .14 CAN/CGSB-1.94-M89, Xylene Thinner (Xylol).
- .15 CAN/CGSB-1.99-92, Exterior and Marine Phenolic Resin Varnish.
- .16 CAN/CGSB-1.104-M91, Semigloss Alkyd Air Drying and Baking Enamel.
- .17 CAN/CGSB-1.132-M90, Zinc Chromate Primer, Low Moisture Sensitivity.
- .18 CGSB 1-GP-189M-78, Primer, Alkyd, Wood, Exterior.
- .19 CGSB 31-GP-3M-88, Corrosion Preventive Compound, Cold Application, Soft Film.
- .20 CGSB 62-GP-9M-80, Prefabricated Markings, Positionable, Exterior, for Aircraft Ground Equipment and Facilities.
- .21 CGSB 62-GP-11M-78, Marking Material, Retroreflective, Enclosed Lens, Adhesive Backing.
- .22 AT - Standard Specifications for Highway Construction (latest edition).

1.2 MEASUREMENT AND PAYMENT PROCEDURES

- .1 Measurement and Payment Procedures for supplying, loading, hauling and installation of regulatory signs, hazard markers and bases will be based on each complete unit installed according to these specifications, and shall include all labour, equipment and material to satisfactorily complete this item of work. Payment will be made under **“Unit Price Item 14a – Traffic Signage – Supply and Install”**.
- .2 Measurement and Payment Procedures for relocation of existing signage, markers, and bases as indicated will be based on each complete unit relocated and shall include all labour, equipment and material to satisfactorily complete this item of work. Payment will be made under **“Unit Price Item 14b – Traffic Signage – Remove and Relocate”**.

- .3 Removal and disposal of existing signs becoming redundant, filling the holes, and all work associated with the removal and disposal of existing signage, markers, and bases will be paid under **“Unit Price 14c – Traffic Signage – Remove and Dispose”**.
- .4 The unit rate for all items under this section is applicable consistently to all signs as identified in the Drawings regardless of the number of posts, size of the sign face, manner in which it is mounted, condition, or any other differentiating factor other than its categorization under the respective work item as detailed in the Drawings.
- .5 Traffic Control required for this Work shall be incidental to **“Lump Sum Price – Traffic Accommodation”** and no separate payment will be made to the Contractor.
- .6 Mobilization and demobilization required for this Work shall be incidental to **“Lump Sum Price – Mobilization / Demobilization”**, and no additional payment will be made.
- .7 Environmental mitigations required in accordance with Section 01 35 43 – Environmental Procedures, for the Work in this Section shall be incidental to the Contract and no separate payment will be made to the Contractor.

1.3 WASTE MANAGEMENT AND DISPOSAL

- .1 Separate and recycle waste materials in accordance with Section 01 35 43 – Environmental Procedures.
- .2 Divert unused metal and/or plastic materials to recycling facility, outside of the National Parks, as approved by Departmental Representative. Disposal of waste and/or recycling is incidental to the Work and no additional payment will be made.

Part 2 Products

2.1 MATERIALS

- .1 The Contractor is responsible for supplying all materials associated with the installation of signage.
- .2 Traffic signs, posts and bases shall be supplied and installed in accordance with AT - Standard Specifications for Highway Construction (latest edition) unless specified otherwise on the IFC Drawings.
- .3 All custom signs to be accepted by the Departmental Representative prior to ordering.
- .4 All signs (permanent and temporary) shall be in both English and French. Translations to be accepted by the Departmental Representative prior to ordering.

Part 3 Execution

3.1 INSTALLATION

- .1 In accordance with AT - Standard Specifications for Highway Construction (latest edition).
- .2 The Contractor shall load, haul and install supplied single post and aluminum signs and bases in the following manner:
 - .1 The Contractor is responsible for locating power / telephone / gas lines / services / utilities at all proposed sign locations.

- .2 The Contractor is responsible for layout and measurements to ensure signs are installed as per the Contract Documents.
- .3 Concrete bases: Excavate one hole for the concrete base at the location and depth as per the Contract Documents. Using some of the excavated material, level and compact bottom of hole. Place base with one side parallel to the edge of asphalt and level. The top of the base is to be flush or 1" above finished grade.
- .4 Adjust the post height by using a pipe cutter or cut off saw in accordance with AT - Standard Specifications for Highway Construction (latest edition). The Contractor will measure existing elevations at each site and calculate the cuts needed.
- .5 Bases must be perfectly plumbed. Vertical and horizontal tolerances for the base are 0.075m. Tolerance for the plumb of the posts is 0.01 m per 1.0 m or 1/4" on a two foot carpenters level. Tolerances for the signs are 0.075 m for distance from asphalt and 0.075 m for height above white line.
- .6 The Contractor is responsible for hauling all materials to and from each work site.
- .7 Landscape so the top of the base is flush or 50 mm above finished grade.
- .8 Remove all excess material from site, including boulders larger than 100 mm.
- .9 All signs are to be covered until the Departmental Representative advises to uncover.
- .10 The Contractor is to place NPC/PNC stickers (provided by the Departmental Representative) on all signs as indicated by the Departmental Representative.
- .11 Payment for this item shall be based on the number of signs installed and shall include all material, labour and equipment required to satisfactorily complete this item of work.

3.2 REMOVAL AND SALVAGE

- .1 Carefully dismantle and salvage post, aluminum and steel materials.
- .2 Deliver salvaged materials to Jasper Field Unit Compound, or as directed by the Departmental Representative.
- .3 Damaged signs and posts to be hauled to recycling facility accepted by the Departmental Representative. Hauling, disposal and/or recycling is incidental to the Works and no additional payment will be made.
- .4 Fill holes with gravel and compact.

3.3 REMOVAL AND REINSTALL

- .1 The Contractor shall carefully dismantle and stockpile posts, bases and aluminum signs.
- .2 Damaged posts, signs or bases to be replaced by the Contractor at the Contractor's expense.
- .3 Damaged signs, posts and bases shall be hauled to recycling facility outside of the Parks. Hauling, disposal and/or recycling is incidental to the Works and no additional payment will be made.
- .4 Fill holes with gravel and compact.
- .5 Reinstall signage as per drawings or as directed by the Departmental Representative.

3.4 REMOVE AND DISPOSE

- .1 Signage, posts and bases or foundations are to be removed and disposed of outside of the Parks. Disposal is considered incidental to the item and no additional payment will be made.
- .2 Fill holes with gravel and compact.

3.5 CLEANING

- .1 Upon completion of installation, remove surplus materials, rubbish, tools and equipment barriers, in accordance with 01 74 11 - Cleaning

END OF SECTION

31 05 10 CORRECTED DRY DENSITY FOR FILL**Part 1 General****1.1 SUMMARY**

- .1 This Section defines correction to maximum dry density to take into account aggregate particles larger than 19 mm.

1.2 REFERENCES

- .1 American Society for Testing and Materials (ASTM)
 - .1 ASTM C127-[04], Standard Test Method for Density, Relative Density (Specific Gravity) and Absorption of Coarse Aggregate.
 - .2 ASTM D698-[00ae1], Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft³ (600 kN-m/m³)).
 - .3 ASTM D1557-[02e1], Test Method for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/ft³ (2,700 kN-m/m³)).
 - .4 ASTM D4253-[00], Standard Test Methods for Maximum Index Density and Unit Weight of Soils Using a Vibratory Table.

1.3 DEFINITIONS

- .1 Corrected maximum dry density is defined as:
 - .1 $D = (D1 \times D2) / ((F1 \times D2) + (F2 \times D1))$.
 - .2 $D = (F1 \times D1) + (0.9 \times D2 \times F2)$.
 - .3 Where: D = corrected maximum dry density kg/m³.
 - .4 F1 = fraction (decimal) of total field sample passing 19 mm sieve.
 - .5 F2 = fraction (decimal) of total field sample retained on 19 mm sieve (equal to 1.00 - F1).
 - .6 D1 = maximum dry density, kg/m³ of material passing 19 mm sieve determined in accordance with Method A of ASTM D1557.
 - .7 D2 = bulk density, kg/m³, of material retained on 19 mm sieve, equal to 1000G where G is bulk specific gravity (dry basis) of material when tested to ASTM C127.
- .1 For free draining aggregates, determine D1 (maximum dry density) to ASTM D4253 wet method when directed by Departmental Representative.

Part 2 Products

- .1 Not Used.

Part 3 Execution

- .1 Not Used.

END OF SECTION

31 11 00 CLEARING AND GRUBBING**Part 1 General****1.1 REFERENCES**

- .1 AT - Standard Specifications for Highway Construction (latest edition).

1.2 MEASUREMENT AND PAYMENT PROCEDURES

- .1 Quantities for payment for clearing will be paid under **“Unit Price Item 1a – Clearing”** and will be measured based on the area in horizontal (2D) hectares of clearing that has been acceptably completed in accordance with these specifications and will, unless otherwise specified, be measured from the edge of the existing pavement to 3m past the cut fill line as shown approximately on the Drawings or as directed by the Departmental Representative. Payment under this item shall include all labour, equipment and material to satisfactorily complete the work.
- .2 Quantities for payment for grubbing will be paid under **“Unit Price Item 1b – Grubbing”** and will be measured based on the area in horizontal (2D) hectares of clearing that has been acceptably completed in accordance with these specifications and will, unless otherwise specified, be measured from the edge of the existing pavement to 3m past the cut fill line as shown approximately on the Drawings or as directed by the Departmental Representative. Payment under this item shall include all labour, equipment and material to satisfactorily complete the work.
- .3 Clearing and grubbing waste shall be removed from the Park. Loading, hauling and disposal of clearing and grubbing waste shall be incidental to the Work.
- .4 No overhaul will be paid for clearing and grubbing.
- .5 Mobilization and demobilization required for this Work shall be incidental to **“Lump Sum Price – Mobilization / Demobilization”**, and no additional payment will be made.
- .6 Traffic Control required for this Work shall be incidental to **“Lump Sum Price – Traffic Accommodation”** and no separate payment will be made to the Contractor.
- .7 Environmental mitigations required in accordance with Section 01 35 43 – Environmental Procedures, for the Work in this Section shall be incidental to the Contract and no separate payment will be made to the Contractor
- .8 Bird surveys must be completed and current for all Works on previously felled timber and grubbing areas in accordance with 01 35 43 Environmental Procedures. Bird surveys must be completed by a Qualified Environmental Professional and no additional payment will be made.
- .9 If the Contractor is requested to arrange for sale of merchantable timber. Any cost / credit for the sale of merchantable timber will be paid under a provisional sum.
- .10 All clearing and grubbing to be completed in accordance with the relevant environmental procedures contained and referenced herein.
- .11 Removal and disposal of previously felled timber to be incidental to **“Unit Price Item 1a – Grubbing”** and no additional payment will be made.
- .12 Additional miscellaneous clearing may be required due to field changes. Quantities for payment for flush cutting, clearing will be paid under a provisional sum.

- .13 The extent of grubbing shall be as indicated on the IFC drawings and the Contractor shall not commence work on this activity until approval to proceed has been granted by the Departmental Representative.

1.3 DEFINITIONS

- .1 Flush cutting consists of cutting trees, stumps or vegetative growth to within 100 mm of the ground, leaving the root structure undisturbed and disposing of felled trees, previously uprooted trees, stumps and clearing wood debris as specified.
- .2 Clearing consists of cutting trees and brush vegetative growth to within 300 mm of the ground and disposing of felled trees, previously uprooted trees, stumps, and clearing wood debris as specified.
- .3 Grubbing consists of excavation and disposal of stumps, roots and wood debris to a depth of 0.6m below the ground line.
- .4 Chipping consists of chipping wood debris, except merchantable timber, into wood chips. Finished wood chip material shall be able to pass through a 100 mm by 100 mm screen.
- .5 Merchantable timber is all timber with butt diameter in excess of 150 mm and top down to 100 mm.

1.4 QUALITY CONTROL

- .1 All Quality Control testing by the Contractor as per Section 01 45 00 – Quality Control.

1.5 PROTECTION

- .1 Prevent damage to trees, natural features, bench marks, existing pavement, water courses and root systems of trees that are to remain.
 - .1 No grubbing to be completed with 1m of the tree drip line.
- .2 Repair any damaged items to approval of Departmental Representative.
- .3 Replace any trees designated to remain, if damaged, as directed by Departmental Representative.
- .4 Contractor shall take all measures to ensure that trees do not fall into streams, rivers, wetlands or water bodies or outside the clearing limits as marked by colored flagging. Generally, work within a 30 metre buffer of watercourses, water bodies or wetlands requires consultation with the Departmental Representative, who will consult with the ESO.
- .5 Trees inadvertently felled into streams, rivers, watercourses or outside the clearing limits shall be removed by means (e.g. winch) so as not to damage the substrate or any standing trees left outside the clearing limits. Machinery shall not go outside the clearing limits, or into streams, rivers, watercourses or water bodies to remove felled trees.
- .6 Logs and other salvage materials are to be conveyed to and placed at the storage site without spread of debris or damage to other standing trees or landscape resources outside the marked clearing or storage limits. They shall not be skidded through wetlands, waterways or water bodies.
- .7 During the grubbing component, stumps, roots, imbedded logs and other non-soil debris shall be pulled and shaken free of loose soil and rocks before transport.

- .8 No slash clearing, pickup or grubbing shall occur outside of the designated area or within 1 metre of the drip line of existing forest.
- .9 Existing areas of vegetation disturbed as a result of this Contract shall be rehabilitated using approved topsoil from the park and a native grass seed mix as specified in Section 32 92 22 – Hydraulic Seeding.

1.6 INDIGENOUS CONTRACTORS

- .1 It is required that at least one of the following indigenous Contractors be engaged for the clearing and grubbing work outlined in this section;
 - .1 Bear Hills Industry
Matt Barich
Email: matt@bearhillsindltd.com
Phone: 403-304-6828
 - .2 Mur-Cal Services Ltd.
Murray Callihoo
Email: info@mur-cal.ca
Phone: 780-539-0928
 - .3 ENOCH Construction Ltd
Summer Ebinger
Email: ecl@enochnation.ca
Phone: 780-470-5079
 - .4 Aseniwuche Development Corporation
Jeanette Harnish
Email: jharnish@adcalberta.com
Phone: 780-827-9670

Part 2 Products

- .1 Not used.

Part 3 Execution

3.1 PREPARATION

- .1 Inspect site and verify with Departmental Representative, items designated to remain.

3.2 CLEARING

- .1 Clear as directed by Departmental Representative by cutting trees and vegetative growth.
- .2 Cut off branches and cut down trees overhanging area cleared as directed by Departmental Representative.
- .3 Cut off unsound branches on trees designated to remain as directed by Departmental Representative.

- .4 All clearing shall be felled in such a manner that surrounding vegetation is preserved along the construction limits. Stumps remaining within 2.0 metres of cleared perimeter are to be cut flush with ground and vegetative mat left undisturbed.

3.3 GRUBBING

- .1 Grub out stumps and wood debris including roots and embedded logs up to a depth of 0.6m below the ground surface.
- .2 Grubbing ripper teeth depth shall be kept as shallow as possible to minimize contamination of topsoil with subsoils. This may require individual ripping of stumps in some locations. In addition, while removing stumps, roots or embedded logs, the Contractor shall shake them on site to remove as much soil as possible.

3.4 REMOVAL AND DISPOSAL

- .1 All cleared and grubbed wood and vegetative materials, excluding merchantable timber, shall be loaded, hauled and disposed of outside of the National Park at a disposal site as agreed with the Departmental Representative at the Contractor's expense.
- .2 Merchantable timber shall remain property of PCA and should be cut at the base to the maximum suitable length.
- .3 Non-Merchantable Timber shall be processed, cut, loaded and hauled according to Provincial highway regulations at the Contractor's expense. Non-merchantable timber shall be disposed of outside the National Park at the Contractor's expense.
- .4 Stockpiled non-merchantable timber may be retained by the Crown and any requirement to process full-length log decks into firewood length will be the responsibility of the Crown if they so choose. The Contractor is to allow for disposal outside the Park at their cost.
- .5 No burning will be permitted.
- .6 Contractor is responsible for ensuring weights of all haul vehicles meet all applicable regulations.

3.5 FINISHED SURFACE

- .1 In areas of grubbing, leave ground surface in condition suitable for stripping of topsoil to approval of Departmental Representative.
- .2 In areas of flush cutting, leave stumps cut flush with ground elevation and root structure undisturbed.
- .3 Finished surface requirements:
 - .1 Refer to Best Management Practices "Vegetation Removal Mitigations Module".
 - .2 In areas of flush cutting, leave stumps cut flush with ground elevation and root structure undisturbed unless otherwise directed by the Departmental Representative.
 - .3 Where possible, vegetative debris should not be left to accumulate on site.
 - .4 Chips cannot exceed two inches in depth to a maximum coverage of 5% ground cover.
 - .5 Where accessible, all stems suitable for firewood should be removed from site, hauled and stockpiled at a location designated by the Departmental Representative.

- .6 At inaccessible sites or for trees with little firewood value, no more than 50 stems per linear kilometer may be left on site. A stem is defined as any tree with a diameter at breast height (DBH) greater than 15 centimeters.
- .7 All retained stems must be limbed and lie flush to the ground.
- .8 Accumulation of fine woody fuels is of greatest concern from both a fire management and vegetation re-growth perspective. Fine fuel accumulation cannot exceed 10% ground cover and must be less than 10 centimeters in depth. Fine woody fuels have a diameter less than 3 centimeters.
- .9 Medium fuels may accumulate to a maximum of 20% ground cover and shall not exceed 20 centimeters in depth. Medium fuels have a diameter ranging from 3 centimeters to 7 centimeters
- .10 Mechanical distributed areas and burn piles must be seeded with an approved native grass seed mix within 6 months of project completion.
- .11 Ground disturbance must be kept to a minimum. Off-highway mechanical equipment must have tire pressure of 7 psi or lower.

END OF SECTION

02 41 13 ASPHALT PAVEMENT REMOVAL**Part 1 General****1.1 MEASUREMENT AND PAYMENT PROCEDURES**

- .1 Payment under **“Unit Price Item 2 – Asphalt Pavement Removal”** shall be the total compensation for all operations involved in milling and pulverizing including but not limited to survey, cold milling, sweeping, loading, hauling, stockpiling and cleaning of remaining pavement surface. Payment shall be made as follows:
 - .1 **“Unit Price Item 2a - Asphalt Pavement Removal – Existing Structure Removal (Full Depth)”** will be measured for payment in square metres of asphalt pavement of existing roadway actually removed and stockpiled. Milling shall be completed according to the Contract Documents or as directed by the Departmental Representative, and shall include all labour, equipment and material to satisfactorily complete this item of work.
 - .2 **“Unit Price Item 2b - Asphalt Pavement Removal – Milling Existing Pavement (Partial)”** will be measured for payment in square metres of asphalt pavement of existing roadway actually removed and stockpiled. Milling shall be completed according to the Contract Documents or as directed by the Departmental Representative, and shall include all labour, equipment and material to satisfactorily complete this item of work.
 - .3 No overhaul will be paid for this Work.
 - .4 Payment per square metre will remain the same, regardless of the number of passes required to complete the Work, to the depth specified, as per the Contract Documents.
 - .5 Placement of gravels to level the running surface for the milling machine, if required, will be considered incidental to the Work and no additional payment will be made.
 - .6 Traffic Control required for this Work shall be incidental to **“Lump Sum Price - Traffic Accommodation”** and no separate payment will be made to the Contractor.
 - .7 Mobilization and demobilization required for this Work shall be incidental to **“Lump Sum Price – Mobilization / Demobilization”** and no additional payment will be made for remobilization of equipment if all milling work cannot be completed at once.
 - .8 Environmental mitigations required in accordance with Section 01 35 43 – Environmental Procedures, for the Work in this Section shall be incidental to the Contract and no separate payment shall be made to the Contractor.
- .2 The Contractor shall refer to Section 32 01 16 for Asphalt Pavement Removal – Full Depth Reclamation specifications.

1.2 WASTE MANAGEMENT AND DISPOSAL

- .1 Separate waste materials for reuse in accordance with Section 01 35 43 - Environmental Procedures.

- .2 The Contractor shall place removed asphalt material in a stockpile at Marmot Pit or at other locations designated by the Departmental Representative.

1.3 DEFINITIONS

- .1 Profile Milling: Removal of asphalt concrete pavement to an accurate depth of cut, profile and cross slope and shall include loading the milled material directly into trucks.
- .2 Partial Depth Milling: Removal of asphalt concrete pavement, other than Profile Milling.
- .3 Full Depth: Complete removal of asphalt concrete pavement to the granular road structure.

Part 2 Products

2.1 EQUIPMENT

- .1 Use cold milling, planning or grinding self-powered equipment with automatic grade controls capable of operating from string line, and capable of removing part or all of pavement surface to depths or grades indicated.
- .2 The Contractor is to ensure that the maximum particle size of milled materials is less than 50 mm and shall sieve or otherwise separate/remove larger particles at their cost.

Part 3 Execution

3.1 PREPARATION

- .1 Prior to beginning removal operation, the Contractor shall inspect and verify with the Departmental Representative, all areas, depths and lines of asphalt pavement to be removed.
- .2 Have appropriate Traffic Control measures in accordance with 01 35 31 Special Procedures for Traffic Control.

3.2 PROTECTION

- .1 Protect existing pavement not designated for removal, concrete deck, concrete curb and barriers, light units and structures from damage. In event of damage, the Contractor shall immediately replace or make repairs to the satisfaction of the Departmental Representative at no additional cost.

3.3 REMOVAL

- .1 Full depth asphalt pavement removal shall be done to the lines shown on the IFC Drawings or as designated by the Departmental Representative.
- .2 Partial Depth Asphalt Pavement Removal by milling to lines and grades shown on the IFC Drawings or as established by Departmental Representative in field:
 - .1 Use self-powered equipment and methods of removal and hauling which do not damage or disturb underlying roadway structure.
- .3 Prevent contamination of removed asphalt pavement by topsoil, underlying gravel or other materials.

- .1 Provide for suppression of dust generated by removal process to ensure a dust free Work Site.
- .4 To tie in from existing pavement to new overlay, remove existing asphalt pavement by milling to lines and grades established by Departmental Representative in field or as per Drawings.
- .5 If applicable, at mill and fill locations, remove existing asphalt to the depths, lengths and width specified in the Drawings and as established by Departmental Representative in field.
- .6 If the base course is disturbed by milling operations the Contractor will be required to rectify the base course, to the acceptance of the Departmental Representative, at the Contractor's cost.

3.4 STOCKPILING OF MATERIAL

- .1 The Contractor shall place removed asphalt material in a stockpile at Marmot Pit or at other locations designated by the Departmental Representative.
- .2 Removed asphalt material shall remain the property of Parks Canada.

3.5 FINISH TOLERANCES

- .1 Finished surfaces in areas where asphalt pavement has been removed shall be within +/-5 mm of the grade specified, and shall not be uniformly high or low.

3.6 SWEEPING

- .1 Sweep remaining asphalt pavement surfaces clean of debris resulting from removal operations using rotary power brooms and hand work and brooming as required. No extra payment will be made for sweeping or associated hand work.

END OF SECTION

31 24 13 ROADWAY AND DRAINAGE EXCAVATION**Part 1 General****1.1 REFERENCES**

- .1 AT - Standard Specifications for Highway Construction (latest edition).
- .2 American Society for Testing and Materials International, (ASTM)
- .3 ASTM D698, Test Method for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,000 ft-lbf/ft³) (600 kN-m/m³).

1.2 DESCRIPTION

- .1 This item consists of the excavation and disposal of all materials in conformity with the lines, grades and dimension indicated on the drawings and as directed by the Departmental Representative and includes:
 - .1 Stripping of organic material.
 - .2 Roadway, culvert, and borrow excavation.
 - .3 Construction of roadway ditches, embankments, permanent access and connecting roads, approaches, entrances, day use areas, berms, approved haul roads and other earthworks necessary for the construction of the road.
 - .4 Removal and disposal of waste / surplus materials from excavation, embankment and borrow areas.
 - .5 Transportation of excavated materials.
 - .6 Finishing of top surfaces and slopes.
 - .7 Maintenance of the work set forth under this section in a finished condition until any portion thereof has been accepted as completed by the Departmental Representative.

1.3 MEASUREMENT AND PAYMENT PROCEDURES

- .1 Stripping and placement in stockpiles:
 - .1 The quantity of Stripping for which payment will be made shall be the volume in cubic metres measured in its original position from cross sections taken by Departmental Representative in areas of excavation. Payment will be made under **“Unit Price Item 3a - Roadway and Drainage Excavation – Stripping”**.
 - .2 Stripping depth for the removal of organic material is estimated to be on average 200 mm but will fluctuate from one location to the other. Contamination of non-organic material will not be permitted during stripping.
 - .3 No overhaul will be paid for this Work.
 - .4 Stripping material is to be hauled to and stockpiled outside the national Park or as directed by the Departmental Representative. Hauling and stockpiling is incidental to the work and no additional payment will be made.
 - .5 Stockpiling along the ROW outside of the cut/fill slope will not be permitted unless approval has been given by the Departmental Representative.

- .6 In areas where the design subgrade ditch elevation is less than the depth of stripping, payment will only be made to the design grade (neatline). No payment will be made for stripping below the design ditch grade.
- .7 No payment will be made if the ditch of backslope are overcut below the design grade line and/or if the area needs to be filled back in to grade.
- .8 **Screening of stripping/organic material will be paid for in accordance with 32 91 19 Topsoil Placement and Grading.**
- .2 Roadway and Drainage Excavation:
 - .1 The quantity of Common Excavation for which payment will be made shall be the volume in cubic metres measured in its original position from cross sections taken by Departmental Representative in areas of excavation. Payment will be made under **“Unit Price Item 3b - Roadway and Drainage Excavation - Common Excavation”** and shall include cost of excavating, loading, hauling, placing and compacting material within the limits of the Contract Works for construction of the roadway embankment.
 - .2 Separating of organic material from non-organic material and stockpiling, as directed by the Departmental Representative, is considered incidental to the Work and no additional payment will be made.
 - .3 **Screening of stripping/organic material will be paid for in accordance with 32 91 19 Topsoil Placement and Grading.**
 - .4 The quantity of waste for which payment will be made shall be the volume in cubic metres measured in its original position (from cross sections) as approved by the Departmental Representative. Payment will be made under **“Unit Price Item 3c - Roadway and Drainage Excavation - Waste”** and shall include all costs for the labour, material, and equipment to complete the work and shall include cost of excavation, loading, hauling, and disposal of material outside of the Parks at a location determined by the Contractor.
 - .5 The Contractor shall take care not to contaminate suitable surplus materials with waste materials. Waste materials shall be stockpiled separately by type.
 - .6 Written approval to proceed must be completed by the Departmental Representative prior to sub-excavation for the removal of unsuitable material(s). Sub-excavation for the removal of unsuitable material(s) to be paid under **“Unit Price Item 3c - Roadway and Drainage Excavation - Waste”**.
 - .7 Payment will not be made until all related submittals have been received and approved by the Departmental Representative
 - .8 Departmental Representative will take initial cross sections after clearing, grubbing and stripping are completed and immediately prior to excavation of material to be incorporated into work.
 - .9 No overhaul will be paid.
 - .10 Embankment construction will not be measured for payment directly, rather it shall be considered incidental to **“Unit Price Item 3 – Roadway and Drainage Excavation”**.
- .3 Borrow Excavation
 - .1 The quantity of imported fill for which payment will be made shall be the neat line volume in cubic metres measured in situ survey taken by the Contractor and approved by the Departmental Representative. Payment will be made under

“Unit Price Item 3c - Roadway and Drainage Excavation – Borrow Excavation” and shall include costs of supply, loading, hauling, placing, compacting, and conditioning by wetting or drying.

- .2 The material being obtained for the Borrow Excavation shall be obtained from outside the National Parks. All costs associated with obtaining this material shall be incidental to **“Unit Price Item 3c – Roadway and Drainage Excavation – Borrow Excavation”**.
- .3 No overhaul will be paid for this Work.
- .4 Mobilization and demobilization required for this Work shall be incidental to **“Lump Sum Price – Mobilization / Demobilization”**, and no additional payment will be made.
- .5 Traffic Control required for this Work shall be incidental to **“Lump Sum Price – Traffic Accommodation”** and no separate payment will be made to the Contractor.
- .6 Environmental mitigations required in accordance with Section 01 35 43 – Environmental Procedures, for the Work in this Section shall be incidental to the Contract and no separate payment will be made to the Contractor
- .7 No measurement payment will be made for:
 - .1 Excavating unnecessarily beyond design lines established by Departmental Representative, with exception of unavoidable slide material. Do not measure slide material, when such slides are attributable to negligence.
 - .2 If overcut, no payment will be made for filling an area back to grade.
 - .3 Loading hauling, placing and compaction of boulders less than 2.0 cubic metres into large embankments.
 - .4 Scarifying or benching existing slopes or existing road surfaces.
 - .5 Removing unsuitable material from embankment attributable to negligence.
 - .6 Overhaul.
 - .7 Watering, drying or compacting soils to achieve specified densities inclusive of all compaction efforts.
 - .8 Proof rolling.
 - .9 Compaction of material (150 mm) below subgrade horizon in areas of cut.
 - .10 Placing material in stockpiles, grading, or maintaining the stockpile site.
 - .11 Finishing.

1.4 DEFINITIONS

- .1 Rock Excavation: excavation of:
 - .1 All forms of “solid rock in place” occurring in masses, ledges, seams or layers of sufficient hardness to require breaking by continuous drilling and blasting before excavation and removal.
 - .2 Detached masses of rock or boulders individually containing a volume of 2.0 cubic metres or more.
- .2 Common Excavation: excavation of materials that are not Rock Excavation or Stripping.
- .3 Borrow:

- .1 Suitable material obtained from locations outside the limits of the roadway cut and placed as embankment material.
- .2 Suitable material obtained from culvert foundation excavations used for the onsite production of granular material.
- .4 Stripping: excavation of organic material covering original ground.
- .5 Embankment: material derived from usable excavation and placed above original ground or stripped surface.
- .6 Waste Material: material unsuitable for embankment, embankment foundation, and material surplus to requirements.
- .7 Topsoil: material passing a 100 mm sieve and capable of supporting good vegetative growth and suitable for use in top dressing, landscaping and seeding.

1.5 QUALITY CONTROL

- .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.
- .2 All Quality Control testing by the Contractor in accordance with 01 45 00 – Quality Control.

1.6 WASTE MANAGEMENT AND DISPOSAL

- .1 Separate and recycle waste materials in accordance with Section 01 35 43 - Environmental Procedures.
- .2 Waste shall be disposed of at a suitable disposal facility outside of the National Parks.

Part 2 Products

2.1 MATERIALS

- .1 Embankment materials require acceptance by Departmental Representative.
 - .1 The Contractor shall provide material test certificates to the Departmental Representative for consideration.
- .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 Obtained from outside the National Park.
 - .2 AT - Standard Specifications for Highway Construction (latest edition)
 - .3 Imported from Contractor determined site outside of the Parks. Supply, loading, hauling, temporary stockpiling, placing, compacting and finishing considered incidental to the unit price.

Part 3 Execution**3.1 UTILITY COORDINATION**

- .1 In accordance with 01 14 00 - Work Restrictions and other than as detailed in Section 22 48 00 – Utility Works.
- .2 Coordinate relocations or protection of utilities (manholes, ducts, conduits or other associated infrastructure) with utility service providers and perform works required to complete relocation or protection. Work to be in accordance with utility service provider instruction or as directed by the Departmental Representative.
- .3 Existing buried utilities are to be located at all new culvert locations and every 100 m along segments of the Work where the utilities may be damaged by the Work, by using low impact excavation such as hydrovac or similar methods which will not damage buried utilities.
- .4 Payment for locating utilities to be incidental to the Works and no additional payment will be made.
- .5 Payment for utility relocations or protection to include all coordination efforts, labour, equipment and materials to be made under a provisional sum 01 14 00 Work Restrictions.

3.2 COMPACTION EQUIPMENT

- .1 Compaction equipment must equivalent of one 12 tonne vibratory packer capable of obtaining required densities in materials on project. Equipment that does not achieve specified densities must be replaced or supplemented.

3.3 WATER DISTRIBUTORS

- .1 Apply water with equipment capable of uniform distribution and in accordance with 01 35 43 – Environmental Procedures.

3.4 STRIPPING OF TOPSOIL

- .1 Commence topsoil stripping of areas on acceptance by the Departmental Representative after clearing and grubbing debris have been removed from these areas.
- .2 Strip topsoil to depths as verified by the Departmental Representative. Do not mix topsoil with subsoil. Stripping depth will vary.
- .3 Stockpile stripped materials outside the Park or at locations directed by the Departmental Representative.
- .4 Stripped soil (including fine forest litter) materials shall be placed and stored at locations outside the Park and in amounts and form as instructed by the Departmental Representative, for later reclamation use on graded slopes at the Contractor's cost. Stripping piles may require erosion control, sedimentation protection or stabilization, depending on the location and anticipated duration of storage.

3.5 EXCAVATING

- .1 General:
 - .1 Notify the Departmental Representative when waste materials are encountered and remove to depth and extent as approved by the Departmental Representative.

This material shall be hauled to and stockpile outside the Park at the Contractor's cost..

- .2 Subcut below subgrade elevation in cut sections only as approved by the Departmental Representative and replace with acceptable embankment material and compact. Compact top 300 mm below final subgrade elevation to minimum 100% Standard Proctor density, ASTM D698 (AASHTO T99). No subcut in ditches or backslope unless Departmental Representative approved.
 - .3 Treat ground slopes, where subgrade is on transition from excavation to embankment, at grade points in accordance with the Drawings.
 - .4 The dimensions of the excavations and embankments shall be, in accordance with the typical sections accompanying these specifications, but the dimensions of any or all excavations and embankments may be increased or decreased at any time by the Departmental Representative as conditions and circumstances may determine.
- .2 Drainage:
- .1 Maintain profiles, crowns and cross slopes to provide positive surface drainage at all times.
 - .2 Provide ditches as work progresses for positive drainage.
- .3 Rock excavation:
- .1 Notify the Departmental Representative if material appearing to conform to classification for rock is encountered, to enable measurements to be made to determine volume of rock. Sufficient time, approximately 24 hours, for Departmental Representative's site review of excavation will be required.
 - .2 The Contractor shall submit statement of qualifications and experience of all personnel assigned to drilling and blasting duties. The driller and the blaster shall have a minimum of 5 consecutive years demonstrated experience in drilling and controlled blasting work on projects involving rock cuts over 8 m height on transportation corridors.
 - .3 The Contractor shall retain a blasting consultant, acceptable to the Departmental Representative, to provide a blast design and quality control. The blast consultant shall not be an employee of the Contractor, explosive manufacturer or explosive distributor. Prior to the pre-construction meeting, the Contractor shall provide the name and qualifications of the blasting consultant. The consultant shall have a minimum of 5 consecutive years demonstrated experience in preparation of successful blast designs along transportation corridors.
 - .4 Submit a Rock Blast Design in accordance with Section 01 33 00 – Submittal Procedures and Section 204.04.07 of the AT Standard Specification for Highway Construction (latest edition).
 - .5 Shatter rock to 300 mm below subgrade elevation.
 - .6 Contractor shall be responsible for safety of all blasting. Particular attention should be paid to control of rock falls from excavation slopes so there is no hazard to Park users and wildlife during construction. Contractor shall advise Departmental Representative 24 hours prior to blasting operations. Contractor shall control blasting so there is no flyrock damaging existing trees and vegetation.

- .7 All rock on cut face that is loose, hanging or that creates a potentially dangerous situation shall be removed or stabilized during or upon completion of excavation of each lift. Drilling of next lift will not be allowed until this work has been completed. Other methods such as machine scaling, hydraulic splitters or light blasting may be used in lieu of, or to supplement hand scaling.
- .8 Controlled Blasting:
 - .1 The purpose of controlled blasting is to minimize damage to rock back slope and to help ensure long-term stability.
 - .2 Controlled blasting will involve controlled use of explosives and blasting accessories in carefully spaced and aligned drill holes to produce a free surface or shear plane in rock along specific excavation backs slope. Controlled blasting techniques will be used for this project.
 - .3 The slopes of the cut shall be scaled of all loose material and ditches shall be formed and cleaned.
 - .4 Subgrade shall be constructed to a true and uniform surface as to line and grade preparatory to application of sub-base material.
- .4 Borrow Excavation:
 - .1 Completely use in embankments, suitable materials removed from right-of-way excavations before taking material from borrow areas.
 - .2 Obtain borrow materials from outside the National Park.

3.6 EMBANKMENTS

- .1 This item consists of the construction of the subgrade in embankments and cuts to the lines, grades, cross-sections and dimensions shown on the drawings.
- .2 Scarify or bench existing slopes in side hill or sloping sections to ensure proper bond between new materials and existing surfaces. Method used to be subject to prior approval of the Departmental Representative.
- .3 Do not place material that is frozen nor place material on frozen surfaces except in areas authorized.
- .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. The Departmental Representative 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 Rock Embankments:
 - .1 Place to full width in layers of sufficient depth to contain maximum sized rocks, but in no case is layer thickness to exceed 0.7 m.
 - .2 Distribute rock material to fill voids with smaller fragments to form compact mass.
 - .3 Fill surface voids at design elevation with rock spalls or selected material to form earth-tight surface.

- .4 The Contractor may place rock embankments during freezing conditions provided compaction equipment of sufficient size to break large rock particles is used and all snow and ice is removed from fill surface.
- .7 Deductions from excavation will be made for overbuild of embankments.
- .8 Excess Excavation placed in stockpile in the designated pits:
 - .1 Material in the quantities specified shall be placed in the designated pits or as otherwise directed by the Departmental Representative.
 - .2 The Contractor shall place, grade and track pack the material in stockpile as necessary to allow for construction access and the movement of equipment.
 - .3 The Contractor shall maintain access to the stockpile area and allow for access to the stockpiled material by other.
 - .4 Materials placed in the designated pits, once accepted by the Departmental Representative, are the property of PCA.

3.7 SUBGRADE COMPACTION

- .1 Break material down to sizes suitable for compaction and mix for uniform moisture to full depth of layer.
- .2 Embankment material shall be placed in successive uniform layers over the entire area as follows:
 - .1 Material containing less than 25 percent by volume of stones larger than 100 mm shall be constructed in successive horizontal layers not exceeding 200 mm in loose thickness except that the top 500 mm shall be constructed in layers not exceeding 100 mm in loose thickness
 - .2 Material containing 25 percent or more by volume of stones larger than 100 mm shall be placed in layers not exceeding the maximum size of the stones. Stones larger than 100 mm shall not be placed within 150 mm of the subgrade elevation.
 - .3 In embankments composed principally of material obtained from rock cuts, the larger stones shall be carefully distributed and the interstices filled with smaller stones and other material to form a compact mass. Such embankments shall be constructed in layers not exceeding 1 metre. The placing of individual rocks and boulder exceeding 1.0 metres in least dimension will be permitted provided they are carefully distributed and the interstices filled with finer material to form a dense and compact mass. Each layer, before starting the next, shall be levelled and smoothed with suitable equipment. Hauling and spreading equipment shall be operated over the full width of each layer.
- .3 Each layer shall be brought to its required degree of compaction throughout its entire width before successive layers are placed.
- .4 Compact each layer to minimum 95% Standard Proctor density, ASTM D698 (AASHTO T99). Top 300 mm of subgrade to be compacted to 100% Standard Proctor density, ASTM D698 (AASHTO T99).
- .5 Add water or dry as required to bring moisture content of materials to level required to achieve specified compaction.
- .6 For rock placed as fill, compact with large steel wheeled or tracked equipment of sufficient size to break larger particles. Compact until rock fill is stable under compaction equipment and all voids are filled.

3.8 PROOF ROLLING

- .1 Finished subgrade must not rut or deflect when proof rolled with a truck having a 9 tonne single axle dual tire or 17 tonne tandem axle group with dual tires with a tire pressure of 600 kPa. The prepared subgrade shall receive one complete coverage by the tires of a truck as specified.
- .2 Proof roll subgrade. If use of non-standard proof rolling equipment is approved, Departmental Representative to accept level of proof rolling.
- .3 Where proof rolling reveals areas of defective subgrade:
 - .1 Remove subgrade material to depth and extent as directed by Departmental Representative.
 - .2 Backfill excavated subgrade with suitable Common material and compact in accordance with Section 31 24 13 – Roadway and Drainage Excavation.
 - .3 Replace subgrade material and compact in accordance with the Contract Documents.
- .4 All associated Works, including replacing defective material with new materials in accordance with the appropriate Sections is to be done at the Contractor's cost.

3.9 FINISHING

- .1 Shape entire subgrade to within ± 15 mm of design elevations but not to be uniformly high or low.
- .2 Round top of back slope as shown on the Drawings.
- .3 Remove rocks over 150 mm in dimension from slopes and ditch bottoms.
- .4 Trim between constructed slopes and edge of clearing to provide drainage.

3.10 PROTECTION

- .1 Maintain finished surfaces in condition conforming to this section until acceptance by the Departmental Representative.

END OF SECTION

31 32 19 GEOTEXTILES**Part 1 General****1.1 MEASUREMENT AND PAYMENT PROCEDURES**

- .1 The quantity of Geotextiles that will be measured for payment shall be the area in square meters of sub-grade over which the geotextile has been successfully installed in accordance with manufacturer's recommendations and as accepted by the Departmental Representative.
- .2 Payment for the supply and installation of geotextiles as shown on the IFC drawings or as directed by the Departmental Representative will be made under, **"Unit Price Item 16 – Geotextiles – Geogrid"**
- .3 Quantities of geotextile required for areas of overlap in accordance with the manufacturer's recommendation or as directed herein, will be considered incidental to, **"Unit Price Item 16 – Geotextiles – Geogrid"** and will not be measured for payment."
- .4 The supply and installation of Geotextiles for environmental purposes including but not limited to non-woven geotextile, geo grid, silt fences, and geosynthetic berms will not be measured directly for payment and shall be considered incidental to the unit price items.

1.2 REFERENCES

- .1 American Society for Testing and Materials International, (ASTM)
 - .1 ASTM D4491-99a, Standard Test Methods for Water Permeability of Geotextiles by Permittivity.
 - .2 ASTM D4595-86(2001), Standard Test Method for Tensile Properties of Geotextiles by the Wide-Width Strip Method.
 - .3 ASTM D4716-01, Test Method for Determining the (In-Plane) Flow Rate per Unit Width and Hydraulic Transmissivity of a Geosynthetic Using a Constant Head.
 - .4 ASTM D4751-99a, Standard Test Method for Determining Apparent Opening Size of a Geotextile.
 - .5 ASTM A123 / A123M Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products
- .2 Canadian General Standards Board (CGSB)
 - .1 CAN/CGSB-4.2 No. 11.2-M89(April 1997), Textile Test Methods - Bursting Strength - Ball Burst Test (Extension of September 1989).
 - .2 CAN/CGSB-148.1, Methods of Testing Geotextiles and Complete Geomembranes.
 - .3 No.2-M85, Methods of Testing Geosynthetics - Mass per Unit Area.
 - .4 No.3-M85, Methods of Testing Geosynthetics - Thickness of Geotextiles.

- .5 No.6.1-93, Methods of Testing Geotextiles and Geomembranes - Bursting Strength of Geotextiles Under No Compressive Load.
- .6 No.7.3-92, Methods of Testing Geotextiles and Geomembranes - Grab Tensile Test for Geotextiles.
- .7 No. 10-94, Methods of Testing Geosynthetics - Geotextiles - Filtration Opening Size.
- .3 Canadian Standards Association (CSA International)
 - .1 CAN/CSA-G40.20/G40.21-98, General Requirements for Rolled or Welded Structural Quality Steel/Structural Quality Steel.
 - .2 CAN/CSA-G164-M92(R1998), Hot Dip Galvanizing of Irregularly Shaped Articles.
- .4 AT - Standard Specifications for Highway Construction (latest edition)

1.3 SUBMITTALS

- .1 Submit samples in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Submit to Departmental Representative following samples in accordance with 01 33 00 – Submittal Procedures for each type of geotextile used on the project:
- .3 Minimum length of 2 m of roll width of geotextile.
- .4 Minimum of 1 m seam with at least 300 mm of geotextile on both sides of seam.
- .5 Submit to Departmental Representative 4 copies of mill test data and certificate at in accordance with Section 01 33 00 - Submittal Procedures.

1.4 DELIVERY, STORAGE AND HANDLING

- .1 During delivery and storage, protect geotextiles from direct sunlight, ultraviolet rays, excessive heat, mud, dirt, dust, debris and rodents.

1.5 WASTE MANAGEMENT AND DISPOSAL

- .1 Separate and recycle waste materials in accordance with Section 01 35 43, Environmental Procedures.
- .2 Remove from site and dispose of all packaging materials at appropriate recycling facilities.
- .3 Collect and separate for disposal paper plastic polystyrene corrugated cardboard packaging material in appropriate on-site bins for recycling in accordance with the EPP.
- .4 Fold up metal banding, flatten and place in designated area for recycling.

Part 2 Products

2.1 MATERIAL

- .1 Nonwoven geotextile shall meet or exceed the specifications of Nilex 4552 Non-Woven Geotextile. If the Contractor wishes to propose an alternate non-woven geotextile, the approval is subject to the discretion of the Department Representative.

- .2 Geogrid shall meet or exceed the specifications of Tensar TriAx TX 160 Geogrid. If the Contractor wishes to propose an alternate geogrid the approval is subject to the discretion of the Department Representative.

Part 3 Execution

3.1 INSTALLATION

- .1 Filter Fabric for Riprap area requirements:
 - .1 Place geotextile material by unrolling onto graded surface in orientation, manner and locations indicated and retain in position with Pins.
 - .2 Place geotextile material smooth and free of tension stress, folds, wrinkles and creases.
 - .3 Place geotextile material on sloping surfaces in one continuous length from toe of slope to upper extent of geotextile.
 - .4 Overlap each successive strip of geotextile 600 mm over previously laid strip.
 - .5 Pin successive strips of geotextile with securing pins at 3m intervals.
 - .6 Protect installed geotextile material from displacement, damage or deterioration before, during and after placement of material layers.
 - .7 Replace damaged or deteriorated geotextile to approval of Departmental Representative.
 - .8 Place and compact Riprap in accordance with Section 31 37 00.
 - .9 Install as per manufacturers specifications.
- .2 Geogrid for road base requirements:
 - .1 Unroll geogrid in the direction of travel so that the long axis of the roll is parallel with channelized traffic patterns.
 - .2 Overlap each successive strip of geogrid 600 mm over previously laid strip.
 - .3 Overlapping of geogrid should be such that it avoids peeling by the advancing fill.
 - .4 Mechanically connect adjacent strips of geogrid if required.
 - .5 Cut and overlap geogrid as recommended by the manufacturer and as approved by the Departmental Representative to accommodate curves.
 - .6 Protect installed geogrid material from displacement, damage or deterioration before, during and after placement of material layers.
 - .7 Replace damaged or deteriorated geogrid to the approval of Departmental Representative.
 - .8 Install as per manufacturer's specifications.

3.2 CLEANING

- .1 In accordance with Section 01 74 11 – Cleaning.
- .2 Remove construction debris from Project site and dispose of debris in an environmentally responsible and legal manner and in accordance with Section 01 35 43 - Environmental Procedures.

3.3 PROTECTION

- .1 Vehicular traffic not permitted directly on geotextile.

END OF SECTION

31 37 00 RIPRAP**Part 1 General****1.1 REFERENCES**

- .1 AT - Standard Specifications for Highway Construction (latest edition).

1.2 MEASUREMENT AND PAYMENT PROCEDURES

- .1 The quantity of placed Riprap that will be measured for payment, shall be the number of cubic metres measured in place and accepted in the completed work, and shall include all labour, equipment and material to satisfactorily complete this item as specified.
- .2 Payment for the supply and placement of AT Class 1M Riprap will be made under **“Unit Price Item 4a – Riprap – Class 1M”**. Material to be placed in accordance with the Drawings and to the satisfaction of the Departmental Representative.
- .3 No overhaul will be paid for this Work.
- .4 Excavation, preparation of Riprap base, geotextiles, and any other related materials will be considered incidental to the work.
- .5 Testing of Riprap is considered incidental to the Work and no additional payment will be made.
- .6 Mobilization and demobilization required for this Work shall be incidental to **“Lump Sum Price – Mobilization / Demobilization”**, and no additional payment will be made.
- .7 Traffic Control required for this Work shall be incidental to **“Lump Sum Price – Traffic Accommodation”** and no separate payment will be made to the Contractor.
- .8 Environmental mitigations required in accordance with Section 01 35 43 – Environmental Procedures, for the Work in this Section shall be incidental to the Contract and no separate payment will be made to the Contractor.

1.3 WASTE MANAGEMENT AND DISPOSAL

- .1 Separate and recycle waste materials in accordance with Section 01 35 43, Environmental Procedures.
- .2 Remove materials defined as hazardous or toxic and dispose of outside of the Parks.
- .3 Divert leftover geotextiles to recycling facility as approved by Departmental Representative. Disposal and/or recycling, including hauling, is incidental to the Work.

Part 2 Products**2.1 STONE**

- .1 Hard, dense with relative density not less than 2.65, free from seams, cracks or other structural defects, to meet following size distribution for use intended:
 - .1 Only non-acid generating and non-metal leaching rock is suitable.
 - .2 Stone Riprap will be Contractor supplied. The Contractor will be responsible for sorting of Riprap and delivering to the sites where Riprap is required.

- .3 Riprap for Culverts inlet / outlet, spillways and barrier drains:
 - .1 AT Class 1M Riprap

2.2 GEOTEXTILE FILTER

- .1 Geotextile: in accordance with Section 31 32 19 - Geotextiles.

Part 3 Execution

3.1 INSTALLATION OF RIPRAP

- .1 Contractor shall do the layout for placement of Riprap.
- .2 Where Riprap is to be placed on slopes, excavate trench at toe of slope to dimensions as indicated.
- .3 Place Geotextile, as applicable, in accordance with Section 31 32 19 Geotextiles
- .4 Fine grade area where Riprap is to be placed, to a uniform, even surface. Fill depressions with suitable material and compact to provide firm bed.
- .5 Place Riprap (by machine or by hand) to thickness and details as indicated or as agreed to by the Departmental Representative.
- .6 Place stones in manner accepted by Departmental Representative to secure surface and create a stable mass or to match existing Streambed. On slopes, place larger stones at bottom of slopes.
- .7 Hand placing Riprap:
 - .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.

END OF SECTION

32 11 24 GRANULAR BASE COURSE**Part 1 General****1.1 MEASUREMENT AND PAYMENT PROCEDURES**

- .1 Quantity of AT Granular Base Course shall be measured by **neat line** cubic meter volumes calculated from the Design cross sections for work completed and accepted by Departmental Representative. Payment shall be made under the applicable item of **“Unit Price Item 5 – Granular Base Course”**.
- .2 Supply, loading, hauling, placing, compacting, finishing and conditioning by wetting or drying will be incidental to the Work.
- .3 No overhaul will be paid for this Work.
- .4 Mobilization and demobilization required for this Work shall be incidental to **“Lump Sum Price – Mobilization / Demobilization”**, and no additional payment will be made.
- .5 Traffic Control required for this Work shall be incidental to **“Lump Sum Price – Traffic Accommodation”** and no separate payment will be made to the Contractor.
- .6 Environmental mitigations required in accordance with Section 01 35 43 – Environmental Procedures, for the Work in this Section shall be incidental to the Contract and no separate payment will be made to the Contractor.

1.2 REFERENCES

- .1 American Society for Testing and Materials (ASTM)
 - .1 ASTM C117-95, Standard Test Methods for Material Finer Than 0.075 mm Sieve in Mineral Aggregates by Washing.
 - .2 ASTM C131-96, Standard Test Method for Resistance to Degradation of Small-Size Coarse Aggregate by Abrasion and Impact in the Los Angeles Machine.
 - .3 ASTM C136-96a, Standard Test Method for Sieve Analysis of Fine and Coarse Aggregates.
 - .4 ASTM D698-00a, Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400ft-lbf/ft³) (600kN-m/m³).
 - .5 ASTM D1557-00, Test Method for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000ft-lbf/ft³) (2,700kN-m/m³).
 - .6 ASTM D1883-99, Standard Test Method for CBR (California Bearing Ratio) of Laboratory Compacted Soils.
 - .7 ASTM D4318-00, Standard Test Methods for Liquid Limit, Plastic Limit and Plasticity Index of Soils.
- .2 Canadian General Standards Board (CGSB)
 - .1 CAN/CGSB-8.1-88, Sieves, Testing, Woven Wire, Inch Series.
 - .2 CAN/CGSB-8.2-M88, Sieves, Testing, Woven Wire, Metric.
- .3 AT - Standard Specifications for Highway Construction (latest edition)

1.3 QUALITY CONTROL

- .1 All Quality Control testing by the Contractor in accordance with 01 45 00 – Quality Control.
- .2 Contractor to provide material samples to the Departmental Representative prior to works commencing for Quality Assurance purposes.

1.4 WASTE MANAGEMENT AND DISPOSAL

- .1 Separate and recycle waste materials in accordance with Section 01 35 43 - Environmental Procedures.
- .2 Divert unused granular material outside the National Park or as directed by Departmental Representative.

Part 2 Products**2.1 MATERIALS**

- .1 Materials as per AT - Standard Specifications for Highway Construction (latest edition).
- .2 AT Designation 2 Class 20 Base Course Aggregate to be supplied by the Contractor from outside the Park.
- .3 AT Designation 2 Class 40 Base Course Aggregate to be supplied by the Contractor from outside the Park.

Part 3 Execution**3.1 PLACING**

- .1 Load, haul and place base aggregate after sub-base aggregate surface is inspected and accepted by Departmental Representative.
- .2 Placing
 - .1 Construct base aggregate 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. For each lift, material shall be placed on crown line using a Tonne / metre spreadsheet. Contractor shall have a checker to indicate spread distance when material is being placed.
 - .4 Begin spreading base aggregate on crown line or on high side of one-way slope.
 - .5 Place material using methods that do not lead to segregation or degradation of aggregate.
 - .6 For spreading and shaping material, use spreader boxes having adjustable templates or screeds that will place material in uniform layers of required thickness.
 - .7 Place material to full width in uniform layers not exceeding 150 mm compacted thickness. Departmental Representative may authorize thicker lifts if specified compaction can be achieved.
 - .8 Shape each layer to smooth contour and compact to the specified density before succeeding layer is placed.

- .9 Remove and replace that portion of layer in which material becomes segregated during spreading.

3.2 COMPACTION

- .1 Compaction equipment to be capable of obtaining required material densities.
- .2 Compact to density not less than 100% Standard Proctor density in accordance with ASTM D698.
- .3 Shape and roll alternately to obtain smooth, even and uniformly compacted base.
- .4 Apply water as necessary during compacting to obtain specified density.
- .5 Dry as necessary to obtain specified compaction.
- .6 In areas not accessible to rolling equipment, compact to specified density with mechanical tampers approved by Departmental Representative.
- .7 Correct surface irregularities by loosening and adding or removing material until surface is within specified tolerance.

3.3 PROOF ROLLING

- .1 Granular base course must not rut or deflect when proof rolled with a truck having a 9 tonne single axle dual tire or 17 tonne tandem axle group with dual tires with a tire pressure of 600 kPa. Each compacted course of base course aggregate shall receive one complete coverage by the tires of a truck as specified.
- .2 Proof roll Granular base course. If use of non-standard proof rolling equipment is approved, Departmental Representative to accept level of proof rolling.
- .3 Where proof rolling reveals areas of defective Granular base course, Gravel fill or subgrade:
 - .1 Remove Gravel fill and subgrade material to depth and extent as directed by Departmental Representative.
 - .2 Backfill excavated subgrade with suitable Common material and compact in accordance with Section 31 24 13 – Roadway and Drainage Excavation.
 - .3 Replace Gravel fill and/or Granular base course material and compact in accordance with the Contract Documents.
- .4 All associated Works, including replacing defective material with new materials in accordance with the appropriate Sections is to be done at the Contractor's cost.

3.4 SITE TOLERANCES

- .1 Finished base surface to be within +/- 10 mm of established grade and cross section but not uniformly high or low.
- .2 Finished sub-base surface to be within +/- 15 mm of elevation as indicated but not uniformly high or low.

3.5 PROTECTION

- .1 Maintain finished base in condition conforming to this Section until succeeding material is applied.

END OF SECTION

32 12 14 ASPHALT TACK COAT**Part 1 General****1.1 MEASUREMENT AND PAYMENT PROCEDURES**

- .1 Supply, delivery and application of tack coat will be will not be measured separately and will be considered to be incidental to **“Unit Price Item 6 – Asphalt Concrete Pavement - EPS”**.

1.2 REFERENCES

- .1 American Society for Testing and Materials International, (ASTM)
 - .1 ASTM D140-01, Standard Practice for Sampling Bituminous Materials.
- .2 Canadian General Standards Board (CGSB)
 - .1 CAN/CGSB-16.2-M89, Emulsified Asphalts, Anionic Type, for Road Purposes.
- .3 AT - Standard Specifications for Highway Construction (latest edition)

1.3 SUBMITTALS

- .1 Submit samples in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Submit two 1 L samples of asphalt tack coat material proposed for use in new, clean, airtight, sealed, wide mouth bottles made with plastic to Departmental Representative, at least 2 weeks prior to beginning Work.
- .3 Sample asphalt tack coat material to: ASTM D140.
- .4 Provide access on tank truck for Departmental Representative to sample asphalt material to be incorporated into Work, in accordance with ASTM D140.

1.4 QUALITY CONTROL

- .1 In accordance with 01 45 00 – Quality Control.
- .2 Upon request by Departmental Representative, submit manufacturer's test data and certification that asphalt tack coat material meets requirements of this Section.

1.5 DELIVERY, STORAGE AND HANDLING

- .1 In accordance with 01 61 00 - Common Product Requirements.
- .2 Deliver, store and handle materials in accordance with ASTM D140.
- .3 Provide, maintain and restore asphalt storage area.

1.6 WASTE MANAGEMENT AND DISPOSAL

- .1 Separate waste materials for reuse and recycling in accordance with Section 01 35 43 - Environmental Procedures.
- .2 Divert unused asphalt materials to facility capable of recycling materials.

Part 2 Products**2.1 MATERIALS**

- .1 Anionic emulsified asphalt: to CAN/CGSB-16.2, grade: SS-1.
- .2 Water: clean, potable, free from foreign matter.

2.2 EQUIPMENT

- .1 Pressure distributor to be:
 - .1 Designed, equipped, maintained and operated so that asphalt material can be:
 - .2 Maintained at even temperature.
 - .3 Applied uniformly on variable widths of surface up to 5 m.
 - .4 Applied at readily determined and controlled rates from 0.2 to 5.4 L/m² with uniform pressure, and with an allowable variation from any specified rate not exceeding 0.1 L/m².
 - .5 Distributed in uniform spray without atomization at temperature required.
 - .6 Equipped with meter, registering metres of travel per minute, visibly located to enable truck driver to maintain constant speed required for application at specified rate.
 - .7 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.
 - .8 Equipped with an easily read, accurate and sensitive device that registers temperature of liquid in reservoir.
 - .9 Equipped with accurate volume measuring device or calibrated tank.
 - .10 Equipped with nozzles of same make and dimensions, adjustable for fan width and orientation.
 - .11 Equipped with nozzle spray bar, with operational height adjustment.
 - .12 Cleaned if previously used with incompatible asphalt material.

Part 3 Execution**3.1 APPLICATION**

- .1 Obtain Departmental Representative's approval of surface before applying asphalt tack coat.
- .2 Apply asphalt tack coat only on clean and dry surface.
- .3 Dilute asphalt emulsion with water at 1:1 ratio for application.
 - .1 Mix thoroughly by pumping or other method accepted by Departmental Representative.
- .4 Apply asphalt tack coat evenly to pavement surface at rate as directed by Departmental Representative, of 0.5 L/m² plus or minus 0.2 L/m².
- .5 Paint contact surfaces of curbs, gutters, headers, manholes and like structures with thin, uniform coat of asphalt tack coat material.

- .6 Do not apply asphalt tack coat when air temperature is less than 10 degrees Celsius or when rain is forecast within 2 hours of application.
- .7 Apply asphalt tack coat only on unfrozen surface.
- .8 Evenly distribute localized excessive deposits of tack coat by brooming as directed by Departmental Representative.
- .9 Where traffic is to be maintained, treat no more than one half of width of surface in one application.
- .10 Keep traffic off tacked areas until asphalt tack coat has set.
- .11 Re-tack contaminated or disturbed areas as directed by Departmental Representative.
- .12 Permit asphalt tack coat to set before placing asphalt pavement.

END OF SECTION

32 12 16 ASPHALT CONCRETE PAVEMENT (EPS)**Part 1 General****1.1 REFERENCES**

- .1 AT - Standard Specifications for Highway Construction (latest edition)

1.2 WORK DESCRIPTION

- .1 Work shall consist of supplying, loading, hauling and placing AT Mix Type H1 Asphalt Concrete Pavement (EPS) as shown on the Contract Drawings, or as directed by the Departmental Representative
- .2 For the asphalt mix, asphalt aggregate used shall consist of a 16mm AT Mix Type H1 Asphalt Aggregate in accordance with AT - Standard Specifications for Highway Construction (latest edition).
- .3 Production of AT Designation 1 Class 16 (16mm) asphalt aggregate will be incidental to the Works.
- .2 Asphalt Cement used shall be 150-200A penetration grade in accordance with AT - Standard Specifications for Highway Construction (latest edition)
- .4 Recycled Asphalt Pavement (RAP) will be permitted in the asphalt pavement mix design in accordance with AT Standard Specifications for Highway Construction Section 3.50 (latest edition).
- .5 Perform mix designs for AT Mix Type H1 Asphalt Concrete Pavement using Asphalt Cement 150-200A and 16mm Asphalt Aggregate. Mix design is subject to acceptance by the Departmental Representative.
- .6 Milled Rumble Strips to be installed as detailed herein and as directed by the Departmental Representative.
- .7 The edge of pavement shall have a 4:1 paved let down for the length of the paving limits and shall be constructed in conjunction with the ACP paving, as shown on the IFC Drawings or as directed by the Departmental Representative. Payment for this Work to be incidental to asphalt unit price items.
- .8 Acceptance and/or rejection of all placed Asphalt Concrete Pavement shall be determined in accordance with the EPS. The Contractor shall be fully responsible for the removal and replacement of rejected materials.

1.3 MEASUREMENT AND PAYMENT PROCEDURES AND UNIT PRICE ADJUSTMENTS

- .1 Accepted asphalt concrete pavement that is for the road widening will be measured in tonnes by scale tickets and will be paid under **“Unit Price Item 6ai - Asphalt Concrete Pavement (EPS) – AT Mix Type H1 150-200 A Asphalt Binder – Road Widening”**. Payment shall be compensation in full for supply of asphalt concrete mix including all materials, supply of asphalt cement and aggregate, labour and equipment to complete the Work in accordance with the Contract Documents.
- .2 Accepted asphalt concrete pavement that is for the road inlay shall be in accordance with AT – Standard Specifications for Highway Construction Section 3.50 – Asphalt Pavement Construction (EPS) with the exception of Testing and Evaluation of Finished

Pavement Surface Smoothness Using International Roughness Index (IRI) Criteria which shall be as defined in Alberta Transportation's Special Provision SP_S301, and any current Special Provisions.

- .1 Smoothness testing to be arranged by the Departmental Representative.
- .3 Applicable payment adjustments (additions or subtractions as applicable) shall be applied to top lift only in accordance with AT – Standard Specifications for Highway Construction Section 3.50 – Asphalt Pavement Construction (EPS) and any current Special Provisions.
- .4 Supply, installation, maintenance, calibration of weight scales and a scale house, or alternately electronic calibrated silo scales, at the plant by the Contractor shall be considered incidental to **“Unit Price Item 6 - Asphalt Concrete Pavement (EPS)”** and no additional payment will be made. The Contractor shall provide a scale person, as required, at their cost.
- .5 Preparing asphalt mix designs (including anti-stripping test), in accordance with Section 01 45 00 Quality Control and Section 01 33 00 Submittal Procedures, shall be considered incidental to **“Unit Price Item 6 – Asphalt Concrete Pavement (EPS)”** and no additional payment will be made.
- .6 The Contractor shall prepare and submit a mix design (including anti-stripping test) in accordance with 01 33 00 Submittals and 01 45 00 Quality Control. This work shall be considered incidental to the Work.
- .7 The movement of equipment and crew, shall be considered incidental to the Work for the type of asphalt placed. A move is defined as the Contractor moving equipment and crew to the next section to pave after having completed, in its totality, the previous section.
- .8 Cleaning of existing pavement prior to paving is incidental to the Works and no additional payment will be made.
- .9 No overhaul will be considered for payment under this Contract.
- .10 Supply and delivery of asphalt cement shall be incidental to **“Unit Price Item 6 - Asphalt Concrete Pavement (EPS)”**.
- .11 Anti-stripping agent(s), if required and accepted by the Departmental Representative, shall be incidental to **“Unit Price Item 6 – Asphalt Concrete Pavement (EPS)”** and no additional payment will be made.
- .12 Measurement for the installation of the Milled Rumble Strips shall be measured per group crossing 4 lanes each as per the Contract documents, including layout, and accepted by the Departmental Representative. Payment shall be made under **“Unit Price Item 6b – Asphalt Concrete Pavement (EPS) - Milled Rumble Strips”**
- .13 Use of processed Reclaimed Asphalt Pavement (RAP) material in hot mix asphalt construction is permitted to maximum 10% in accordance with AT Standard Specifications for Highway Construction Section 3.50 (latest edition) and as approved by the Departmental Representative. Any costs associated with this process including labour, equipment or materials shall be considered incidental to **“Unit Price Item 6 – Asphalt Concrete Pavement – EPS”**.
- .14 Payment for shouldering with aggregate shall be measured per linear metre of work accepted and shall consist of blending RAP with Contractor supplied aggregates and placing as directed by the Departmental Representative. Payment to be made under a

provisional sum. Any costs associated with this process including labour, equipment or materials shall be considered incidental to the Work.

- .15 The edge of pavement shall have a 4:1 paved let down for the length of the paving limits and shall be constructed in conjunction with the ACP paving, as shown on the IFC Drawings or as directed by the Departmental Representative. Payment for this Work to be incidental to asphalt unit price items.
- .16 Asphalt Concrete Pavement placing at milled tie-in location is considered incidental to the Work and no additional payment will be made.
- .17 Cleaning of existing pavement shoulder, whether via sweeping or other methods, is considered incidental to the Work and no additional payment will be made.
- .18 Adjustment of existing catch basin grates and manhole lids as accepted by the Departmental Representative shall be incidental to the Work.
- .19 Traffic Control required for this Work shall be incidental to **“Lump Sum Price - Traffic Accommodation”** and no separate payment will be made to the Contractor.
- .20 Mobilization and demobilization required for this Work shall be incidental to **“Lump Sum Price – Mobilization / Demobilization”** and no additional payment will be made.
- .21 Environmental mitigations required in accordance with Section 01 35 43 – Environmental Procedures, for the Work in this Section shall be incidental to the Contract and no separate payment will be made to the Contractor.

Part 2 Products

2.1 MATERIALS

- .1 Penetration grade 150-200A asphalt binder shall be used.
- .2 Asphalt Aggregate:
 - .1 Materials used shall be in accordance with AT Standard Specifications for Highway Construction Section 3.50 (latest edition).
 - .2 AT Designation 1 Class 16 Asphalt Aggregate is to be supplied from outside the Park or produced, in whole or in part, from suitable material excavated from within the roadway cuts and structure excavations.
- .3 Reclaimed Asphalt Pavement (RAP):
 - .1 RAP to be processed by crushing and/or screening into a consistent material with uniform gradation, AC content and other properties prior to being utilized in accordance with the AT Standard Specifications for Highway Construction Section 3.50 (latest edition).
 - .2 Use of processed Reclaimed Asphalt Pavement (RAP) material in hot mix asphalt construction is permitted to maximum 10% in accordance with AT Standard Specifications for Highway Construction Section 3.50 (latest edition) and as approved by the Departmental Representative.
 - .3 Only RAP sourced from Highway 16 shall be considered. Only Classified RAP will be permitted.
 - .4 The Contractor shall fulfill or exceed the requirements of the BC MoTI Standard Specifications for Highway Construction SS 505 Appendix 1 – RAP Management Best Practices for the management of RAP materials from the time

of collection through processing, mix design, and quality control practices during the production of asphalt mixtures containing RAP as confirmed through the Contractor's Quality Control documentation.

- .5 RAP testing is required in accordance with AT Standard Specifications for Highway Construction Section 3.50 (latest edition).
- .6 The Contractor shall process and crush the RAP so as to ensure compliance with all gradation requirements of their approved Job Mix Formula.
- .4 All additives (including anti-stripping agents) to be in accordance with the Approved Products List as published by AT.

Part 3 Execution

3.1 QUALITY CONTROL

- .1 Contractor is responsible for all Quality Control required in accordance AT Standard Specifications for Highway Construction Section 3.50 (latest edition) and Section 01 45 00 – Quality Control.
- .2 Contractor is to provide a full time Road Checker during all times of asphalt placement that shall be responsible for providing a daily Road Checker's Summary in accordance with AT Standard Specifications for Highway Construction Section 3.50 (latest edition).
- .3 The Road Checker's Summary shall be provided to the Departmental Representative no less than 24 hrs after the relevant shift end.
- .4 To assist in the Road Checker's role, the Contractor shall layout and stake stations at the appropriate intervals to achieve the desire accuracy throughout the Work Site. All survey and marking stakes shall be removed prior to completion of the Works.

3.2 METHODOLOGY

- .1 ACP placement:
 - .1 Asphalt concrete mix shall not be placed when the air temperature is below 4°C, or when rain is forecasted.
 - .2 Asphalt concrete mix shall be placed only on clean, dry, and unfrozen surfaces.
 - .3 Unless otherwise shown on the plans, the asphalt concrete mix shall be placed in the following lift thicknesses:
 - .1 in a single lift when the design compacted total thickness is 75 mm or less.
 - .2 in two or more lifts when the design compacted total thickness is greater than 75 mm. The lift thickness selection shall be determined by the Contractor except that:
 - .1 the maximum thickness of any lift shall be 75 mm.
 - .2 the minimum thickness of a final lift shall be 50 mm.
 - .3 On widenings, the thickness of asphalt concrete mix up to 75 mm may be placed in one lift. Over 75 mm thickness, the asphalt concrete shall be placed in two or more lifts.
 - .4 A pickup machine shall be used for all mainline highway lane paving.
- .2 Milled Rumble Strips shall be installed in accordance with AT Standard Specifications for Highway Construction – Section 3.52 – Milled Rumble Strips.

- .1 Contractor to provide layout of rumble strips, including starts and ends, in accordance with the Contract Documents.
- .2 Contractor's Quality Control to be present during all stages of this Work.
- .3 Environmental mitigations required in accordance with Section 01 35 43 – Environmental Procedures, for the Work in this Section shall be incidental to the Contract and no separate payment will be made to the Contractor.

3.3 EQUIPMENT, PLANT AND MIXING REQUIREMENTS

- .1 Execution of the Work shall be in accordance with AT - Standard Specifications for Highway Construction (latest edition).
- .2 The Contractor will not be permitted to setup a Mobile Asphalt Plant or use a Stationary Asphalt Plant for this Project in the National Parks.
- .3 Asphalt plant to be used on this project, regardless of location, shall be a minimum of 200 tonne per hour production plant, equipped with a dry bag system for pollution control, in addition to, or in replacement of standard cyclone dust collectors, to effectively eliminate emissions of dust and smoke pollutants into the atmosphere. Use of secondary dust collection systems, requiring discharge of dust polluted water into settling ponds or drainage system will not be permitted. In addition, Asphalt plant must comply with all environmental pollution control regulations applicable in the asphalt plant area. The plant operator must make daily inspections of the emission control components, to ensure proper working order and provide the most recent stack monitoring results for viewing by the Departmental Representative or their designate.

END OF SECTION

32 16 15 CURB AND GUTTER, SIDEWALK AND MEDIAN INFILLS**Part 1 General****1.1 DESCRIPTION**

- .1 Supply and installation of concrete curb and gutter at various locations as identified in the Contract Documents.

1.2 REFERENCES

- .1 CSA A23.1 & A23.2, Concrete Materials and Methods of Concrete Construction / Test Methods and Standard Practices for Concrete
- .2 AT Standard Specification for Highway Construction (current edition) Section 4.1 Asphalt Curb, Medians, Traffic Islands and Flumes.
- .3 AT Standard Specification for Highway Construction (current edition) Section 4.2 Concrete Curbs, Gutters, Sidewalks, Medians and Traffic Islands.
- .4 AT Standard Specification for Highway Construction (current edition) Section 5.5 Supply of Portland Cement Concrete.

1.3 MEASUREMENT FOR PAYMENT

- .1 Supply and installation of concrete barrier curb and gutter will be measured in linear metres and shall be paid under **“Unit Price Item 9b – Supply and Install Concrete Curb and Gutter”**. Payment shall be compensation in full for all material, equipment and labour required to complete the Works, regardless of the size of concrete curb and gutter.
 - .1 Grade work required for the curb and gutter install, including supply, placing, compacting and finishing of base aggregates shall be considered incidental to the Work and no additional payment will be made. Aggregate type to be as specified in the Contract Documents or as directed by the Departmental Representative.
- .2 Survey, preparing the sites, removal and disposal of existing concrete curb and gutter and/or asphalt pavement outside the National Parks, finishing of concrete, grading the area as necessary and clean up the work sites is considered incidental to the Works and no additional payment will be made.
- .3 Payment for raising and/or lowering manholes and catch basins to match sidewalk or curb and gutter grades will be made under a provisional sum.
- .4 No additional payment will be made for defective work that requires replacement to meet the Contract requirements.
- .5 Traffic Control required during work identified under this Section shall be included under **“Lump Sum Price - Traffic Accommodation”** and no separate payment will be made to the Contractor.
- .6 Mobilization and demobilization required for this Work shall be included under **“Lump Sum Price - Mobilization / Demobilization”** and no separate payment will be made to the Contractor.
- .7 Environmental mitigations required in accordance with Section 01 35 43 – Environmental Procedures, for the Work in this Section shall be incidental to the Contract and no separate payment will be made to the Contractor.

Section 32 16 15

CURB AND GUTTER, SIDEWALK AND MEDIAN INFILLS)

1.4 INSPECTION, TESTING, AND CERTIFICATION

- .1 Testing as specified in CSA A23.1-09 and CSA A23.2-09
- .2 Submit test data in accordance with 01 33 00 Submittal Procedures.
- .3 The following materials must meet the specified requirements:
 - .1 Portland cement
 - .2 Supplementary cementing materials
 - .3 Grout
 - .4 Admixtures
 - .5 Aggregates
 - .6 Water
 - .7 Joint Filler

Part 2 Products**2.1 WASTE MATERIALS**

- .1 Once removed from its existing location, all existing concrete curb and gutter shall become the property of the Contractor who shall dispose of it outside the National Parks in an approved facility.

2.2 MATERIALS

- .1 Portland Cement: to CAN/CSA-A3000
- .2 Supplementary cementing materials: to CAN/CSA-A3000
- .3 Water: to CAN/CSA-A23.1
- .4 Air entraining admixture: to CAN/CSA-A2661
- .5 Chemical admixtures: to CAN/CSA-A266.2.
 - .1 Departmental Representative to approve accelerating or set retarding admixtures during cold and hot weather placing.
- .6 Curing compound
 - .1 To be spray applied, liquid type conforming to ASTM C309 containing a fugitive dye.
 - .2 To be applied in accordance with manufacturer's recommendations.
 - .3 Other curing methods such as sheet material and burlap mats, subject to Departmental Representative's approval.
- .7 Preformed bituminous impregnated fiber board for expansion joints shall conform to ASTM D-1751 with the same shape as the concrete cross sections and having a minimum thickness of 13mm.
- .8 Joint sealant: Sikasil 728 NS or equivalent as accepted by the Departmental Representative.
- .9 Concrete to be Exposure class C-2 with the following modifications:
 - .1 Hand-formed curb and gutter, walks and median infill concrete:

Slump:	80mm
Air entrainment:	5 to 8%

- | | | |
|-----|--|-----------------------|
| | Max aggregate size: | 20 mm |
| | Min cement content: | 335 kg/m ³ |
| | Min 28 day compressive strength: | 32 MPa |
| .2 | Extruded concrete: | |
| | Slump: | 0 - 25mm |
| | Air entrainment: | 6 to 9% |
| | Max aggregate size: | 10 mm |
| | Fineness modulus: | 2.1 to 2.4 |
| | Min cement content: | 335 kg/m ³ |
| | Min 28 day compressive strength: | 32 MPa |
| .10 | Forms to CAN/CSA-A23.1.11 | |
| .1 | Free from surface defects for all concrete faces exposed to view | |

Part 3 Execution

3.1 QUALITY CONTROL

- .1 All Quality Control is to be performed by the Contractor in accordance with Section 01 45 00 Quality Control.

3.2 SUBGRADE PREPARATION

- .1 Excavate or fill to design subgrade as indicated in the Contract Documents or as directed by Departmental Representative.

3.3 GRANULAR SUBBASE AND BASE

- .1 Where required:
- .1 Place subbase and base to design grade as indicated in the Contract Documents and typical sections or as directed by the Departmental Representative.
 - .2 Soft, yielding or unsuitable base material shall be removed and disposed of, as directed by the Departmental Representative.
 - .3 Base material shall be thoroughly compacted to 100% of Standard Proctor Density at optimum moisture to a depth of 150 mm and finished to a smooth, uniform surface, true to established line and grade.
 - .4 Base preparation shall extend sufficiently beyond the edges of the structure to enable forming and construction of the Work.
 - .5 Obtain Departmental Representative's approval of compacted base prior to placing forms or control devices for extruding equipment.

3.4 FORMWORK

- .1 Contractor to be familiar with utilities in the Work area prior to installing formwork pins into the grade.
- .2 Ensure steel forms of approved design and free from twists and warp.
- .3 Ensure wood forms of select dressed lumber, straight and free from defects and thoroughly cleaned.

- .4 Use flexible forms for all curves less than 60m radius.
- .5 After obtaining Departmental Representative's approval of compacted base, set forms to line and grade as shown on Contract Drawings, free from waves or irregularities in line or grade.
- .6 Set special isolation forms as required around catch basins, manholes, poles or other objects as shown on drawings or as directed by the Departmental Representative.
- .7 Forms to be to shape, lines and full dimensions of work being formed. Adequately brace forms to maintain specified tolerances after concrete is placed.
- .8 Treat forms lightly with approved release agent and remove surplus agent.

3.5 INSPECTION

- .1 Immediately prior to placement of concrete, carefully inspect all formwork to ensure forms are properly set at required horizontal and vertical alignment, sufficiently rigid, clean, surface treated and ready for placement of concrete. Obtain Departmental Representative's approval of formwork and compacted base.

3.6 CURB AND GUTTER EQUIPMENT

- .1 Contractor shall place all curb and gutter with a slip form curbing machine (SFCM). The Departmental Representative shall have the authority to waive this requirement for sections where use of a SFCM is impractical or otherwise requested by the Contractor.
- .2 The slip form curbing machine shall be self propelled, automated for line and grade control from a stringline and equipped with an extrusion mould capable of producing the specified curb.

3.7 CONCRETE PLACEMENT

- .1 Obtain Departmental Representative's approval before placing concrete. Provide minimum 24 hours notice prior to placing concrete.
- .2 Prior to placing of concrete obtain Departmental Representative's approval of proposed method for protection of concrete during placing and curing.
- .3 Do not place concrete during rain or on ponded water or frozen base
- .4 Do not place concrete when air temperature appears likely to fall below 5 degrees Celsius within 24 hours, unless specified precautions are taken and approved by Departmental Representative.
- .5 When temperature is below 5 degrees Celsius, maintain all concrete at temperature not less than 10 degrees Celsius for at least 72 hours and protect from freezing for at least another 72 hours or such time as required to ensure proper curing of concrete.
- .6 Schedule concrete placement to ensure sufficient daylight hours available to permit edging and finishing or provide adequate illumination.
- .7 Moisten granular base immediately prior to placing concrete.
- .8 Place concrete within 1.5 hours of batching time.
- .9 Place concrete in forms, ensuring no segregation of aggregate and consolidate with approved mechanical vibrator or power screed.
- .10 Place concrete in continuous operation until entire panel or section completed. Do not place fresh concrete on concrete which has achieved partial set.
- .11 Discontinue placement at expansion, construction or isolation joints only.

3.8 WORKMANSHIP

- .1 Strip forms ensuring no damage to concrete.
- .2 Ensure curing procedures consistent with weather and temperature conditions.
- .3 Maintain accurate records of poured concrete items to indicate date, location of pour, quality, air temperature and test samples taken.
- .4 Do not place load upon new concrete until authorized by Departmental Representative.
- .5 Protect exposed surfaces from weather and vandalism during initial set period
- .6 Where finished product does not conform to specifications and finish quality, remove defective product and replace.

3.9 TOLERANCES

- .1 Maximum horizontal deviation = 6mm
- .2 Maximum vertical deviation = 6mm
- .3 Maximum deflection from horizontal or vertical alignment to be 6mm in 3 m.

3.10 EXPANSION JOINTS

- .1 Form transverse expansion joints at both ends of curb returns and at a maximum spacing of 9m for sidewalks and curb and gutter or as shown in the Contract Drawings.

3.11 CONTROL JOINTS

- .1 In sidewalks, construct control joints at a maximum 3m interval.
- .2 In curb and gutter construct control joints at a maximum 3m interval and match with control joints in abutting sidewalk.
- .3 Use proper tool to make cut while concrete is still green or sawcut after concrete has hardened.
- .4 Cut minimum of 1/3 cross sectional area of concrete section.

3.12 ISOLATION JOINTS

- .1 Form isolation joints around all poles, hydrants, manholes and all structures or fixed objects located within the concrete section by using specified joint filling material.
- .2 Form longitudinal isolation joints between sidewalk and abutting curb and gutter, abutting structures using 13mm approved filling material.

3.13 FINISHING

- .1 Finish surface of concrete sidewalks and median infill to smooth surface with magnesium or wood float and brush or broom to provide uniform non-skid surface.
- .2 Broom or brush crossways or as otherwise required to match adjacent finish or as directed by Departmental Representative.
- .3 Grooves or scoring (dummy joints) used for aesthetic purposes as shown on the drawings or as directed by the Departmental Representative to be marked with proper tools and set 15mm deep.
- .4 Round edges with steel edging tool with a width of 50mm around perimeter of each panel or as shown on drawings

- .5 Ensure surface of hand-formed curb and gutter is smooth magnesium or wood float finish. Ensure extruded curb and gutter is smooth finished and hand floated as required to correct irregularities.
- .6 Under no circumstances is concrete to be overworked by trowelling, dusted with dry cement or finished with mortar coat.

3.14 CLEANUP

- .1 Cleanup of Work area in accordance with 01 74 11 Cleaning.

END OF SECTION

32 17 23 PAVEMENT MARKING**Part 1 General****1.1 REFERENCES**

- .1 CAN/CGSB-1.5-M99 Low Flash Petroleum Spirits Thinner.
- .2 CGSB1-GP-12C-83 Standard Paint Colours.
- .3 CGSB1-GP-71-83 Method, of Testing Paints and Pigments.
- .4 CAN/CGSB 1.74-01 Alkyd Traffic Paint.
- .5 U.S. FED-STD-595B, 1989 – Colours Used in Government Procurement.
- .6 Health Canada / Workplace Hazardous Materials Information System (WHMIS)
 - .1 Material Safety Data Sheets (MSDS).
- .7 AT Design Bulletin #18/2003
- .8 AT Typical Drawings
 - .1 CB6-3.52M1
 - .2 CB6-3.52M3
 - .3 CB6-3.52M4

1.2 DESCRIPTION

- .1 As detailed here and in the Drawings, the Contractor is to supply and install pavement markings in the areas adjacent to and impacted by the Works.
- .2 The Contractor shall complete a survey of the pre-existing pavement markings prior to their disturbance so as to ensure their ability to re-instate them accurately.

1.3 SAMPLES

- .1 Submit samples in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Submit to Departmental Representative following material sample quantities in accordance with 01 33 00 – Submittal Procedures.
 - .1 Two samples of each type of paint.
 - .2 One sample of glass beads.
 - .3 Sampling to CGSB1-GP-71.
- .3 Mark samples with name of project and its location, paint manufacturer's name and address, name of paint, CGSB specification number and formulation number and batch number.

1.4 MEASUREMENT AND PAYMENT PROCEDURES

- .1 Temporary Pavement Marking in accordance with Section 01 35 31 - Special Procedures for Traffic Control shall be considered incidental to the Contract and will not be measured for payment.
- .2 Final line painting shall be measured in linear metres along the centre of the paint line regardless of width or line-gap ratio. Double center lines are to be measured as one line. Payment shall be considered full compensation for all equipment, labour, and materials

- required to complete the Work. Payment will be made under **“Unit Price Item 7a – Pavement Marking - Line Painting”**. Center line painting to be completed following rumble strip installation and no additional payment will be made.
- .3 Payment for final pavement gore and hatching markings as shown on the IFC Drawings or as requested by the Departmental Representative will be made under **“Unit Price Item 7b – Pavement Markings – Chevrons (600mm)”** and shall be measured in square metres of paint work accepted and will include all labour, equipment and material to satisfactorily complete this item of work.
 - .4 Gore area boundary lines shall be measured and paid for under **“Unit Price Item 7a - Pavement Marking – Line Painting”**.
 - .5 Stop bars shall be paid for as though they formed painted gore markings (square metres).
 - .6 Payment for final pavement crosswalk markings as shown on the IFC Drawings or as requested by the Departmental Representative will be made under **“Unit Price Item 7c – Pavement Marking – Crosswalk”** and shall be measured in linear metres of cross walk and shall include all labour, equipment and material to satisfactorily complete this item of work and will be measured per unit regardless of specific type.
 - .7 Removal of existing paint lines shall be incidental to **“Lump Sum Price – Traffic Accommodation”**, in accordance with 01 35 31 – Special Procedures for Traffic Control, and no separate payment will be made to the Contractor.
 - .8 Repair or removal and replacement of incorrect pavement markings as directed by the Departmental Representative shall be completed at the Contractor’s cost.
 - .9 Final design Pavement Marking layout shall be by string line, surveyor or other methods accepted by the Departmental Representative. Pavement Marking layout methods shall be incidental to the Work and no separate payment will be made.
 - .10 Traffic Control required for this Work shall be incidental to **“Lump Sum Price - Traffic Accommodation”** and no separate payment will be made to the Contractor.
 - .11 Mobilization and demobilization required for this Work shall be incidental to **“Lump Sum Price – Mobilization / Demobilization”** and no additional payment will be made.
 - .12 Environmental mitigations required in accordance with Section 01 35 43 – Environmental Procedures, for the Work in this Section shall be incidental to the Contract and no separate payment will be made to the Contractor.

Part 2 Products

2.1 MATERIALS

- .1 Paint:
 - .1 To CGSB 1.74-2001-CAN/CGSB, alkyd traffic paint.
 - .2 Colour: to FED-STD-595B, yellow 33538 and white 37925.
 - .3 Upon request, Departmental Representative will supply a qualified product list of paints applicable to work. Qualified paints may be used but Departmental Representative reserves right to perform further tests.
- .2 Thinner: to CAN/CGSB-1.4-2000.
- .3 Glass beads:

.1 Overlay type: to CGSB1-GP-74M.

2.2 SUPPLY, STORAGE AND HANDLING

- .1 Storage and handling shall meet the requirements of Section 01 35 43 - Environmental Procedures and Section 02 81 01 - Hazardous Materials.
- .2 The Contractor shall make all arrangements for the supply and delivery of paint and glass beads and shall provide the Departmental Representative with records of all materials received and/or returned, on a daily basis.
- .3 The Contractor shall provide, maintain and reclaim all material storage sites.
- .4 No paint formulation shall be diluted or mixed with a different formulation or with any other material, without the specific approval of the Departmental Representative.
- .5 The Contractor shall take all necessary steps to prevent contamination of the materials. Paint shall be protected from freezing.
- .6 The Contractor shall be responsible for the proper clean-up of waste or spilled material, and the proper disposition of containers.

Part 3 Execution

3.1 TEMPORARY MARKINGS

- .1 The Contractor shall supply and place temporary line markings on newly constructed hard surfaces (pavement, sealcoat, etc.) throughout the project, re-establishing centreline and all lane-dividing lines prior to being opened to traffic, and shall maintain such markings until the earlier of the Actual Completion Date or the date Permanent markings have been placed. Temporary line markings are not required for lane edge lines (fog lines) unless otherwise directed.
- .2 Temporary line markings must be placed on an offset from the permanent lane marking and must be removed once permanent markings are in place.
- .3 Centreline of undivided highway shall be marked throughout as “no passing” unless otherwise directed by the Departmental Representative.
- .4 Painted temporary lines are not permitted on the final surface.

3.2 PERMANENT MARKINGS

- .1 Prior to any work affecting pavement markings, the Contractor shall pick-up survey all key control points of existing markings at intersections, turn slots, exit tapers and similar features and, upon completion of the final hard surfacing, re-establish those points unless shown otherwise on the IFC drawings or directed by the Departmental Representative.
- .2 Further to the key control pick-up, the Contractor shall also pick-up survey all Transverse and Chevron and Crosshatch Pavement Markings and upon completion of the final hard surfacing, re-establish those points unless shown otherwise on the IFC drawings or directed by the Departmental Representative.
- .3 All layout markings shall be done with white or yellow centreline paint which will be clearly visible after exposure to all Site Conditions for a minimum period of two (2) months past the Actual Completion Date.

- .4 Key control points shall be marked at their design location within tolerances of $\pm 50\text{mm}$ transversely and $\pm 100\text{mm}$ longitudinally. Longitudinal tolerances for intermediate points, when required, are $\pm 10\text{mm}$.

3.3 APPLICATION

- .1 Pavement markings to be laid out by Contractor after confirming with the Departmental Representative that there are to be no changes.
- .2 Apply paint only when air temperature is above 10°C , wind speed is less than 60 km/h and no rain is forecast within next 4 h.
- .3 Apply traffic paint evenly at rate of 3 L/m^2 .
- .4 Do not thin paint.
- .5 Paint lines to be of uniform colour and density with sharp edges.
- .6 Thoroughly clean distributor tank before refilling with paint of different colour.
- .7 Apply glass beads at rate of 200 g/m^2 of painted area immediately after application of paint.

3.4 TOLERANCE

- .1 All painted lines shall not exceed a dimensional width of 110 mm for specified 100 mm wide line. No tolerance below 100 mm is allowed for the specified 100 mm wide line.
- .2 All painted lines shall not exceed a dimensional width of 210 mm for specified 200 mm wide line. No tolerance below 200 mm is allowed for the specified 200 mm wide line.
- .3 All painted direction dividing, lane dividing or continuity lines shall not exceed a maximum dimensional length deviation of $\pm 100\text{ mm}$ for specified 3 m length of line.
- .4 All spaces between painted direction dividing, lane dividing or continuity lines shall not exceed a maximum dimensional length deviation of $\pm 100\text{ mm}$ for specified 6 m or 3 m length of space.
- .5 All paint shall be applied at the proper locations in accordance with the Drawings or as directed by the Departmental Representative.
- .6 All paint and glass beads shall be uniformly applied.
- .7 All painted lines shall be uniform in thickness and free of tire tracking, with no splatter, excessive overspray or other defects.
- .8 Remove incorrect markings as directed by the Departmental Representative at Contractor's cost.
 - .1 Blackout painting for incorrect lane marking will not be permitted. Incorrect paint work must be eradicated and re-painted by method approved by the Departmental Representative.

3.5 EQUIPMENT REQUIREMENTS

- .1 Paint applicator to be an approved pressure type mobile distributor capable of applying paint in single, double and dashed lines. Applicator to be capable of applying marking components uniformly, at rates specified, and to dimensions as indicated, and to have positive shut-off.
- .2 Distributor to be capable of applying reflective glass beads as an overlay on freshly applied paint.

3.6 CONDITION OF SURFACES

- .1 Pavement surface to be dry, free from ponded water, frost, ice, dust, oil, grease and other foreign materials.

3.7 TRAFFIC CONTROL

- .1 In accordance with Section 01 35 31 and Contractor's accepted Traffic Management Plan.

3.8 APPLICATION

- .1 Pavement markings to be laid out by Contractor.
- .2 Apply paint only when air temperature is above 10°C, wind speed is less than 60 km/h and no rain is forecast within next 4 h.
- .3 Apply traffic paint evenly at rate of 3 L/m².
- .4 Do not thin paint.
- .5 Paint lines to be of uniform colour and density with sharp edges.
- .6 Thoroughly clean distributor tank before refilling with paint of different colour.
- .7 Apply glass beads at rate of 200 g/m² of painted area immediately after application of paint.

3.9 REMOVAL, REPAIR OR REPLACEMENT OF UNACCEPTABLE PAVEMENT MARKINGS

- .1 All painted lines that do not meet the requirements of this specification shall be removed and correctly applied or repaired by the Contractor.
- .2 In cases where the paint is "tracked" by vehicles tires, the lines may be repaired by reapplying paint and glass beads to the damaged areas.
- .3 In cases where incorrectly painted lines need to be removed, the Contractor shall use methods and equipment that will totally eliminate the pattern of the lines without damaging the integrity of the pavement surface. The methods and equipment used for such work shall be reviewed and accepted by the Departmental Representative prior to their use. Obliterating incorrectly painted lines through the sole use of paint, liquid asphalt, slurry seal or other similar materials will not be permitted.

3.10 QUALITY CONTROL

- .1 In accordance with 01 45 00 – Quality Control.
- .2 The Contractor is responsible for quality control inspection throughout every stage of the work to ensure that materials and workmanship comply with the requirements of this specification.
- .3 The Contractor to include in the Quality Control Plan actions to address all the elements that affect the quality of the line painting including, but not limited to:
 - .1 Paint Application Rates.
 - .2 Glass Bead Application Rates.
 - .3 Pavement Surface and Atmospheric Conditions.
 - .4 Line Widths, Line Lengths and Space Lengths.

- .4 The Contractor shall maintain records of QCIP data, complaints from the public, and other details relevant to the Work and shall provide these records to the Departmental Representative daily.

3.11 HIGHWAY OPERATION

- .1 Highway operation shall be in accordance with the Contractor's accepted Traffic Management Plan and shall meet the following requirements:
 - .1 General
 - .1 Painting shall be carried out in accordance with 01 14 00 - Work Restrictions and 01 35 31 - Special Procedures for Traffic Control.
 - .2 Operation of the painting truck against the flow of traffic will not be permitted.
 - .3 Loading glass beads or paint onto the painting truck is not permitted on a roadway surface.
 - .2 Operation of Companion Vehicles
 - .1 When the roadway to be painted is open to public traffic, the Contractor shall operate a crash attenuator vehicle and a pilot vehicle in conjunction with the painting truck during the painting of all longitudinal lines. Companion vehicle operators shall not attempt to control traffic from inside the vehicle.
 - .2 The actual operating parameters of the companion vehicles will be determined by the Contractor to safely accommodate traffic and will be based on site specific conditions such as sight distances, highway geometrics and traffic patterns and volumes. Typical operating parameters are as follows:
 - .1 The crash attenuator vehicle shall be equipped with a crash attenuator that meets National Cooperative Highway Research Program, Report 350 Test Criterion. Test Level 3 for 100 km/hr. The vehicle shall follow behind the painting truck at a distance of 50 to 400 m.
 - .2 The pilot vehicle shall be driven in the same travel lane as the paint machine, following it at a constant distance of approximately two kilometres.
 - .3 The crash attenuator vehicle, pilot truck and the painting truck are to display the same message at all times. The painting truck and the companion vehicles shall be equipped with a two-way radio for communication and overhead revolving beacon with an amber lens of a minimum 180 mm high and 180 mm wide.

3.12 PROTECTION OF COMPLETED WORK

- .1 If applicable, centre line painting to be completed following centre line rumble strip installation. No additional payment will be made for repainting of centre line paint following rumble strip installation.
- .2 If applicable, shoulder line painting to be completed prior to shoulder rumble strip installation.

Project No. PRO1285

Parks Canada Agency

Hwy 16
East Gate – Km 0.8
Jasper East Gate

Jasper National Park

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END OF SECTION

32 17 31 GUIDE POSTS**Part 1 General****1.1 REFERENCES**

- .1 AT - Standard Specifications for Highway Construction (latest edition)
- .2 Canadian General Standards Board (CGSB)
 - .1 CAN/CGSB-1.28-98, Exterior Alkyd House Paint.

1.2 SUBMITTALS

- .1 Samples:
 - .1 Submit samples in accordance with Section 01 33 00 - Submittal Procedures.
 - .2 Notify Departmental Representative at least 4 weeks prior to installation of proposed source of guide posts and provide access for inspection.

1.3 MEASUREMENT AND PAYMENT PROCEDURES

- .1 Measurement and Payment Procedures for supply and installation of plastic Guide Posts will be based on each post installed according to these specifications, and shall include all labour, equipment and material to satisfactorily complete this item of work. Payment will be made under **“Unit Price Item 8 – Supply and Install Guide Posts”**.
- .2 Removal, disposal and/or storage of existing guide posts being replaced will be incidental to the Work.
- .3 Mobilization and demobilization required for this Work shall be incidental to **“Lump Sum Price – Mobilization / Demobilization”**, and no additional payment will be made.
- .4 Traffic Control required for this Work shall be incidental to **“Lump Sum Price – Traffic Accommodation”** and no separate payment will be made to the Contractor.
- .5 Environmental mitigations required in accordance with Section 01 35 43 – Environmental Procedures, for the Work in this Section shall be incidental to the Contract and no separate payment will be made to the Contractor.

1.4 QUALITY CONTROL

- .1 In accordance with 01 45 00 – Quality Control.

1.5 DELIVERY, STORAGE, AND HANDLING

- .1 Storage and Protection:
 - .1 Stockpile guide posts as recommended by the Supplier.
 - .2 If required, stockpile guide posts at location determined by the Departmental Representative.

1.6 WASTE MANAGEMENT AND DISPOSAL

- .1 Separate and recycle waste materials in accordance with Section 01 35 43 - Environmental Procedures.

- .2 Divert unused metal and/or plastic materials to recycling facility approved by Departmental Representative.
- .3 Damaged posts from the removal of existing posts to recycling facility, outside of the National Parks, accepted by the Departmental Representative.

Part 2 Materials

2.1 ROUND PLASTIC POSTS

- .1 The flexible guide posts shall return to upright positions following repeated impacts and passages of vehicles over them. Such collisions shall not cause serious damage to the post or vehicle. Failure to conform to the requirements specified herein shall be cause for rejection.
- .2 General
 - .1 The posts shall be of uniform quality and workmanship and be free from defects.
 - .2 The Contractor shall provide a complete report of the physical properties of the post to the Departmental Representative. This report shall include properties such as low temperature impact resistance, after-impact recoverability and weather resistance.
- .3 Specifications - Dimensions, Colour and Construction
 - .1 The round posts shall have a minimum outer diameter of 90 mm and on overall length of 1.97 metres.
 - .2 The top 250 mm of the post length shall be black and the remainder shall be white.
 - .3 The post shall be straight. Straight is defined as having no point along the length of the post any more than 6 mm removed from a perfectly straight edge placed parallel to any side of the post.
 - .4 Round posts shall be open at the top and bottom.
 - .5 The surface of the post shall be smooth and free from irregularities or defects. The surface of the post shall not be affected by cleaning using scrapers, detergent and water, or solvent.
 - .6 The black portion of the post shall accept and hold securely high-intensity reflectorized sheeting applied to its surface area with heavy-duty stainless steel staples, glue or other adhesives deemed suitable by the manufacturer.
 - .7 If one piece construction is not used, then the connections between the pieces shall be at least as strong as if constructed of a single piece. The strength shall exist at temperatures ranging from -50°C to 50°C.
 - .8 The reflective portion of round posts shall be visible from all directions and shall be of sufficient size so as to be recognizable in the dark as a guide post reflector. The reflective portion of semi-flat posts shall be visible to traffic.
- .4 Weather Resistance and Durability
 - .1 The post shall not be seriously affected by ozone, exhaust fumes, asphalt or road oils, dirt, vegetation, de-icing salts or any other types of air contamination or materials likely to be encountered after installation.

- .2 The post shall withstand without serious damage all elements likely to be encountered after installation including hot (50°C) or cold (-50°C) temperatures, rain, snow, hail, abrasion and physical abuse.
- .5 Strength and Flexibility
 - .1 The posts shall resist, without breaking, tearing, shattering or other serious damage, one highway vehicle impact at a speed of 100 km/h at a test temperature of -33°C.
 - .2 The post shall not bend, warp or distort when installed at temperatures up to 50°C or installed in wind velocities up to 120 km/h.
- .6 High-Intensity Reflectorized Sheeting
 - .1 Each post shall have a 50 mm wide reflective sheeting material fastened between 100 mm and 150 mm from the top of the post. The reflective sheeting shall be green when the guidepost is used to mark the edges of approaches located on curves, and white in all other instances. When green is required, white sheeting shall be screen printed green using a process recommended by the sheeting manufacturer.
 - .2 The reflective sheeting material shall be high-intensity encapsulated glass bead reflective sheeting meeting or exceeding the minimum requirements as specified in ASTM-D4956, performance requirement Type III and Class I pressure sensitive adhesive backing requirements.

Part 3 Execution

3.1 INSTALLATION

- .1 Install posts to details as straight and plumbed vertically to a uniform depth of 0.6 m below finished grade.
- .2 Excavate post holes to minimum diameter of 150 mm and compact bottom of hole to provide firm foundation. Set post plumb and backfill with competent material in 150 mm layers. Compact each layer before placing succeeding layer.

3.2 CLEANING

- .1 Upon completion of installation, remove surplus materials, rubbish, tools and equipment barriers in accordance with 01 74 11 – Cleaning.

END OF SECTION

32 91 19 TOPSOIL PLACEMENT AND GRADING**Part 1 General****1.1 DESCRIPTION**

- .1 Topsoil to be native organic soils stripped and screened from the Contract Work area and stockpiled at the locations directed by the Departmental Representative.

1.2 MEASUREMENT AND PAYMENT PROCEDURES

- .1 Topsoil placement and finishing will be measured by the cubic metre as measure in original position (from stockpiles) acceptably installed within the areas indicated on the IFC Drawings or as approved by the Departmental Representative. Payment for topsoil placement shall be full compensation for all labour, equipment, materials and incidentals required to screen stripping material, prepare the finished grade, load, haul from stockpiles, place, fine grade, and prepare the topsoil materials for planting in accordance with the requirements of the Contract Documents and direction of the Departmental Representative. Payment will be made under **“Unit Price Item 10 – Topsoil Placement and Grading”**.
- .2 Stockpiles will be measured by Departmental Representative and volume of topsoil removed calculated by surface to surface prismatic method.
- .3 Payment for stripping will be made in accordance with Section 31 24 13 - Roadway and Drainage Excavation.
- .4 Offsite removal of the waste generated from screening the stripping, will be incidental to the Works and no further payment will be made.
- .5 Payment for hauling screened topsoil from an offsite stockpile will be considered incidental to **“Unit Price Item 10 – Topsoil Placement and Grading”**.
- .6 No overhaul will be paid for this Work.
- .7 Environmental mitigations required in accordance with Section 01 35 43 – Environmental Procedures, for the Work in this Section shall be incidental to the Contract and no separate payment will be made to the Contractor.
- .8 Testing of topsoil to be considered incidental to the Works with no payment to be made.
- .9 Payment for supply and application of soil amendments will be paid under a provisional sum.
- .10 Traffic Control shall be incidental to **“Lump Sum Price – Traffic Accommodation”** and no additional payment will be made.
- .11 Mobilization and demobilization required for this Work shall be incidental to **“Lump Sum Price - Mobilization/ Demobilization”** and no additional payment will be made.

1.3 REFERENCES

- .1 Agriculture and Agri-Food Canada
 - .1 The Canadian System of Soil Classification, Third Edition, 1998.
- .2 Canadian Council of Ministers of the Environment
 - .1 PN1340-[2005], Guidelines for Compost Quality.

- .3 Canadian Green Building Council (CaGBC)
 - .1 LEED Canada-NC Version 1.0-[December 2004], LEED (Leadership in Energy and Environmental Design): Green Building Rating System For New Construction and Major Renovations.
- .4 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.
- .5 AT Standard Specifications for Highway Construction (latest edition)

1.4 DEFINITIONS

- .1 Compost:
 - .1 Mixture of soil and decomposing organic matter used as fertilizer, mulch, or soil conditioner.
 - .2 Composed bio-solids to: CCME Guidelines for Compost Quality, Category (A) (B).

1.5 SUBMITTALS

- .1 Provide submittals in accordance with Section 01 33 00 - Submittal Procedures.
- .2 LEED Submittals:
 - .1 Submit erosion and sedimentation control plan for Credit SSp1 in accordance with LEED Canada-NC.
- .3 Quality control submittals:
 - .1 Soil testing: submit certified test reports showing compliance with specified performance characteristics and physical properties as described in PART 2 - SOURCE QUALITY CONTROL.

1.6 QUALITY CONTROL

- .1 In accordance with 01 45 00 – Quality Control.

1.7 WASTE MANAGEMENT AND DISPOSAL

- .1 Separate waste materials for recycling in accordance with Section 01 35 43 Environmental Procedures.
- .2 Divert unused soil amendments from landfill to official hazardous material collections site, outside of the Parks, as approved by Departmental Representative.
- .3 Do not dispose of unused soil amendments into sewer systems, into lakes, streams, onto ground or in locations where it will pose health or environmental hazard.

1.8 INDIGENOUS CONTRACTORS

- .1 It is required that at least one of the following indigenous Contractors be engaged for the topsoil placement and grading work outlined in this section;
 - .1 Bear Hills Industry
Matt Barich
Email: matt@bearhillsindltd.com
Phone: 403-304-6828

- .2 Mur-Cal Services Ltd.
Murray Callihoo
Email: info@mur-cal.ca
Phone: 780-539-0928
- .3 ENOCH Construction Ltd
Summer Ebinger
Email: ecl@enochnation.ca
Phone: 780-470-5079
- .4 Aseniwuche Development Corporation
Jeanette Harnish
Email: jharnish@adcalberta.com
Phone: 780-827-9670

Part 2 Products

2.1 TOPSOIL

- .1 Topsoil for seeded areas and planting beds: mixture of particulates, microorganisms and organic matter that provides suitable medium for supporting intended plant growth.
 - .1 Native topsoil to be stripped from on-site sources.
 - .2 Contain no toxic elements or growth inhibiting materials.
 - .3 Finished surface free from:
 - .1 Debris and stones over 100 mm diameter.
 - .2 Course vegetative material, 10 mm diameter and 100 mm length, occupying more than 2% of soil volume.

2.2 SOURCE QUALITY CONTROL

- .1 Advise Departmental Representative of sources of topsoil and manufactured topsoil to be utilized with sufficient lead time for testing.
- .2 Contractor is responsible for amendments to supply topsoil as specified.
- .3 Soil testing by recognized testing facility for PH, P and K, and organic matter.
- .4 Testing of topsoil will be carried out by testing laboratory designated by Departmental Representative.
 - .1 Soil sampling, testing and analysis to be in accordance with Provincial standards.

Part 3 Execution

3.1 TEMPORARY EROSION AND SEDIMENTATION CONTROL

- .1 In accordance Section 01 35 43 – Environmental Procedures
- .2 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 sediment and erosion control drawings,

sediment and erosion control plan, specific to site, that complies with EPA 832/R-92-005 or requirements of authorities having jurisdiction, whichever is more stringent.

- .3 Inspect, repair, and maintain erosion and sedimentation control measures during construction until permanent vegetation has been established.
- .4 Remove erosion and sedimentation controls and restore and stabilize areas disturbed during removal.

3.2 PREPARATION OF EXISTING GRADE

- .1 Verify that grades are correct.
 - .1 If discrepancies occur, notify Departmental Representative and do not commence work until instructed by Departmental Representative.
- .2 Grade soil, eliminating uneven areas and low spots, ensuring positive drainage.
- .3 Remove debris, roots, branches, stones in excess of 50 mm diameter and other deleterious materials.
 - .1 Remove soil contaminated with calcium chloride, toxic materials and petroleum products.
 - .2 Remove debris that protrudes more than 75mm above surface.
 - .3 Dispose of removed material off site.
- .4 Cultivate entire area that is to receive topsoil to minimum depth of 100 mm.
 - .1 Cross cultivate those areas where equipment used for hauling and spreading has compacted soil.

3.3 SCREENING OF STRIPPING MATERIAL

- .1 Contractor to screen stripping material to 50 mm max size prior to placement in stockpile. Load, haul and place screen waste material in the designated area, as directed by the Departmental Representative.
- .2 Material deemed as waste from the screening process shall be removed from the Park in accordance with Section 31 24 13 – Roadway and Drainage Excavation.

3.4 PLACING AND SPREADING OF TOPSOIL / PLANTING SOIL

- .1 Place topsoil after Departmental Representative has accepted subgrade.
- .2 Spread topsoil in uniform layers not exceeding 100 mm.
- .3 Spread topsoil as indicated to following minimum depths after settlement.
 - .1 100 mm for seeded areas.
 - .2 600 mm for shrub beds.
- .4 Manually spread topsoil/planting soil around trees, shrubs and obstacles.

3.5 FINISH GRADING

- .1 Grade to eliminate rough spots and low areas and ensure positive drainage.
- .2 Prepare loose friable bed by means of cultivation and subsequent raking.
- .3 Consolidate topsoil to required bulk density using equipment approved by Departmental Representative.
- .4 Leave surfaces smooth, uniform and firm against deep footprinting.

3.6 ACCEPTANCE

- .1 Departmental Representative will inspect and test topsoil in place and determine acceptance of material, depth of topsoil and finish grading.

3.7 SURPLUS MATERIAL

- .1 Dispose of materials, except topsoil not required, where directed by Departmental Representative off site.

END OF SECTION

32 92 22 HYDRAULIC SEEDING**Part 1 General****1.1 DESCRIPTION OF WORK**

- .1 The work covered by this specification shall consist of: hydraulically seeding in areas within the limits of construction, or as designated by the Departmental Representative.
- .2 No mechanical seeding will be allowed for this project.

1.2 MEASUREMENT AND PAYMENT PROCEDURES

- .1 Hydraulic Seeding will be measured by the hectare acceptably installed resulting in full grass growth, 75% germination and growth of specified seed mixture, within the dimensions indicated on the Drawings or as approved by the Departmental Representative. Payment for hydraulic seeding shall be full compensation for all labour, equipment, materials and incidentals required to place the materials in accordance with the requirements of the Specifications, IFC Drawings and direction of the Departmental Representative. Payment shall be paid under **“Unit Price Item 11 – Hydraulic Seeding”**
- .2 Areas of blending into existing landscape will not be measured for payment.
- .3 Maintenance is incidental and will not be paid for separately.
- .4 Mobilization and demobilization required for this Work shall be incidental to **“Lump Sum Price – Mobilization / Demobilization”**, and no additional payment will be made.
- .5 Traffic Control required for this Work shall be incidental to **“Lump Sum Price – Traffic Accommodation”** and no separate payment will be made to the Contractor.
- .6 Environmental mitigations required in accordance with Section 01 35 43 – Environmental Procedures, for the Work in this Section shall be incidental to the Contract and no separate payment will be made to the Contractor.

1.3 SUBMITTALS

- .1 In accordance with 01 33 00 – Submittal Procedures.
- .2 Product Data
 - .1 Provide product data for:
 - .1 Seed
 - .2 Mulch
 - .3 Tackifier/Soil Stabilizer
 - .2 Submit in writing to Departmental Representative prior to commencing work:
 - .1 Volume capacity of hydraulic seeder in litres.
 - .2 Amount of material to be used per tank based on volume.
 - .3 Number of tank loads required per hectare to apply specified slurry mixture per hectare.

1.4 QUALITY CONTROL

- .1 In accordance with 01 45 00 – Quality Control.
- .2 Test Reports: certified test reports showing compliance with specified performance characteristics and physical properties to be provided to the Departmental Representative.

1.5 MATERIAL DELIVERY, HANDLING AND STORAGE

- .1 Use all means necessary to protect all materials before, during and after installation. Provide adequate protection to materials that may deteriorate if exposed to weather.
- .2 Seed to be stored in dry weatherproof place and shall be protected from damage by heat, rodents and other causes. Deliver and store grass seed in original packages with label indicating:
 - .1 Analysis of seed mixture;
 - .2 Percentage of pure seed by weight;
 - .3 Year of production;
 - .4 Net mass, and
 - .5 Date tagged and location.

1.6 INDIGENOUS CONTRACTORS

- .1 It is required that at least one of the following indigenous Contractors be engaged for the hydraulic seeding work outlined in this section;
 - .1 Bear Hills Industry
Matt Barich
Email: matt@bearhillsindltd.com
Phone: 403-304-6828
 - .2 Mur-Cal Services Ltd.
Murray Callihoo
Email: info@mur-cal.ca
Phone: 780-539-0928
 - .3 ENOCH Construction Ltd
Summer Ebinger
Email: ecl@enochnation.ca
Phone: 780-470-5079
 - .4 Aseniwuche Development Corporation
Jeanette Harnish
Email: jharnish@adcalberta.com
Phone: 780-827-9670

Part 2 Products**2.1 SEED**

- .1 Seed shall be Certified Canada No. 1 Grade quality seed varieties, in accordance with the Canadian Seeds Act and Regulations, and having a minimum purity of 97% and germination of 75%. Seed shall be free of impurities and disease.
- .2 Seed mix for all applications to be the following, by weight:
 - 50% Sand Grass Calamovilfa Longifolia
 - 30% Awned/Slender Wheatgrass Elymus Trachycaulus
 - 10% June Grass Koeleria Macrantha
 - 10% Tufted Hairgrass Deschampsia Caespitosa
- .3 Seeding rate to be 100 kg/ha for hydraulic seeding.
- .4 **Seed certificate to be approved by the PCA ESO prior to ordering.**
- .5 Seed mix shall be free of Scentless Chamomile, Downy Brome and Canada Thistle.

2.2 WATER

- .1 In accordance Section 01 35 43 – Environmental Procedures

2.3 SOIL STABILIZER/TACKIFIER

- .1 Soil stabilizer/tackifier shall be a nontoxic, colourless copolymer emulsion with no less than 52.6% solids. Acceptable product is: Soil Master WR or approved alternate.

2.4 MULCH

- .1 Wood fibre mulch shall be manufactured from virgin wood fibres and contain not less than 3% of an organic tackifier by volume. Cellulose type products are not acceptable. Acceptable product is: Eco Fibre Plus or approved alternate.

Part 3 Execution**3.1 GENERAL**

- .1 Contractor shall advise Departmental Representative prior to the start of seeding operations.
- .2 Contractor shall mechanically remove any weeds prior to seeding. Weed removal method to be approved by Departmental Representative prior to commencement. This will be incidental to the work.
- .3 Contractor shall ensure that equipment is steam cleaned, free of soil and seed from previous project to prevent site contamination.
- .4 Seeding shall be done upon completion of stripped soil material/chip compost placement.
- .5 Contractor shall not perform work under adverse field conditions such as frozen soil, excessively wet or dry soil, or soil covered with snow, ice or standing water.
- .6 Contractor shall hydraulic seed only during dry weather conditions with no rain forecasted for the next 24 hours and ensuring a seasonably dry seedbed to provide for

proper curing of soil stabilizers/tackifier. Contractor shall check weather conditions to ensure soil stabilizer has sufficient time to cure prior to heavy rainfall.

- .7 Seeding shall be done to ensure a catch satisfactory to the Departmental Representative's approval. In areas where seed fails to germinate for whatever reason, the Contractor shall re-cultivate and reseed until acceptable germination takes place.
- .8 Contractor shall carry out seeding in locations as shown on Drawings or, as directed by Departmental Representative.

3.2 HYDRAULIC SEEDING

- .1 The following application rates are the minimum required for hydraulic seeding:
 - .1 Seed: 100 kg/hectare
 - .2 Mulch: 1500 kg/hectare
 - .3 Tackifier: As per Manufacturer's Instructions
 - .4 Water: 30,000 L/hectare
- .2 The Contractor shall measure quantities of materials by weight, or weight calibrated Contractor to calculate and submit applicable area of coverage per tank load of slurry in accordance with Section 01 33 00 – Submittal Procedures
- .3 Contractor shall physically stake and identify limits of tank coverage prior to seeding to the satisfaction of Departmental Representative.
- .4 Each tank load of slurry shall be fully applied within the designated boundaries for each load as staked volume measurement, to the satisfaction of the Departmental Representative.
- .5 The Contractor shall fill the tank half full with required water and add mulch while continuing to fill with water. Seed mix and fertilizer is to be added. All material is to be added into the hydraulic seeder under agitation. The Contractor shall pulverize mulch with tackifier and charge slowly into seeder.
- .6 The Contractor shall charge soil stabilizer/tackifier into seeder after all other material is well mixed in seeder. Contractor shall mix slowly to avoid foaming but thoroughly to complete slurry.
- .7 The Contractor shall use hydraulic seeding equipment with a minimum slurry tank capacity of 4500 litres.
- .8 The Contractor's equipment shall have an agitation system for slurry capable of operating during charging of tank and during seeding, consisting of recirculation of slurry and mechanical method:
 - .1 Pumps shall be capable of maintaining a continuous non-fluctuating flow of solution.
 - .2 Equipment shall be capable of seeding up to 150m distance from hydraulic seeder using hand operated hoses and appropriate nozzles.
- .9 The Contractor shall apply slurry when wind velocities will not affect the application and cause the mixture to be blown.
- .10 The Contractor shall apply slurry uniformly, at optimum angle of application for adherence to surfaces and germination of seed. Ensure good contact of slurry with soil with minimal air pockets.
- .11 The Contractor shall use the correct nozzle(s) for application and use hoses to access difficult to reach surfaces and to control application.

- .12 The Contractor shall ensure that the application is uniform and the surface is evenly covered. Contractor shall blend into retained landscape for approximately 1 metre.
- .13 The Contractor shall clean all structures, appurtenances and natural features not designated to be seeded of any overspray, to the satisfaction of the Departmental Representative.
- .14 The Contractor shall ensure that at all times during the seeding, that no vehicles are parked within the path of public travel and the Contractor shall provide warning devices as directed by the Departmental Representative to ensure safe operations.
- .15 Traffic Control to be in accordance with Section 01 35 31 – Special Procedures for Traffic Control.

3.3 MAINTENANCE DURING ESTABLISHMENT PERIOD

- .1 Establishment period is a minimum of four months of continuous growing season. Growing season shall not be divided by winter.
- .2 The Contractor shall repair and reseed dead or bare spots, as directed in these specifications to Departmental Representative's satisfaction, to allow establishment of seed prior to acceptance. In the case of erosion, the Contractor shall be compensated at the specified unit rates for reseeding.
- .3 For areas of poor seed germination and growth, as determined by the Departmental Representative, the soil shall be scarified or re-cultivated as directed by the Departmental Representative, and seeding and fertilizing undertaken as specified. This work is incidental to the Contract.

3.4 CONSTRUCTION COMPLETION ACCEPTANCE

- .1 Seeded areas will be accepted by the Departmental Representative provided that all areas are uniformly established and turf is not eroded or rutted and relatively free of weeds. Seeded areas to be growing for a minimum of four continuous months prior to construction completion acceptance inspection.
- .2 Areas seeded in fall will be accepted in following spring, a minimum of four months after start of growing season, provided acceptance conditions are fulfilled.
- .3 Minimum 75% growth by area of coverage of specified seed mixture must be present in order to be acceptable.

3.5 MAINTENANCE DURING WARRANTY PERIOD

- .1 Maintenance shall occur for one full year from Construction Completion Acceptance. The estimated period of maintenance within one calendar year shall be from approximately April 1 to October 31. The Contractor will be required to employ all of the necessary measures to establish and maintain all seeding in an acceptable, vigorous and healthy growing condition.
- .2 The Contractor shall repair and reseed dead or bare spots, as directed in these specifications to Departmental Representative's satisfaction, to allow establishment of seed prior to acceptance. In the case of erosion, the Contractor shall be compensated at the specified unit rates for reseeding.
- .3 For areas of poor seed germination, or as determined by the Departmental Representative, the soil shall be scarified or re-cultivated as directed by the

Departmental Representative, and seeding and fertilizing undertaken as specified. This work is incidental to the Contract.

- .4 For small areas of poor seed germination or as determined by the Departmental Representative, the soil shall be scarified to a depth of 25 mm and seeding and fertilizing shall be undertaken as specified. This work is incidental to the Contract.
- .5 Weed control shall be undertaken as determined by the Departmental Representative. Hand pulling of weeds may be required. This work is incidental to the Contract.

3.6 CLEANING

- .1 Upon completion of installation, remove surplus materials, rubbish, tools and equipment barriers in accordance with Section 01 74 11 – Cleaning.

END OF SECTION

33 42 13 PIPE CULVERTS**Part 1 General****1.1 REFERENCES**

- .1 AT - Standard Specifications for Highway Construction Manual (latest edition)
- .2 CSA-G401-01 Corrugated Steel Pipe Products.
- .3 CSA-B182.8 Profile Polyethylene Storm Sewer and Drainage Pipe and Fittings.

1.2 MEASUREMENT

- .1 Supply and Installation of CSP Culvert Extensions
 - .1 The quantity of CSP culverts that will be measured for payment shall be the number of linear metres of the types and sizes supplied, assembled, installed and accepted by the Departmental Representative, and shall be inclusive of all costs of labour, materials, equipment to satisfactorily complete the work. Payment will be made under **“Unit Price Item 12 – Supply and Install 800mm CSP Culvert Extensions”**.
 - .2 The survey and layout of the CSP Culverts as per requirements identified in the Contract Documents, will not be measured directly for payment but shall be considered incidental to **“Unit Price Item 12 – Supply and Install 800mm CSP Culvert Extensions”**.
 - .3 At locations of extensions to existing culverts, thoroughly cleaning and flushing the existing culvert ends and barrel, excavating up to 2m from present exposed end or as directed by the Departmental Representative, cutting off damaged sections of exposed end and painting remaining end with a high zinc dust oxide paint and supplying and placing a joint sealant shall be considered incidental to **“Unit Price Item 12 – Supply and Install 800mm CSP Culvert Extensions”**. Includes all equipment, labour and materials required to complete the Work.
 - .4 The supply of bolt-type corrugated couplers and ancillary materials will not be measured directly for payment but shall be considered incidental to **“Unit Price Item 12 – Supply and Install 800mm CSP Culvert Extensions”**.
- .2 All work required as part of the installation of CSP Culverts and extensions, including excavation, sawcutting, milling, haul and disposal of unsuitable material shall be considered incidental to the work and no additional payment to be made.
- .3 Payment for backfill Works, including but not limited to; supply, placement and compaction of all backfill materials will be incidental to the Work and no additional payment will be made.
- .4 Asphalt concrete pavement will be paid under **“Unit Price Item 6 - Asphalt Concrete Pavement – EPS”** in accordance with Section 32 12 16 Asphalt Concrete Pavement.
- .5 Placing Riprap, if required, will be paid under **“Unit Price Item 4 – Supply and Install Riprap – Class 1M”** in accordance with Section 31 37 00 – Riprap.
- .6 Mobilization and demobilization required for this Work shall be incidental to **“Lump Sum Price – Mobilization / Demobilization”**, and no additional payment will be made.

- .7 Traffic Control during the survey, layout and Construction of the culverts shall be incidental to **“Lump Sum Price – Traffic Accommodation”** and no separate payment will be made to the Contractor.
- .8 All Work required as part of the installation of CSP Culverts and extensions, including excavation, sawcutting, asphalt removal, hauling and disposal of unsuitable material shall be considered incidental to the Work and no additional payment to be made.
- .9 Payment for backfill Works, including but not limited to; supply, placement and compaction of all backfill materials, will be incidental to the Work and no additional payment will be made.
- .10 Excavation for the types of materials encountered will be paid under the applicable Unit Price Item.
- .11 Dewatering as required to complete the Work shall be considered incidental to the Work.
- .12 Environmental mitigations required in accordance with Section 01 35 43 – Environmental Procedures, for the Work in this Section shall be incidental to the Contract and no separate payment will be made to the Contractor.
- .13 No separate measurement will be made for couplings, fittings or end sections for CSP.
- .14 Payment for plugging of existing culverts will be made under a provisional sum in metres of invert length for each size, type and class of pipe.
- .15 Culvert installation must be coordinated with embankment construction. No payment will be made for re-excavation of embankment material required to install culverts.

1.3 SUBMITTALS

- .1 In accordance with 01 33 00 – Submittal Procedures.
- .2 Submit manufacturer's test data and certification.
- .3 Provisions for staged construction shall be shown in the shop drawings, including any temporary support required.
- .4 Certification to be marked on pipe.

1.4 STORAGE AND HANDLING

- .1 In accordance with 01 61 00 Common Product Requirements.
- .2 Handle and store pipe products in a manner to avoid damage, alteration, deterioration and soiling.
- .3 Store pipes on a clean and flat surface at the location designated by the Departmental Representative.
- .4 Where the material supplied is damaged, the Contractor shall immediately separate nested sections of the plate or pipe to facilitate more detailed inspection. Culvert material designated by the Departmental Representative as unacceptable, due to damage or failure to meet specified requirements, shall be immediately repaired or replaced by the Contractor.
- .5 No separate measurement will be made for couplings, fittings or end sections for CSP, SPSCP or HDPE.

1.5 WASTE MANAGEMENT AND DISPOSAL

- .1 Separate waste materials for reuse and recycling in accordance with Section 01 35 43 - Environmental Procedures.
- .2 Remove from site and dispose of packaging materials at appropriate recycling facilities, outside of the National Parks.
- .3 Divert unused metal materials from landfill to metal recycling facility as approved by Departmental Representative, outside of the National Parks.
- .4 Fold up metal banding, flatten and recycle at appropriate facilities, outside of the National Parks.

Part 2 Products**2.1 CORRUGATED STEEL PIPE**

- .1 Corrugated steel pipe: to CSA-G401.
- .2 Culverts to be annular or spiral with annular ends. Coupling bands to be two piece annular bolted with minimum width of nine corrugations.
- .3 Minimum wall thickness to be 2.0 mm.
 - .1 Or greater in accordance with manufactures recommendations in the specific installed conditions.
- .4 Corrugations to be 68 mm x 13 mm.
- .5 For all exposed culvert ends, 4:1 mitred end sections will be required.
- .6 Design Code CHBDC S6-06.
- .7 Design Live Load CL-800.

2.2 CORRUGATED HDPE PIPE

- .1 Pipe to be Armtec BOSS 2000 or approved equal.
- .2 Pipe stiffness in accordance with AT Standard Specifications for highway Construction (latest edition) Section 5.
- .3 Pipe joint shall be bell and spigot in accordance with AT Standard Specifications for highway Construction (latest edition) Section 5.

2.3 GRANULAR BEDDING AND BACKFILL

- .1 AT Designation 2 Class 20 Base Course Aggregate for pipe bedding to be supplied by the Contractor from outside the Park or produced from suitable material excavated from within the design cuts and structure excavations.
- .2 AT Designation 2 Class 40 Base Course Aggregate for backfill to be supplied by the Contractor from outside the Park or produced from suitable material excavated from within the design cuts and structure excavations.

2.4 RIPRAP

- .1 Riprap shall be installed in accordance with Section 31 37 00 – Riprap.

Part 3 Execution**3.1 METHODOLOGY**

- .1 Contractor to verify all culverts in field including size, length, and condition at their first opportunity and prior to ordering.
- .2 Traffic control and staging to be in accordance with Section 01 35 31 Special Procedures for Traffic Control.
- .3 Pipe culvert works cannot commence until accepted by the Departmental Representative.
- .4 Existing culverts within the construction limits, that remain in service must be thoroughly cleaned and flushed; all sediments and bedload must be removed to the satisfaction of the Departmental Representative.

3.2 CUT ENDS

- .1 All exposed ends of CSP culverts to have sloped end sections conforming to roadside slope, by cutting culvert with mechanical saw.
- .2 All cut edges shall be made smooth by grinding so that all the burrs are removed. Any damaged galvanizing shall be restored by zinc metallizing in accordance with CSA G401.
- .3 Where an existing culvert is extended, up to 2 m of the existing culvert end shall be removed as directed by the Departmental Representative.
- .4 Cutting of culvert ends to the satisfaction of the Departmental Representative is considered incidental to the Work and no additional payment will be made.

3.3 BEDDING

- .1 Dewater excavation, as necessary, to allow placement of culvert bedding in dry condition.
- .2 Place minimum thickness of 300 mm of approved granular material on bottom of excavation and compact to minimum 98% Standard Proctor density to ASTM D698.
- .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 Departmental Representative, free from sags or high points.
- .4 Place bedding in unfrozen condition.

3.4 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 Do not allow water to flow through pipes during construction except as permitted by Departmental Representative.

3.5 JOINTS: CORRUGATED STEEL CULVERTS

- .1 Match corrugations of coupler with pipe sections before tightening.
- .2 Insert and tighten bolts.

- .3 Tap couplers firmly with a rubber mallet or similar non-marring tool as they are being tightened, to take up slack and ensure snug fit.
- .4 Repair spots where damage has occurred to coating in the field by applying two coats of zinc rich paint approved by the CSP supplier. Allow each coat to dry before placing second coat, bedding or backfill.

3.6 BACKFILLING

- .1 Backfill around and over culverts as indicated on the drawings or as directed by Departmental Representative.
- .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 98% Standard Proctor density to ASTM D698 taking special care to obtain required density under haunches. Hand tamp where necessary to obtain compaction.
- .4 Protect installed culvert with minimum 900 mm cover of compacted fill before heavy equipment is permitted to cross. During construction, width of fill, at its top, to be at least twice diameter or span of pipe and with slopes not steeper than 2H:1V.
- .5 Place backfill in unfrozen condition.
- .6 Place Riprap in accordance with 01 37 00 – Riprap.

3.7 TRENCHING EXISTING PAVEMENT STRUCTURES

- .1 Where trenches are cut into existing pavement structures, backfill will match the existing materials and thickness.

3.8 CLEANING OF CULVERTS

- .1 Remove and dispose of material from the culvert barrels and/or ends to restore proper drainage, as directed by the Departmental Representative.
- .2 Removed material to be disposed of outside of the Parks. Disposal, including hauling, is considered incidental to the Work.

3.9 CULVERT EXTENSIONS

- .1 Extensions to existing culverts shall be as noted on drawings. Payment for installation shall include all hardware and necessary features to attach new sections. Backfill and bedding shall be as per Contract Documents and paid as per the appropriate unit price item.

3.10 CULVERT / STRUCTURE REMOVAL

- .1 Culvert removal shall be as indicated on IFC Drawings and shall include disposal of sections to a suitable disposal facility outside of the National Parks. Disposal, including hauling, is incidental to the Works.
- .2 Bedding and backfill for culvert removal shall be incidental to the unit price items.

END OF SECTION

33 71 13 PRECAST CONCRETE BARRIER**Part 1 General****1.1 DESCRIPTION**

- .1 Supply and installation of precast concrete barriers in accordance to this section. Precast Concrete barrier supplied shall be as per British Columbia Standard Specifications for Highway Construction (latest edition), Section 941 – Precast Reinforced Concrete Barriers. In addition, all end faces to **have 25 mm chamfered edges**.
- .2 Barrier drain pipes shall be supplied and installed in accordance with the drawings at locations specified by the Departmental Representative.

1.2 MEASUREMENT AND PAYMENT PROCEDURES

- .1 Supply and install Precast Concrete Barrier:
 - .1 Installation and supply of precast concrete barrier shall be measured by each specific unit of precast concrete barrier including end treatments loaded, hauled from stockpiles and installed in their final location in accordance with the Contract documents. Payment will be made under **“Unit Price Item 13 – Supply and Install Precast Concrete Barrier”**.
- .2 Supply and Install of Crash Attenuator:
 - .1 Supply and installation of Crash Attenuators in accordance with these specifications and manufacturer’s requirements. The measure for payment shall be by each end treatment supplied, assembled, installed and accepted by the Departmental Representative, and will be inclusive of all costs of labour, materials, tools and equipment to satisfactorily complete this work. Payment will be made under **“Unit Price Item 13f – Supply and Install TL-3 Crash Cushion System”**.
- .3 Barrier costs shall be inclusive of all costs of labour, materials, and equipment to satisfactorily complete this item as specified and in accordance with this Section.
- .4 The supply and installation of barrier mounted reflectors shall not be measured directly and shall be considered incidental to the unit price items.
- .5 The placement and removal of Precast Concrete Barriers for use as temporary barricades during construction will not be measured for payment and shall be considered incidental to the Contract.
- .6 The survey and layout of the Precast Concrete Barriers as per requirements identified in this Section and the plans, will not be measured directly for payment but shall be considered incidental to **“Unit Price Item 13 –Precast Concrete Barrier”**.
- .7 Mobilization and demobilization required for this Work shall be incidental to **“Lump Sum Price – Mobilization / Demobilization”**, and no additional payment will be made.
- .8 Traffic Control for survey, installation, removal or relocation of Precast Concrete Barriers shall be incidental to **“Lump Sum Price – Traffic Accommodation”** and no separate payment will be made to the Contractor.

- .9 Environmental mitigations required in accordance with Section 01 35 43 – Environmental Procedures, for the Work in this Section shall be incidental to the Contract and no separate payment will be made to the Contractor

Part 2 Products

2.1 MATERIALS

- .1 Precast Concrete barrier shall be manufactured as per British Columbia Standard Specifications for Highway Construction (latest edition), Section 941 - Precast Reinforced Concrete Barriers with the following exceptions:
 - .1 All end faces to have 25mm chamfered edges.
 - .2 Synthetic Fiber reinforcing shall be added to the precast concrete barriers in accordance with the project specifications.
- .2 810mm Special Drainage Barrier to be per manufactured as per the Contract drawings and as directed by Departmental Representative.
- .3 Crash Cushion Systems shall meet or exceed NCHRP 350 TL-3 crash requirements and be approved for use in the current Products List as published by AT.
- .4 Barrier reflectors to be hard plastic type raised pavement markers mounted with fast cure construction adhesive.
 - .1 Reflectors to be placed at 25m intervals mounted as per the Drawings or as directed by the Departmental Representative.
 - .2 Acceptable products include:
 - .1 3M Raised Pavement Marker (RPM)
 - .2 Stimsonite Raised Pavement Marker (RPM)
 - .3 Or equivalent as approved by the Departmental Representative

2.2 PRECAST CONCRETE BARRIER

- .1 Concrete Quality: to CAN/CSA-A23.1 except where amended below.
- .2 Compressive Strength: Compressive strength test result is equal to or exceeds 30 MPa and no individual cylinder strength is less than 27 MPa.
- .3 Calcium chloride or admixtures containing calcium chloride are not to be used in concrete.
- .4 Cement Content: minimum of 320 kg/m³.
- .5 Water/Cement Ratio: maximum of 0.45.
- .6 Coarse Aggregate: nominal maximum size not exceeding 28mm.
- .7 Slump: 50 mm plus or minus 20mm.
- .8 Entrainment Air: 5 to 8%.
- .9 Reinforcement:
 - .1 Fibrillated fiber strand reinforced concrete to be used for production of barriers. Welded wire mesh reinforcement will not be permitted.
 - .2 50 mm fibrillated polypropylene fibres to be added at the rate of 1.0 kg/m³.
 - .3 Fibrillated fibres shall meet requirements of ASTM C 1116 Type 3 Synthetic Fibre Reinforced Concrete or shotcrete.

- .4 Fibres shall have a minimum tensile strength of 350 MPa and a minimum modulus of elasticity of 4.2 GPa.
- .5 Fibres are to be added early in the mixing process following manufacture's recommendations to ensure evenly distributed fibres.
- .6 A single length of 15 mm rebar shall be wire tied to the horizontal sections of the hook or eye assemblies as shown on the Reference Drawings.
- .7 Additional 10M rebar shall be installed for drainage barriers as shown on the reference drawings.
- .10 Concrete Placing and Consolidation:
 - .1 To CAN/CSA-A23.4, Clause 19.
- .11 Concrete Curing and Protection:
 - .1 Strictly to CAN/CSA-A23.4, Clause 21.
 - .2 During curing period temperature differential between concrete surface and ambient air not to exceed 20 ° C.
- .12 Exposed Concrete Surfaces:
 - .1 Uniform in texture and colour as produced from well-maintained steel form surfaces and proper vibration methods without excessive surface fines or laitance.
- .13 Surface defects will normally be cause for rejection of any unit except where such are within the following permissible limits or area subject to making good within the following permissible limits:
 - .1 Unobtrusive defects of any kind where their total area is not in excess of 2% of exposed surface area of unit.
 - .2 Air holes not greater than 3 mm in diameter and not more than 20 in any isolated 300 mm x 300 mm area.
 - .3 Sharp ridges at edges of exposed concrete surfaces softened where necessary by careful rubbing or grinding.
 - .4 Patching of isolated small holes, cavities and similar self-confining defects may be permitted when authorized by the Departmental Representative.
- .14 Patching, if authorized, to be completed as follows:
 - .1 Defective are saturated with water and defect prepared with cement paste and filled with mortar.
 - .2 Mortar to be properly proportioned to same sand and cement as original concrete and reasonably colour-matched to cured dry unit with addition of white cement where necessary, to be pre-shrunk for about one hour before retempering and use.
 - .3 Patching mortar to be well tooled in, finished flush and smooth and are covered to cure adequately.
- .15 Surface tolerance to be +/- 3 mm unless otherwise directed by the Departmental Representative.
- .16 Finished Product:
 - .1 Contractor to notify Departmental Representative in advance of manufacturing of schedule so that inspection can be carried out. All processes are subject to inspection by the Departmental Representative. Inspection or release of units by the Departmental Representative is required prior to shipping.

- .2 Identification indicated by embedding manufacturer's name or trademark, year of manufacture, and form number on end of each unit in manner, size and depth that will be permanently legible.
- .3 Authorized patching or making good to be inspected by the Departmental Representative before shipment or upon delivery and rejected units replaced at no cost.
- .17 Welded Steel Wire Mesh Reinforcement:
 - .1 Welded wire mesh reinforcement will not be permitted.
- .18 Reinforcing Steel for Bent and Hooked Connections:
 - .1 To CAN/CSA-G40.21-M, Grade 260W.
- .19 Bending:
 - .1 Carefully bend reinforcing steel to radii detailed and install as shown on the reference drawings.
 - .2 Inspect reinforcing steel after bending for evidence of fracture. Fractured pieces to be replaced.
- .20 Surface Treatment:
 - .1 Treatment of exposed surfaces not required.
- .21 Pick-up Points:
- .22 Form with accurately placed rigid PVC pipe recessed 15 mm from both finished surfaces as shown on the reference drawings.
- .23 Drainage Slots:
 - .1 Drainage slots to be cast-in as shown on the reference drawings.

Part 3 Execution

3.1 DELIVERY

- .1 Care shall be taken to protect Precast Concrete Barrier from elements and temperature extremes during curing period. Under no circumstances are barrier components to be exposed to freezing conditions until fully cured.
- .2 Storage of Precast Concrete Barriers on site to be in single layer, for first seven days.
- .3 Stacking of three layers high, with wood blocking between lifts, permitted with Departmental Representative approval, after seven days.
- .4 Barriers to be stacked three layers high, with wood blocking between lifts, at delivery location. Cost of supply and installation of wood blocking shall be incidental to the Contract and no separate payment will be made.

3.2 INSTALLATION

- .1 Precast Concrete Barriers shall be installed permanently on asphalt concrete pavement in accordance with these Specifications or as directed by the Departmental Representative.
- .2 Contractor shall do the layout of the barriers for both removal and installation operations.
- .3 The Departmental Representative will determine location of barriers with drainage opening for drainage and for small animal crossings. Some of the roadside drainage

barriers will require the installation of drain pipe to control runoff. The drain shall be supplied installed at locations and as directed by the Departmental Representative.

3.3 FIELD QUALITY CONTROL

- .1 Contractor shall carry out all the necessary quality control to ensure the barrier work complies with these specifications.

3.4 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.

END OF SECTION

33 71 14 W-BEAM GUARDRAIL**Part 1 General****1.1 DESCRIPTION**

- .1 Removal and stockpile of W-Beam Guardrail at various locations in Jasper National Park.
- .2 Removal and relocation of Strong Post W-Beam Guardrail with metal posts at locations identified on the Contract drawings or as directed by the Departmental Representative. The Contractor shall not install replacement guardrail until approved by the Department Representative. Each location will be independently safety audited prior to guardrail replacement.
- .3 Removal and relocation of impact absorbing guardrail end treatments at locations in Jasper National Park as directed by the Departmental Representative.
- .4 Removal and stockpile of impact absorbing guardrail end treatments at locations in Jasper National Park as directed by the Departmental Representative.
- .5 Work includes:
 - .1 Mobilization / Demobilization
 - .1 Survey, layout and staging
 - .2 Traffic Accommodation
 - .3 Removal and relocation of Strong Post W-Beam guardrail, posts, and hardware
 - .4 Removal and stockpile of surplus W-Beam guardrail, posts and hardware
 - .5 Removal and relocation of impact absorbing guardrail end treatment
 - .6 Removal and stockpile of impact absorbing guardrail
 - .7 Gravel end treatments
 - .8 Supply and installation of reflectors
 - .9 Backfilling of holes and incidental grading
 - .10 Cleanup

1.2 REFERENCES

- .1 AT - Standard Specifications for Highway Construction (latest edition)
- .2 AT – Roadside Design Guide (latest edition)
- .3 CSA G40.20 and G40.21-M87 - Structural Quality Steels
- .4 CSA G164-M - Hot Dip Galvanizing of Irregularly Shaped Articles
- .5 CSA W59-M - Welded Steel Construction (Metal Arc Welding)
- .6 CSA 080-M - Wood Preservation,
- .7 AASHTO Standard Designation M-180-841 "Corrugated Sheet Steel Beams for Highway Guardrail
- .8 ARTBA Technical Bulletin No. 268-B

.9 NLGA Standard Grading Rules for Canadian Lumber

1.3 MEASUREMENT AND PAYMENT PROCEDURES

- .1 W-Beam Guardrail (rails and posts) removal, including end terminals, will be measured in linear metres and shall be paid under **“Unit Price Item 15b – Remove and stockpile”**. Payment shall be compensation in full for all material, equipment and labour required to dismantle the W-Beam rails, remove posts, stockpile the rails, hardware and posts in Marmot Pit, backfill post holes, grade the area as necessary and clean up the work sites.
- .2 Removal and relocation of Strong Metal Post W-Beam Guardrail, including end treatments, in accordance with these specifications. The Measurement and Payment Procedures shall be the number of linear metres of complete strong metal post w-beam guardrail removed and relocated to the locations specified in the Contract Documents or as accepted by the Departmental Representative, and shall be inclusive of all costs of labour, materials, tools and equipment to satisfactorily complete this work. Payment will be made under **“Unit Price Item 15a – Remove and Relocate”**.
- .3 Site preparation, including but not limited to shoulder widening, grading and levelling to the standard required by the manufacturer of the Impact Absorbing Guardrail End Treatment shall be considered incidental to **“Unit Price Item 15a – Remove and Relocate”**, and no separate or additional payment will be made.
- .4 Traffic Control required during work identified under this Section shall be included under **“Lump Sum Price - Traffic Accommodation”** and no separate payment will be made to the Contractor.
- .5 Mobilization and demobilization required for this Work shall be included under **“Lump Sum Price - Mobilization / Demobilization”** and no separate payment will be made to the Contractor
- .6 Environmental mitigations required in accordance with Section 01 35 43 – Environmental Procedures, for the Work in this Section shall be incidental to the Contract and no separate payment shall be made to the Contractor.

1.4 LOCATION

- .1 Actual guardrail removal and installation locations will be as directed on site by the Departmental Representative, quantities may vary from those listed.

1.5 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 Certificates: submit certificates signed by manufacturer certifying that materials comply with specified performance characteristics and physical properties.

- .4 Manufacturer's Instructions: submit manufacturer's storage and installation instructions and special handling criteria, installation sequence, and cleaning procedures.

1.6 QUALITY CONTROL

- .1 As per Section 01 45 00 – Quality Control.
- .2 Provide certification by Professional Engineer licensed to practice in British Columbia or Alberta, wherever the Work is occurring, that the Strong Metal Post W-Beam Guardrail system and Impact Absorbing Guardrail End Treatment meets the specifications prior to delivery of materials. Certification to include mill certifications and galvanizing thickness test results performed by independent laboratory retained by the Contractor.

1.7 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.
- .2 Storage and Protection:
 - .1 Store materials in accordance with manufacturer's recommendations
 - .2 Replace defective or damaged materials with new.

Part 2 Products

2.1 GENERAL

- .1 The Contractor shall inform the Departmental Representative and Owner and make clear at the Preconstruction Meeting, the proposed post material or system that they will supply and install. **Steel** post systems with spacer blocks are a requirement and that the complete system meets or exceeds NCHRP 350 TL-3 crash requirements.

2.2 WASTE MATERIALS

- .1 All existing guardrails, posts and hardware are the property of Parks and the Contractor shall stockpile the w-beam not required for relocation at Marmot Pit or as accepted by the Departmental Representative.

2.3 MATERIAL

- .1 Strong Metal Post W-Beam Guardrail to be in accordance with AT –Standard Specifications for Highway Construction, Section 5.25 – Supply of W-Beam Guardrail and Posts (latest edition), or as contained herein, whichever requirement is more stringent.
- .2 Posts shall be W150 x 14 x 1830mm. Steel for post, spacer and hardware to be in accordance with manufacturer's recommendations, CSA Standard G40.21 Grade 350W or ASTM Standard A36, and be hot dip galvanized after fabrication as per CSA G164-M or ASTM A123/A123M.

- .3 Impact absorbing guardrail end treatments shall meet or exceed NCHRP 350 TL-3 crash requirements and be approved for use in the current Approved Products List as published by AT.

2.4 RAILS AND TERMINAL ELEMENTS

- .1 W-beam guardrail shall consist of rail sections fabricated to develop a continuous beam strength with the necessary safety end feature components
- .2 All rail sections and other components shall match the design profiles and dimensions of the AASHTO/ARTBA hardware requirements for full interchangeability of similar components regardless of the manufacturer.
- .3 The name or trademark of the manufacturer, the metal thickness and the year of production shall be clearly and permanently stamped on each component clear of the splicing overlap and on the face opposite the traffic side.
- .4 The rails and terminal elements shall be manufactured from open hearth, electric furnace or basic oxygen semi-spring steel sheet and hot dip galvanized after fabrication, all in general accordance with the AASHTO Standard Designation M180-841 and shall conform to the relevant TEB and RDG drawings.
- .5 Rails shall be punched for splice and post bolts in strict conformity with the AASHTO Standard to the designated number and centre-to-centre spacing of posts. No punching, cutting or welding will be permitted on site except for special details in unforeseen and exceptional cases with the prior approval of the Departmental Representative.
- .6 If any guardrail installation requires curved W-beam rails, the Contractor shall form these to fit the radius of the existing highway.
- .7 The rails and terminal elements shall be manufactured according to the following standards:
 - .1 Metal properties of the base metal for the rails shall conform to the following requirements:
 - .1 Minimum Yield Point: 345 MPa
 - .2 Minimum Tensile Strength: 483 MPa
 - .3 Minimum Elongation: 12% in 50 mm length
 - .4 Sheet thickness shall be in accordance with Table 1 (Class A, Type 2) of AASHTO Standard M180-841 with a nominal base metal thickness of 2.8 mm (2.67 mm minimum).
 - .5 Sheet width for the W-beam rail shall be 483 mm, with a permissible tolerance of minus 3.2 mm.
 - .6 Welding for the fabrication of terminal elements shall conform to the requirements of CSA-W59M. Rails and terminal elements shall be hot dip galvanized after fabrication, in accordance with CSA-G164M.
 - .7 Drainage Slots: Cast-in as shown on drawings.

2.5 BOLTS, NUTS AND WASHERS

- .1 Bolts, nuts and washers shall conform to ASTM-A307, and shall be hot dip galvanized in accordance with CSA-G164M (Drawing TEB 3.06).

Part 3 Execution**3.1 PREPARATION**

- .1 Removal and stockpile of existing guardrail sections and posts.
- .2 Backfill holes and perform minor grading as necessary.
- .3 Excavate accumulated granular material, load, haul, and dispose of material at a suitable disposal facility outside of the Park or as directed by Departmental Representative.

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 DELIVERY/RELOCATION

- .1 Removal and relocation of existing guardrail sections and posts.
- .2 Backfill holes and perform minor grading as necessary.
- .3 Excavate accumulated granular material, load, haul, and dispose of material at a suitable disposal facility outside of the Park or as directed by Departmental Representative.
- .4 Materials are to be stored in a secure location prior to installation as designated by the Departmental Representative.
- .5 Contractor to get approval from the Departmental Representative field prior to ordering new W-Beam.
- .6 Materials shall be inspected by the Contractor during delivery to ensure that they are free of defects

3.4 INSTALLATION

- .1 Strong Metal Post W-Beam Guardrail and Impact Absorbing Guardrail End Treatments shall be installed permanently along the road embankment in accordance with Alberta Transportation Standard Drawings and these Specifications.
- .2 The installed top of rail height shall be in accordance with AT Specifications.
- .3 Contractor shall perform the layout of the Strong Post W-Beam Guardrail and Impact Absorbing Guardrail End Treatments.

3.5 FIELD QUALITY CONTROL

- .1 Prior to installing any guardrail, the Contractor shall provide the Departmental Representative with a copy of the manufacturer's certificate verifying that materials supplied conform to Section 16 of CSA G40.20M, for each of the mechanical and chemical tests.
- .2 Inspection of W-Beam Guardrail Material:
 - .1 Hot dip galvanized coating shall be smooth, free of beading or sharp projections at edges. Coating adherence shall prevent the peeling of any portion of the zinc coating so as to expose the base metal by cutting or prying with a stout knife under considerable pressure (bond check). A magnetic gauge will be used for checking thickness in accordance with ASTM Standard E316.3(c).

- .2 Warped or otherwise deformed rails and terminal elements will be rejected, as will those with injurious defects or excessive roughness of the zinc coating. When the rail is laid on a flat surface, the warpage shall not be greater than 5 cm.
- .3 Inspection of Posts and Blocks:
 - .1 The Departmental Representative may verify the penetration and retention of the preservative by the assay method.
- .4 Posts and blocks shall be subject to inspection by the Departmental Representative when the bundles are opened immediately prior to use. Contractor shall carry out all the necessary quality control to ensure Strong Metal Post W-Beam Guardrail are supplied and installed as per these specifications.

3.6 CLEANUP

- .1 Cleanup of work sites as accepted by the Departmental representative.
- .2 Proceed in accordance with Section 01 74 11 – Cleaning.

END OF SECTION

35 10 01 OVERHEAD VARIABLE MESSAGE SIGN**Part 1 General****1.1 DESCRIPTION OF WORK**

- .1 Design-Build of an overhead variable message sign (VMS) at the Jasper National Park East Gate on Highway 16.
- .2 Removal and disposal of existing cantilevered electronic lane control sign as indicated on the Drawings.
- .3 Relocation of an overhead cantilever sign as indicated on the Drawings.
- .4 Provide all necessary labor, material, tools, transportation, services and facilities required for the complete electrical installation as shown on the drawings and as specified.
- .5 Provide all necessary labor, materials, equipment, devices and apparatus not mentioned in the specifications, or shown on the drawings as required for the complete electrical installation.
- .6 Obtain all permits and pay all fees required for the electrical installation.

1.2 LOCATION

- .1 The location of the new VMS is approximately 0.8 Km west of the east boundary of Jasper NP on Highway 16 and is indicated on the Drawings.

1.3 REFERENCES

- .1 National Electrical Manufacturing Association (NEMA)
- .2 TS4 Hardware Standards for Dynamic Message Signs (VMS) with NTCIP Requirements
- .3 American Association for State Highway and Transportation Officials (AASHTO):
 - .1 AASHTO Standard Specifications for Highway Bridges.
 - .2 AASTHO Standard Specification for Structural Supports for Highway Signs, Luminaires and Traffic Signals.
- .4 Canadian Standards Association (CSA):
 - .1 CSA C22.1-09, Part 1 Canadian Electrical Code.
 - .2 CSA S6-14, Canadian Highway Bridge Design Code.
 - .3 CSA S16, Design of Steel Structures.
 - .4 CSA G40.20/G40.21, General Requirements for Rolled or Welded Structural Quality Steel / Structural Quality Steel.
 - .5 CSA S269.1, Falsework for Construction Purposes.
 - .6 CSA W48, Filler Metals and Allied Materials for Metal Arc Welding.
 - .7 CSA W59, Welded Steel Construction, (Metal Arc Welding).
- .5 ASTM International:
 - .1 ASTM A123 / A123M, Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products.

- .2 ASTM F3125 / F3125M, Standard Specification for High Strength Structural Bolts.
- .6 American Welding Society (AWS) – Bridge Welding Code.
- .7 Manual of Uniform Traffic Control Devices (MUTCD):
 - .1 Chapter 2L, Changeable Message Signs.
- .8 AT - Standard Specifications for Highway Construction (latest edition).
- .9 AT - Specifications for Bridge Construction (latest edition).
- .10 Electrical installation shall be in accordance with the current edition of the Canadian Electrical Code, National Building Code, and applicable Municipal and Provincial Codes, Rules and Regulations.
- .11 Provide all necessary material and labor required to meet the requirements of these codes, rules and regulations even though the work may not be shown on the drawings or mentioned in the specifications.

1.4 MEASUREMENT AND PAYMENT PROCEDURES

- .1 Payment under **“Lump Sum – Design-Build VMS – Message Board”** shall be compensation in full for the design and construction of the overhead variable message sign including all materials, labour and equipment which among other things, includes all new infrastructure identified on Drawings E-32 and E-33, and further requirements specified elsewhere in the Drawings and Specifications.
 - .2 Payment under **“Lump Sum – Design-Build VMS – Steel Support Structure”** shall be compensation in full for the design and construction of the overhead variable message sign steel support structure including all materials, labour and equipment.
 - .3 Payment under **“Lump Sum – Design-Build VMS – Foundation”** shall be compensation in full for the design and construction of the overhead variable message sign foundations including all materials, labour and equipment
 - .4 Payment for **“Lump Sum – Design-Build VMS”** will be made as percentage complete in the following manner: up to 20% on acceptance of the completed detailed designs, up to 50% on the supply of materials to site, and up to 80% on the completion of the installation Works, including backfill and reinstatement of the highway, and up to 100% on complete commissioning and full acceptance by the Departmental Representative.
 - .5 Detailed design, excavation, dewatering, shoring, bracing, disposal of excess material, equipment, labour, erection of scaffolding / staging, shop drawings and submittals, and all other items necessary for successful completion of the Work shall be considered incidental to **“Lump Sum – Design-Build VMS”** and no additional payment will be made.
 - .6 Payment for the Power Infrastructure and Connections shall include costs for the design, completion of necessary submittals, supply and installation of necessary infrastructure to facilitate the connection and supply of power to the VMS. The costs shall include locating existing utilities, all civil works (including trenching, ground-grid and duct works complete with pull rope, and transformer pads), coordination of utility inspections and all other items necessary for successful completion of the work.
- Payment for Power Infrastructure and Connections Works will be considered incidental

- to **“Lump Sum – Design-Build VMS”** and no additional payment will be made.
- Payment for Communication Infrastructure and Connection will be considered
- .7 incidental to **“Lump Sum – Design-Build VMS”** and no additional payment will be made. Payment to include all costs for design, completion of necessary submittals, supply and installation or relocation to facilitate telecommunication to the VMS. Payment shall include locating existing utilities, all civil works (including trenching, conduit with pull rope, and junction boxes), coordination of utility inspections and all other items necessary for successful completion of the work. Additionally, payment shall include all of the Contractor costs associated with coordination of the utility companies’ connection to the communication network.
- .8 Survey, layout, transportation of materials within the site, construction and assembly of the VMS unit and operating system, including installing and configuring of operating system hardware and software shall be paid under **“Lump Sum – Design-Build VMS”** and shall be inclusive of all costs of labour, materials, permits, licenses, manuals, documentation and equipment to satisfactorily complete this item as specified and in accordance with Section 35 10 01 – Overhead Variable Message Sign.
- .9 Testing and commissioning of the VMS shall be incidental to **“Lump Sum – Design-Build VMS”**
- .10 All the work, including but not limited to labour, equipment, and materials, associated with the removal and disposal of the cantilevered electronic lane control sign shall be paid under **“Lump Sum – Design-Build VMS - Remove and Dispose Cantilevered Electronic Lane Control Sign”**.
- .11 All the work, including but not limited to labour, equipment, and materials, associated with the relocation of the existing cantilever sign shall be paid under **“Lump Sum – Design-Build VMS - Remove and Relocate Existing Cantilever Sign”**.
- .1 The design-build of the signs new foundation shall be considered incidental to **“Lump Sum – Design-Build VMS – Remove and Relocate Existing Cantilever Sign”**.
- .2 The supply and installation of the signs new electrical and power feeds, connections, and other required items as per the Contract Documents shall be considered incidental to **“Lump Sum – Design-Build VMS – Remove and Relocate Existing Cantilever Sign”**.
- .12 Mobilization and demobilization shall be incidental to **“Lump Sum Price – Mobilization / Demobilization”**, and no additional payment will be made.
- .13 Traffic Control during the survey, layout and construction shall be incidental to **“Lump Sum Price – Traffic Accommodation”** and no separate payment will be made.
- .14 Environmental mitigations required in accordance with Section 01 35 43 – Environmental Procedures, for the Work in this Section shall be incidental to the Contract and no separate payment shall be made to the Contractor.

1.5 STAGED CONSTRUCTION

- .1 Provisions for staged construction shall be shown in the Contractor’s Traffic Management Plan and Works Plan, including any temporary support required, until the installation is complete.

1.6 DESIGN REVIEW

- .1 The Contractor shall provide the Departmental Representative with one (1) electronic copy of complete working Drawings, and one (1) electronic copy of detailed design calculations, for review at least four (4) weeks prior to the planned fabrication or manufacture. Drawings and design calculations to bear signature and stamp of qualified Professional Engineer registered in Province of Alberta.
- .2 Design notes and drawings shall conform to the requirements of Section 24.2.1.2 of the AT Specifications for Bridge Construction.
- .3 The Contractor shall verify existing site conditions and ground elevations before preparing Drawings.
- .4 The Departmental Representative retains right of final approval for equivalent products and locations.
- .5 Product Data, the Contractor shall:
 - .1 Submit manufacturer's instructions, printed product literature and data sheets for all sign structure components and include product characteristics, performance criteria, physical size, finish and limitations
- .6 Shop Drawings, the Contractor shall:
 - .1 Submit shop drawings in accordance with Section 01 33 00 – Submittal Procedures.
 - .2 Submit shop drawings of all required consumables.
 - .3 Ensure each drawing submitted bears stamp and signature of qualified Professional Engineer registered in the Province of Alberta.
- .7 The Contractor shall incorporate as-built conditions and re-submit all design notes and shop drawings, at the completion of construction. As-built drawings and design calculations to bear signature and stamp of qualified Professional Engineer registered in Province of Alberta.

1.7 DESIGN CRITERIA

- .1 The Contractor shall design to ensure minimum effective service life of 25 years.
- .2 All materials and components must be designed, constructed and installed in accordance with the following current codes and regulations:
 - .1 National Building Code (Canadian), where applicable
 - .2 Workers Compensation Board regulation (Province of AB), where applicable
 - .3 Alberta Electrical Code (wiring)
 - .4 Canadian Standards Association (CSA): C22.1-09, Part 1 Canadian Electrical Code.
 - .5 WHMIS, where applicable
 - .6 Canadian Radio-television and Telecommunications Commission regulations, where applicable
 - .7 Transportation of Dangerous Good regulations, where applicable
 - .8 AB Safety Authority
- .3 All systems must abide by all relevant licensing and permitting requirements. For details on licensing and permitting requirements, it is the Contractor's responsibility to

contact any authorities directly and to act as agent, once approved to do so, on behalf of Parks in obtaining the necessary permits.

1.8 VMS AND CANTILEVER SIGN FOUNDATION DESIGN CRITERIA

- .1 VMS foundation shall be designed in accordance with Section 24.2.4 of the AT - Specifications for Bridge Construction (latest edition). If the AT specifications referenced above are silent on a particular design or fabrication standard, then the requirements of the Canadian Highway Bridge Design Code (CAN/CSA-S6-14) shall be used for that particular design or fabrication standard. Additionally, the foundation design shall be designed for the requirements of:
 - .1 The soil and geotechnical conditions present at the sign location as per the provided geotechnical information and the Contractor's own site investigation. The Contractor shall undertake additional geotechnical work at their own cost where necessary to ensure proper performance of the sign structure.
 - .2 The sign foundations shall be designed to support the new/existing sign structure in accordance with all relevant design conditions.
 - .3 The VMS sign foundation shall incorporate the median barrier and connections to the crash attenuator and concrete barriers as detailed in the Drawings.
 - .4 The sign foundations shall be designed and sealed by a Professional Engineer registered in the province of British Columbia or Alberta, wherever the Work is occurring.
- .2 The cantilever sign foundation shall be designed in accordance with Section 24.2.4 of the AT - Specifications for Bridge Construction (latest edition). If the AT specifications referenced above are silent on a particular design or fabrication standard, then the requirements of the Canadian Highway Bridge Design Code (CAN/CSA-S6-14) shall be used for that particular design or fabrication standard.

1.9 VMS STEEL STRUCTURE DESIGN CRITERIA

- .1 The design of the VMS steel structure shall conform to Section 24.2.1.1 of the AT Specifications for Bridge Construction (latest Edition).
- .2 The VMS steel structure shall be a maximum of 1.2m wide and not protrude in any way beyond the extents of the concrete median barrier for at least 6.1m above the road surface as detailed on the Drawings.

1.10 VMS MESSAGE SIGN DESIGN CRITERIA

- .1 Provide new graphic display sign suitable for text and animations. 19.8mm pixel pitch is preferred format.
- .2 Display is to be suitable for providing direction/lane control for three (4) lanes of traffic with three (3) being on a single sing, and the 4th being separate as detailed on the Drawings.
- .3 Equipment is to allow for quick disconnect/connect for ease of maintenance and repair.
- .4 Text Message display is to be provided above lane control section.
 - .1 Software for the display is to be easily programmable for quick changes of the text messages with the capability to place a variety of messages without reliance on predetermined messages or templates.

- .2 Test message changes are to be possible at all control interfaces without outside assistance, support, or additional equipment.
- .5 Provide VMS control interfaces within the new kiosk and at the Jasper Parks Canada Compound and persistent communication and control between both and the VMS sign.
- .6 Provide training for software system for the Owner and Engineer. Allow for a minimum of 6 hours of training time. Include video recording of training for inclusion in O&M manual.
- .7 System is to be equivalent to Daktronics Galaxy GS6 series displays. Provide equipment data sheets to Engineer and Owner prior to selection of alternate equipment, for review and acceptance.

1.11 VMS ELECTRICAL SYSTEM DESIGN CRITERIA

- .1 All new power infrastructure to be designed and constructed to:
- .2 Canadian Standards Association (CSA): C22.1-09, Part 1 Canadian Electrical Code.
- .3 The power supply will be from the Entry Gate Kiosk. Proposed power supply is to be 120/240V, single phase. Confirm power requirements during shop drawing submission.

1.12 RECORD DRAWINGS

- .1 Within one month of Substantial Performance and prior to Completion, the Contractor shall submit to the Departmental Representative for review and acceptance Drawings of Record of all drawings and supporting documentation used for construction shall be supplied by the Contractor in accordance with Section 01 78 00 of the Specifications and shall as a minimum include the following:
 - .1 Final “as-built” record drawings;
 - .2 All Quality Control folders showing test data and location;
 - .3 Any vendor produced drawings or specifications (eg. shop drawings and supplemental specifications etc.); and
 - .4 Bound and indexed copies of all shop drawings and all documents from the QC program including copies of all test results, mill certificates, and other quality control reports and information.
 - .5 Final record drawings shall indicate the precise location of the new foundation, including the offset from the nearest travelled lanes. Minimum actual overhead clearance above the paved surface must be noted on the final record drawings.
 - .6 Copies of the original computer assisted drafting and design (“CADD”) drawings are to be used and amended as required to reflect the actual constructed works at project completion. The drawing numbers will remain the same as the originals for storage and retrieval purposes. Record Drawings will be stand-alone documents and contain all of the original information except that which has been changed by the construction revisions.
 - .7 The Contractor shall prepare drawings in accordance with the following requirements:
 - .1 The Contractor shall sign and date each drawing when completed.
 - .2 The record drawings will be signed and sealed by the Contractor’s Design Engineer of Record to verify the drawings represent the

original design with all construction and design revisions identified.

- .3 The record drawings will also be signed and sealed by the Quality Manager to verify that the Work has been constructed in accordance with the design drawings, including all revisions.
- .4 All of the Contract drawings shall be produced as record drawings.
- .8 The signed drawings shall be forwarded to the Departmental Representative for review and comment. The hard copy drawings shall be accompanied by “PDF’s” of each drawing and the CADD drawings saved on a CD or DVD.

1.13 MAINTENANCE MANUALS

- .1 Provide operation and maintenance data for incorporation into maintenance manuals as follows in hard cover 3 ring binder c/w index tab separators. \A0; provide three (3) hard copies and one (1) pdf softcopy. Softcopy may be submitted using compact disc, USB flash drive or email.
- .2 Technical data, product data, supplemented by bulletins component illustrations, exploded views, technical descriptions of items and parts lists. (advertising or sales literature is not acceptable).
- .3 Wiring and schematic diagrams.
- .4 Names and addresses of local suppliers for items included in maintenance manuals.

1.14 PERFORMANCE REQUIREMENTS

- .1 Overhead clearance above the paved surface and offset from the travelled lanes must be as per the Contract Drawings.
- .2 Tolerances in fabrication and installation as per Section 24.2.2.6 (5) of the AT - Specifications for Bridge Construction (latest edition).
- .3 The foundation must be structurally designed for installation in the geological conditions found at the sites as described in the attached McElhanney Geotechnical Assessment, and according to any requirements specified by further geotechnical analysis performed at the request of the Departmental Representative or as required by the Contractor’s Professional Geotechnical Engineer. The aforementioned McElhanney Geotechnical Assessment is based on published geological information and has not considered a reconnaissance visit to the work site.
- .4 The Contractor is responsible for a detailed geotechnical investigation and/or geotechnical testing, if required to perform the Work.
- .5 The Contractor will be responsible for preparing all foundation engineered form work drawings, concrete drawings and drawings of any other structures.

1.15 HANDLING

- .1 The Contractor shall be responsible for any damage that occurs to the system during, storage and installation and no additional payment for repairs shall be made.
- .2 The Contractor shall be responsible for all costs associated with the storage and security of the system, and no additional payment shall be made.

1.16 QUALITY CONTROL – TESTING

- .1 All Quality Control testing shall be performed by the Contractor.
- .2 Testing shall be as per accepted Manufacturer's and Contractor's Quality Control Plan.
- .3 The Contractor is required to complete all inspections as required by the VMS manufacturer, as recommended by any of the additional Design Engineers, or as a result of studies carried out as part of the installation of the VMS.

1.17 WARRANTY

- .1 In addition to any other requirement of the Contract, all material and workmanship shall be under warranty for one year after the date of Substantial Performance. All parts, hardware, software, and any other materials supplied and/or installed by the Contractor for a period of 24 months from the date of Substantial Performance that fail to operate, break, are defective or show unusual wear will be replaced or repaired by the Contractor without charge for material or costs associated with reinstallation. The period of time for initiating rectification of any defects or other condition within the warranty period shall not exceed 96 hours.
- .2 No certificate given, payment made, partial or entire use of the equipment by the owner, shall be construed as acceptance of defective work.

Part 2 Products**2.1 MATERIALS**

- .1 All materials shall be new and of the type and quality specified or accepted in writing.
- .2 Structural steel shall conform to the requirements of CAN/CSA-G40.21-M.
- .3 All structural steel plate material shall conform to CSA G40.21M 300W. Silicon content shall be less than 0.04% for the shafts, whereas for flanges and base plates the silicon content shall be either less than 0.04% or between 0.15% to 0.25%.
- .4 All bolts, nuts and washers shall conform to ASTM F3125 Grade A325 or shall meet property class 8.8 of the Industrial Fasteners Institute for metric high strength structural bolts, nuts and washers. Certified mill test reports for the fastener material shall be provided.
- .5 Anchor bolts shall be fabricated from DYWIDAG thread bars conforming to the requirements of CSA Standard G279.
- .6 Welding electrodes to CSA W48 series.

2.2 CONDUIT AND RACEWAY

- .1 Rigid steel conduit: for all exposed and underground conduit exposed to mechanical damage. (minimum size: 3/4" (19mm)).
- .2 Electrical metallic tubing (EMT): interior power and lighting branch circuits where run concealed above suspended ceiling, in stud walls, furred spaces, and where not exposed to mechanical damage, or above 6' (1830mm) from floor. (minimum size: 3/4" (19mm)).
- .3 Flexible metallic conduit: in dry locations, connection to transformers, (6' (1830mm) max.), vibrating equipment (24" (610mm) max) and to recessed lighting fixtures.

- .4 Liquid-tight flexible metallic conduit: in damp and wet locations for connection to all pump motors, solenoid valves, HVAC equipment and similar devices shall be made using liquid tight flexible metallic conduit. Provide separate ground wire independent of conduit, run inside conduit and bonded at both ends to enclosures. Maximum length of 24" (610mm).
- .5 Conduit in direct contact with earth to be rigid PVC type.
- .6 Conduit system shall be concealed unless exposed work is clearly called for on Drawings.
- .7 Conduits shall be tightly covered and well protected during construction using metallic bushings and bushing "pennies" to seal open end.
- .8 In all empty conduits or ducts, install a 200 lb (90 kg) tensile strength polyethylene pulling rope.
- .9 Conduit systems shall be electrically continuous throughout. Install code sized, insulated, copper, green grounding conductor in all conduit runs pulled with phase and/or neutral conductors.
- .10 Locations of conduit runs shall be planned in advance of the installation and coordinated with the ductwork, plumbing, ceiling and wall construction in the same areas and shall not unnecessarily cross other conduits or pipe, nor prevent removal of ceiling or tiles or panels, nor block access to mechanical or electrical equipment.
- .11 Where practical, install conduits in groups, in parallel, for vertical and horizontal runs and at elevations that avoid unnecessary offsets.
- .12 Exposed conduit shall be run parallel or at right angles to the centerlines of columns and beam.
- .13 All raceway systems shall be secured to the building structures using specified fasteners, clamps and hangers spaced according to code requirements.
- .14 Support single runs of conduit using one hole pipe straps. Where run horizontally on walls in damp or wet location, install "clamp-backs" to space conduit off the surface.
- .15 Raceways shall be joined using specified coupling or transition couplings where dissimilar raceway systems are joined.
- .16 Conduits shall be securely fastened to cabinets, boxes, and gutters using two locknuts and an insulating bushing or specified insulating connectors. Install grounding bushings or bonding jumpers on all conduits terminating at concentric knockouts.
- .17 Conduit terminations exposed at weatherproof enclosures and cast outlet boxes shall be made watertight using specified connectors and hubs.
- .18 Install expansion couplings where any conduit crosses a building separation or expansion joint.
- .19 All floor penetrations shall be sealed water-tight. Maintain fire rating as required.
- .20 Fire-safe all rated wall penetrations using 3m listed fire-safing sealants and assemblies.

2.3 CABLE AND WIRE

- .1 Conductors shall not be installed in conduit until all work of any nature that may cause damage is completed. Care shall be taken in pulling conductors that insulation is not damaged. U.L. And C.S.A. Approved non-petroleum base and insulating type pulling compound shall be used as needed.

- .2 All cables shall be installed and tested in accordance with manufacturers requirements and warranty.
- .3 All aspects of splicing and terminating shall be in accordance with cable manufacturers published procedures.
- .4 Make up all splices in outlet boxes with connectors as specified herein with separate tails of correct color to be made up to splice. Provide at least 6" (150mm) of tails packed in box after splice is made up.
- .5 All wire and cable in panels, terminal cabinets and equipment enclosures shall be bundled and clamped.
- .6 All feeders less than 60A shall be copper. Feeders 60A or larger may utilize aluminum conductors with engineer approval
- .7 Minimum wire size shall be no. 12 AWG R90 copper.

2.4 PROTECTIVE DEVICES

- .1 Circuit breakers: molded case, bolt-on, thermal magnetic type, 40 degrees C. Ambient temperature compensated, fixed mounting, with quick-make and quick-break switching mechanism mechanically trip-free from the operating handle.
- .2 Ratings: refer to drawings and panel schedules for trip frame and poles required. Minimum short circuit rating for 120/240 Volt breakers is 10,000 A, if not indicated otherwise.
- .3 Manual motor starters: fractional H.P. 1 phase motors shall be protected by thermal O.L. Relay integral with the disconnect.

2.5 GROUNDING

- .1 Enclosures of equipment, raceways, and fixtures shall be permanently and effectively grounded. Provide code-sized (unless otherwise indicated) copper, insulated green equipment ground with all branch and feeder circuit runs. Equipment ground shall originate at panel board ground bus and shall be bonded to all switch and receptacle boxes and electrical equipment enclosures.

2.6 IDENTIFICATION

- .1 Identify all places of electrical equipment (including each and every receptacle) other than conduits and conductors with engraved laminated plastic nameplates or brother P-Touch labels having 1/8" (3mm) minimum height. Attach all lamaroid labels, unless otherwise directed with silicone cement.
- .2 Colors of labels to be as follows:
 - .1 Normal power - black lettering on white background
 - .2 Standby power - red lettering on white background
 - .3 Emergency power - white lettering on red background
 - .4 Low voltage - blue lettering on white background
- .3 All junction and pull boxes for conduits, ducts and other raceways in concealed ceiling spaces shall be permanently marked using a black felt pen as follows (where ceiling space is painted out, put marking on inside of cover plates).
- .4 For lighting and power show the complete circuit number of all enclosed circuits. For all communications and fire alarm show the usage (i.e. "fire alarm", "telephone").

2.7 COMMUNICATION CABLING

.1 Data cabling:

- .1 Install communication cable from sign controller to the sign structure in accordance with manufacturers requirements.
- .2 All data cables are to be tested for continuity, crosstalk and attenuation and be within limits specified by the sign manufacturer.
- .3 Contractor must be a qualified installer, trained and authorized by an approved manufacturer.

2.8 CONTROL PANEL

- .1 Submit shop drawings prior to ordering.
- .2 Provide a complete & operational control system as indicated on the drawings consisting of master control unit, input modules, output modules, sensors, discrete control devices & all necessary accessories.
- .3 Master control unit (MCU) is to scan analog & digital inputs, perform control of connected points (analog & digital), control of connected systems & execution of optimization routines.
- .4 Provide surge protection on all inputs & outputs from field wiring devices.
- .5 System to be capable of automatic dial out on alarm condition or user set point. Provide all necessary programming & commissioning for interconnection.
- .6 Control system enclosure to be wall mounted and lockable.
- .7 All indicator & alarm lights are to be of led type.
- .8 Upon project completion, provide hard copy of set points and control logic for integration into O&M manual.

Part 3 Execution

3.1 GENERAL

- .1 The Contractor must take care to not damage the cantilever structure, sign face, cabinets, electrical components or any other portion of the new VMS.
- .2 All exposed cables shall be installed in weatherproof and watertight conduits.
- .3 The VMS and cabinet shall be energized immediately following their installation.
- .4 All electrical and civil electrical work (ie; conduit, boxes, wiring, etc) shall be supplied and constructed in accordance with Canadian Electrical Code, except as noted otherwise.
- .5 The Contractor is responsible for obtaining locates of all underground and overhead utilities and ensuring these utilities will not be impacted by the work.
- .6 The Contractor shall layout all equipment as required.
- .7 The VMS shall be powered from a power supply from the local kiosk. The Contractor shall coordinate with the Entry Kiosk Design Engineer.

3.2 STAGING

- .1 The Contractor shall stage the works to follow the restrictions outlined in Section 01 35 31.
- .2 For reinstallation of the VMS Support Structure or Message Board, full highway closures may be required, the closure must be between the hours of 19:00 and 07:00. Two (2) weeks' notice must be given to the Departmental Representative prior to full closure of the Highway.
- .3 Full Highway closures are not to exceed one (1) hour and there must be at least one (1) hour between each full closure.
- .4 Restrictions for Holiday weekends as noted in 01 14 00 Work Restrictions still apply for full closures.

3.3 WORK SITE PREPARATION

- .1 The Contractor shall assess the work site and staging location for potential hazards.
- .2 Disturbance to surrounding area shall be kept to a minimum; the Contractor shall remove only trees, vegetation and overburden where the VMS is to be installed in accordance with Section 01 35 43 - Environmental Procedures.
- .3 No additional payment will be made for work site preparation.
- .4 Contractor shall coordinate power shut-off and provide at least two (2) weeks notice to the Departmental Representative.

3.4 DECOMMISSION EXISTING CANTILEVERED SIGN FOR RELOCATION

- .1 Prior to decommissioning the cantilevered static sign with amber lights, the Contractor's Design Engineer of Record shall coordinate with the Departmental Representative to:
 - .1 Undertake close visual inspection using elevated work platforms to assess the message board and note any existing defects or damages.
 - .2 Undertake operational and functional testing of the message board including the electrical components, communications and control.
- .2 Prior to disassembling the support structure, the Contractor's Design Engineer of Record shall coordinate with the Departmental Representative to:
 - .1 Undertake close visual inspection using elevated work platforms to assess the support structure for existing defects or damages.
 - .2 Measure the existing overhead clearance from the paved surface and existing offset from the travelled lanes.
- .3 Following the inspections of the existing sign the Contractor's Design Engineer of Record must provide to the Departmental Representative a Pre-Decommissioning Inspection Report detailing the findings. The completed report must be provided to the Departmental Representative two (2) weeks prior to planned commencement of decommissioning and must be approved prior to decommissioning.
- .4 Decommission the existing sign in accordance with the Manufacturer's specification and the Contractor's Design Engineer of Record recommendations.
- .5 Cut off existing foundation pile not less than 300mm below final subgrade.
- .6 Components to be stored at a secure location provided by the Contractor at their cost.

3.5 REMOVAL AND DISPOSAL OF CANTILEVERED SIGN

- .1 The Contractor shall remove and dispose of the cantilevered static sign with amber lights as directed by the Departmental Representative.
- .2 The Contractor will dispose of the materials in an approved disposal facility approved by the Departmental Representative.

3.6 VMS AND CANTILEVERD SIGN REINFORCED CONCRETE FOUNDATION INSTALLATION

- .1 The Contractor shall excavate, form and pour concrete foundations for the VMS and the cantilevered sign as per Contractor's accepted Drawings and in accordance with AT - Standard Specifications for Highway Construction (latest edition).
- .2 Foundations will be inspected and approved by the Contractor's Design Engineer of Record and the Departmental Representative prior to VMS assembly.

3.7 VMS STEEL STRUCTURE INSTALLATION

- .1 The Contractor shall supply and fabricate the steel structure as per Contractor's accepted Drawings and in accordance with Section 24.2.2 of the AT - Specifications for Bridge Construction and the AT - Standard Specifications for Highway Construction (latest edition).
- .2 The contractor shall conduct testing in accordance with Section 24.2.2.7 of the AT - Specifications for Bridge Construction.
- .3 The Contractor shall erect the steel structure as per Contractor's accepted Drawings and in accordance with Section 24.2.3 of the AT - Specifications for Bridge Construction and the AT - Standard Specifications for Highway Construction (latest edition).
- .4 Provide grounding of steel structure in accordance with CEC Section 10.

3.8 VMS AND CANTILEVERD SIGN CONDUITS AND WIRING

- .1 The Contractor shall be responsible for conducting field investigations in order to determine the optimum placement of conduits needed to connect the VMS to the power and communications access points. The selected placement location must utilize a route which minimizes the associated impacts to surrounding infrastructure and area including vegetation and watercourses.
- .2 All conduits shall be minimum 50 mm diameter and shall meet the requirements of CSA C22.2-211.2. All conduit shall be buried a minimum of 0.9 m below grade.
- .3 Placement of all electrical lines (depth of cover, trenches alignment in relation to the roadway), shall meet the requirements of AT - Standard Specifications for Highway Construction (latest edition).
- .4 The Contractor shall be responsible for the installation of all conduits and wiring. The installation of conduits must be completed in accordance with:
- .5 Canadian Standards Association (CSA): C22.1-09, Part 1 Canadian Electrical Code.
- .6 The Contractor shall install the conduit and wiring for the cantilever sign as per the Drawings.

3.9 VMS AND CANTILEVER POWER

- .1 The VMS shall be powered from a power supply from the local electrical service in the entry kiosk. The Contractor shall complete field investigations necessary to determine the optimum method of power installation. The Contractor will then coordinate with the local Kiosk Design Engineer to supply and install the electrical cables and conduits to the VMS.
- .2 The Contractor shall be responsible for obtaining any permits and arranging for inspections of the work in accordance with the requirements of the local utility. The Contractor is responsible for obtaining locates of all underground and overhead utilities and ensuring these utilities are not impacted by the Work.
- .3 All electrical components and work shall meet or exceed the current Canadian Electrical Code and British Columbia Electrical Utility Code standards.
- .4 The Contractor shall be powered as stated on the Drawings.

3.10 COMMUNICATIONS

- .1 Connections shall be by suitable high speed data connections. Connections to hardwired lines shall be protected from high voltage and lightning strikes by a surge protective device.
- .2 The Contractor shall be responsible for obtaining any permits and arranging for inspections of the work in accordance with the requirements of the local authority.
- .3 Contractor is responsible for obtaining locations of all underground and overhead utilities and ensuring these utilities are not impacted by the Work.
- .4 Cables shall be installed with sufficient slack to accommodate for the movement of the support structure and thermal contraction/expansion.

3.11 EXCAVATION

- .1 This work will be considered incidental to “**Lump Sum – Design-Build VMS**” and no additional payment will be made.
- .2 Any excess excavation surplus to the VMS installations shall be removed from the site and disposed of at a disposal facility approved by the Departmental Representative.
- .3 The stripped organic material removed from the site shall be screened and reused as topsoil material on the site.
- .4 The Contractor shall place 100 mm of topsoil and hydroseed in areas where construction resulted in disruption of existing vegetation. It is the Contractor’s responsibility to ensure that appropriate erosion control methods are implemented to mitigate potential erosion and thus achieve environmental requirements.
- .5 At the completion of construction, all surface drainage in areas disturbed by construction shall be returned to equal or better condition than in place prior to construction.

3.12 TESTING AND COMMISSIONING

- .1 The Contractor shall be responsible for all performance verification, system integration testing, and documentation.
- .2 Additionally, all test certificates submitted shall show VMS compliance with NEMA TS4 requirements. Testing of NTCIP for VMS controllers is specified in the “NTCIP

Compliance” document. All VMS shall be tested by the sign manufacturer and the Contractor prior to final acceptance. The manufacturer and the Contractor shall demonstrate functionality of the computer hardware and control software during execution of the accepted test plan.

- .3 The Contractor shall submit an outline of the testing and commissioning procedure to the Departmental Representative demonstrating how each item will be tested including the test equipment requirements.
- .4 Additional performance verification and testing shall include:
 - .1 A demonstration of operation with the VMS controller unit including demonstration of the use of all software commands which are capable of operating the control system from the local kiosk and from PCA’s Jasper Operations office, via cellular communication link.
 - .2 A visual inspection of the equipment and demonstrating the unit is in proper working order. The units will not be accepted or deployed in the field until any deficiencies are rectified. Visibility tests including test drives during day and night conditions to verify the legibility distance. Testing at dawn or sunset will be required depending on site location. Pixel luminance shall vary automatically during the tests.
 - .3 A demonstration of all pixels activated/deactivated in alternating mode using a checkerboard test pattern for 30 minutes’ minimum.
 - .4 Continuous operation over 72 hours using a message display change every 15 minutes. Any pixel failures during this test will require satisfactory repeat of the complete test. Demonstration of various pixel luminance levels, set and operating in accordance with the specifications, is required. The sign enclosure shall not be covered during this operation.
- .5 The Contractor’s Design Engineer of Record must conduct inspections and testing to ensure the new VMS meets or exceeds all quality and functionally noted in the specifications.

END OF SECTION

22 48 00 UTILITY WORKS**Part 1 General****1.1 SUMMARY**

- .1 This section defines the procedures to be taken for the relocation and construction of the wastewater system and raw water system through the site and the coordination and construction of road lighting works.

1.2 RAW WATER SYSTEM

- .1 The Raw Water System includes all Works as detailed in the Drawings to, in general summary, decommission the existing well and its auxiliary infrastructure, provide, commission and complete the new well, connect the new well to the new kiosk, and make provisions for future use.

1.3 WASTEWATER SYSTEM

- .1 The Wastewater System includes all Works as detailed in the Drawings to, in general summary, decommission the existing wastewater tank and its auxiliary infrastructure, provide, commission and complete the new wastewater tank, and connect the new tank to the remaining wastewater infrastructure and new kiosk.

1.4 ROAD LIGHTING

- .1 The Road Lighting Works require the Contractor to coordinate ATCO Electric's salvage of existing infrastructure, ATCO Electric's supply and installation of new infrastructure, and perform all Customer responsibilities identified under ATCO Proposal D64812 (ATCO Proposal) other than ensuring required municipal development permits are in place. This specifically requires the Contractor to install all westbound road lighting duct work as detailed in the ATCO Proposal including trenching, duct work, backfilling, and warning tape with all materials other than the conduit being supplied by the Contractor.

1.5 MEASUREMENT AND PAYMENT PROCEDURES

- .1 The payment for the raw water system decommissioning, supply, and installation shall be paid under **"Lump Sum – Raw Water System"** and shall include all the labour equipment, materials, and any other costs associated with the raw water system replacement and connection.
 - .1 The "PEX water service" is to be incidental to **"Lump Sum – Raw Water System"** and is to include all labour, equipment and material supply to preform the work. This includes (but is not limited to) the trenching, stockpiling of material, pipe supply, pipe assembly, fittings, bedding material, backfill, compaction, flushing, testing and validation/certification to the satisfaction of the Department Representative.
 - .2 All conduit, cable and electrical to be incidental to **"Lump Sum – Raw Water System"** and is to include all labour, equipment and material supply to preform the work. This includes (but is not limited to) the trenching, stockpiling of material, conduit/cable supply, conduit/cable assembly, equipment install and

connections, fittings, bedding material, backfill, compaction, testing and validation/certification to the satisfaction of the Department Representative.

- .2 The payment for the sewer system decommissioning, supply, and installation shall be paid under **“Lump Sum – Wastewater System”** and shall include all the labour equipment, materials, and any other costs associated with the wastewater system replacement and connection.
- .1 The “10,000 L Wastewater tank” will be incidental to **“Lump Sum – Wastewater System”** for the supply and install (including transportation, stripping, excavating, fittings, bedding, backfilling and all related appurtenances). This is inclusive of:
 - .1 The blackwater tank and appurtenances, Connection piping and related appurtenances as shown on the design drawings.
 - .2 Electrical control system, detailed on the electrical drawing.
 - .3 Any work or products related to buoyancy control (as required and recommended by the manufacture and as approved by the Departmental Representative).
 - .4 All work and materials incidental to the supply, handling, installation, testing, repairing or for which separate payment is not provided elsewhere.
- .2 The supply and install of the 100mm PVC SDR 35 pipe is to be incidental to **“Lump Sum – Wastewater System”** and is to include all excavation, fill (supply of material, haul, place, compaction) and the pipe material, as shown on the drawings.
- .3 Manholes will be incidental to the **“Lump Sum – Wastewater System”**. Payment shall be compensation in full for excavation, supply of materials, installation of the manhole complete with bedding, benching, frame and cover, backfill and compaction.
- .4 Connections to existing manholes will be incidental to **“Lump Sum – Wastewater System”**. Payment shall be compensation in full for excavation, breaking into the manhole or catch basin; supply and installation of all concrete, pipe connectors, adaptors, bedding, grouting the junction area, benching and channeling the floor, sealing off connections to be abandoned, backfill and compaction.
- .5 Catch basins will be incidental to **“Lump Sum – Wastewater System”**. Payment shall be compensation in full for excavation, supply of materials, installation of the manhole complete with bedding, benching, frame and cover, backfill and compaction.
- .6 Breaking into manholes or catch basin manholes shall be incidental to the contract.
- .7 The “300mm concrete pipe” – shall be as supplied by Lafarge (or approved equal), and will be incidental to **“Lump Sum – Wastewater System”**, payment shall be full compensation for the following:
 - .1 Trench excavation, bedding, initial backfill, backfill and compaction as per Section “Excavation, Trenching and Backfilling” of this specification.

- .2 All work necessary for supply and installation of pipe, including pipe laying, jointing and testing of system including costs associated with camera testing.
- .3 Connections, sealants, coring and connections to tanks, catch basins, manholes or existing pipes or manholes to be incidental to this effort and will not be paid for separately unless otherwise indicated.
- .8 Removal or abandonment of existing wastewater line shall be incidental to the **“Lump Sum – Wastewater System”**.
- .3 The payment for the road lighting coordination, including decommissioning, supply, and installation shall be paid under **“Lump Sum – Road Lighting”** and shall include all the labour equipment, materials, and any other costs associated with the road lighting works.
- .4 Remitting payment to ATCO Electrical as per the ATCO Proposal is the Contractor’s responsibility and will be reimbursed under **“Lump Sum – ATCO Fee Remittance”**. Payment to the Contractor reimbursing the ATCO Fee Remittance will be made following the Contractor’s provision of written confirmation from ATCO that all necessary payments have been made. The total payment to the Contractor shall not exceed the amount noted on the ATCO Proposal for any reason.
- .5 Payments for the above shall be based on up to 20% being made once all shop drawings and approvals are in place, up to 40% once all materials have been supplied to site, up to 80% once all installation works have been completed, and up to 100% once the respective systems have been fully commissioned and accepted by the Departmental Representative.
- .6 There is no additional payment for “Trench excavation, compaction and backfilling”. This work is incidental to all Related Sections and incidental to the respective payment item, as described in that section. No extra payment will be made.
- .7 The cost of supplying, placing, maintaining and removal of shoring, bracing, cofferdams, underpinning and dewatering equipment will be incidental to the pipe installation. No extra payment will be made.
- .8 No additional payment will be made for the method selected for utility pipe installation, trenching and backfilling such as ditch witching, open trench or directional drilling. The method of installation is to be discussed and approved by the engineer, prior to the work being executed.
- .9 Traffic Control required for this Work shall be incidental to **“Lump Sum Price - Traffic Accommodation”** and no separate payment will be made to the Contractor.
- .10 Mobilization and demobilization required for this Work shall be incidental to **“Lump Sum Price – Mobilization / Demobilization”** and no additional payment will be made for remobilization of equipment if all milling work cannot be completed at once.
Environmental mitigations required in accordance with Section 01 35 43 –
- .11 Environmental Procedures, for the Work in this Section shall be incidental to the Contract and no separate payment shall be made to the Contractor.

1.6 EXCAVATION, TRENCHING AND BACKFILLING FOR PIPE AND BURIED UTILITIES

- .1 All existing buried utilities are to be protected where possible, existing utilities have been generally indicated on Drawings for general awareness and guidance, but this information is provided as reference data only. The Contractor shall locate any and all existing utilities, whether shown on the Drawings or not, prior to any excavation.
- .2 If excavating in the vicinity of suspected buried utilities, the existing utilities are to be physically located prior to the excavation, using non-damaging methods as is appropriate (such as hydrovac, hand excavation, or other approved by the Departmental Representative).
- .3 Contractor to provide a written plan (inclusive of any necessary diagrams), of where and how existing utilities are to be relocated, prior to any being relocated (ensuring all necessary permits and approvals are obtained by the Contractor).
- .4 Contractor to protect existing buildings, trees and other plants, lawns, fencing, service poles, wires, or paving located within the right of way or adjoining properties from damage while work is in progress. Repair to Departmental Representative's satisfaction any damage which may occur. If excavation necessitates root or branch cutting, do so only under direct control of the Departmental Representative.
- .5 Whenever shoring, sheeting, timbering and bracing of excavations, Contractor shall engage the services of a Professional Engineer to design and assume responsibility for adequacy of shoring and bracing. When requested by the Departmental Representative, Contractor to submit for review Drawings and Calculations signed and stamped by the Professional Engineer responsible for their preparation.
- .6 Safety requirements shall include, among other things, that the Contractor shall:
 - .1 Observe and adhere to all applicable sections of the Occupational Health and Safety Act covering the worker safety in trenches and excavations, shoring and bracing as required. Open cut trenches shall be shaped as required by the Act and the accident prevention regulations of the Occupational Health and Safety divisions of the Department of Labor and Municipal Ordinances (AB) and as may be necessary to protect life, property, the environment, and the Work.
 - .2 Adhere to all crossing permit (railway, pipeline, communications etc) requirements.
 - .3 Provide barricades, fencing around all open trenches, flares etc. to adequately denote area of excavation adjacent to roadways and public thoroughfares.
 - .4 Accept that safety is considered incidental to the cost of installing the required items and will not be paid for additionally.

Part 2 Products**2.1 EXCAVATION, TRENCHING AND BACKFILLING FOR PIPE AND BURIED UTILITIES**

- .1 When not loaded under a road, native soil may be used as backfill material, unfrozen and free from deleterious material and with moisture content within 2% of optimum.

- .2 When loaded under a road, minimize fill settlement under self-weight, native excavated soil with a moisture content not exceeding 2% of optimum shall be conditioned and dried prior to use as backfill.
- .3 Self compacting granular material (20-80mm diameter, pending application) shall be used in lieu of unsuitable native material, unless other wise directed by the Departmental Representative.

2.2 WASTEWATER TANK

- .1 Contractor to meet the design requirements as shown in the approved construction civil detail drawing for the tank, as supplied by ZCL Composites Inc. (ZCL) or an approved equivalent. The tank and its installation to achieve:
 - .1 Tank to be suitable for AASHTO load rating of H-20, for given cover provided (as shown on the Drawings).
 - .2 Contractor to provide shop drawings from the manufacturer for approval by the Departmental Representative to verify the tank specifications have been met prior to ordering and installation, including suitable buoyancy mitigation (as recommended by the manufacturer).
 - .3 Completed with access hatches, vents, and piping, as shown on the design Drawings. All Access hatches, piping, and appurtenances that rise above the surface must extend a minimum of 300mm above finished grade surface (surface grading to slope away from the surface appurtenances, vents, and accesses).
 - .4 HVAC access hatch to be 600x600mm (minimum) checker plate stainless steel lockable and watertight swing door.
 - .5 Suitable, sealed connections to the treated water tank (installed as per manufacturer's recommendations).
 - .6 Tank to be fibreglass reinforced plastic (FRP), as supplied by ZCL or approved equivalent.
 - .7 Standards – FRP tank to adhere to the following:
 - .1 Tank manufacturer shall be recognized by Underwriters Laboratory of Canada as a manufacturer of tanks listed to the ULC S615 Standard.
 - .2 Tank manufacturer shall be recognized by Underwriters Laboratory of Canada as a manufacturer of tanks listed to the CSA B-66 prefabricated septic and sewage holding tanks.
 - .3 ANSI/AWWA D120 – Thermosetting fibreglass-reinforced
 - .4 American Concrete Institute (ACI) standard ACI 318, Building Code Requirements for Structural Concrete.
 - .8 Tank Design and Operational Requirements – Single or doubled walled (as shown on the Drawings). If double walled:
 - .1 The interstitial space between the primary and secondary walls shall be constructed with glass reinforcement such as Parabeam, which provides a structural bond between the two tank walls, while creating a defined interstice that allows for free flow of air or liquid.

- .2 A tank top fitting shall be provided to allow for a monitoring sensor to be installed at the bottom of the interstice.
- .3 The interstice of the tank shall be designed to withstand 20-PSIG (138kPa) pressure.
- .9 Tank structure – as per approved shop drawings, stamped by a professional engineer.
 - .1 If required, structured ribs are to be fabricated as an integral part of the tank wall.
 - .2 FRP tanks shall be manufactured with laminate consisting of resin and glass fiber reinforcement only, no sand/silica fillers or resin extenders shall be used.
 - .3 Tank shall be vented to atmospheric pressure.
 - .4 Tank shall be capable of holding liquids with specific gravity of up to 1.1.
 - .5 Tank shall be compatible with liquids identified in the manufacturer's standard limited warranty.
- .10 Fittings – the tank size, fittings and accessories shall be as shown on the Drawings.
 - .1 Tank shall be equipped with factory-installed flanged pipe stubs (unless otherwise directed). In the case of bell and spigot piping being used, suitable adaptors are to be used to connect to the tank (as discussed and approved by the Departmental Representative). All fittings to be sealed using methods which permit natural flexing, associated with tank settlement.
 - .2 PVC piping shall at a minimum meet the requirements of ANSI schedule 40.
 - .3 All flanged nozzles shall be flanged and flat-faced, and conform to class 150 bolting patterns as specified in ANSI/ASME/ B16.5.
 - .4 Carbon steel and stainless-steel NPT fittings shall withstand a minimum of 150 foot-pounds (203Nm) of torque and 1,000 foot-pounds (1356Nm) of bending, both with a 2:1 safety factor.
- .11 Loading conditions – Tank shall meet the following design criteria.
 - .1 Internal load – tank shall be designed to withstand a 5-PSIG (35kPa) air-pressure test with a safety factor of 5:1.
 - .2 Surface loads – tank shall be designed to withstand surface H-20 and HS-20 axle loads when properly installed according to manufacturer's current installation manual and operating guidelines.
 - .3 External hydrostatic pressure – tank shall be designed for 7 feet (2.1m) of overburden over the top of the tank, the hole fully flooded, and safety factor of 5:1 against general buckling.

- .12 Tank anchoring, buoyancy control – anchor straps shall be as supplied by tank manufacturer and designed for a maximum load of 25,000 lbs (11340kg). Galvanized turnbuckles shall be supplied by the tank manufacturer. Prefabricated concrete anchors shall be supplied by the tank manufacturer, designed to the ACI 318 Standard, manufactured with 4,000 PSI concrete and shall have adjustable anchor points.
- .13 Accesses – all access openings shall have a diameter of 610mm or 762mm and be PVC or FRP as supplied by the tank manufacturer (or approved equals), complete with riser, lid and necessary hardware. Attached access risers shall be 610mm or 762mm diameter. Access risers shall be attached to access openings during installation utilizing adhesive or FRP bonding kits as supplied by the tank manufacturer. Accesses used for manways shall be flanged, 762mm diameter and complete with gaskets, bolts and cover. Manway openings shall be designed to withstand 5-PSIG (35kPa) test pressure with a 5:1 safety factor.
- .14 Ladders – ladders shall be the standard FRP ladder provided by the tank manufacturer.

2.3 MANHOLE AND CATCH BASIN

- .1 Precast manhole units – to be supplied by Lefarge, or approved equal:
 - .1 Standard round (1200mm) manholes to ASTM C478M, circular, top sections flat slab type with opening for offset for vertical ladder installation.
 - .2 Manholes to be completed with Riser-Wrap (as supplied by Martech) or approved equal to minimize infiltration into manholes.
- .2 Joints as follows:
 - .1 Sanitary manhole shall have all joints made watertight utilizing rubber gaskets conforming to the requirements of CSA-A257.3 and ASTM C448, preformed bituminous gasket or other approved sealant.
 - .2 Storm manholes and catch basin barrel section joints may be left unparged. Joints between slab top, concrete adjusting rings, and frame shall be made watertight utilizing preformed bituminous gasket or other approved sealant.
- .3 Mortar:
 - .1 Aggregate to CAN3-A82.56.
 - .2 Masonry cement: to CAN/CSA-A3000-A8 sulphate resistant type 50.
- .4 Ladder rungs – to CAN/CSA-G30.18, NO.25M billet steel deformed bars, hot dipped galvanized to CAN/CSA-G164, rungs to be safety pattern drop step type.
- .5 Adjusting rings – to ASTM C478M.
- .6 Frames, gratings, cover – to dimensions as indicated and the following requirements:

- .1 Metal gratings and covers to bear evenly on frames. A frames with gratings or cover to constitute one unit. Assemble and mark unit components before shipping.
- .2 NF-80 gray iron casting to ASTM A536 Class 60-40-18.
- .3 Casting sand blasted cleaned and ground to eliminate surface imperfections and coated with two (2) applications of asphalt varnish.

2.4 CONCRETE PIPE AND PIPE PRODUCTS

- .1 All concrete pipe and outfalls (flared ends) shall be reinforced concrete pipe as supplied by Lafarge Canada or approved equal.
- .2 Concrete used in sewer construction shall be manufactured from sulphate resistant cement type HS (type 50) in accordance with CSA A3001 or type v in accordance with ASTM C150. All concrete structures shall be designed for CL-800 truck loading as per CSA-S6-00 (Canadian highway bridge design code).
- .3 900mm diameter and smaller shall conform to ASTM C76/ C76M.
- .4 1050mm diameter and larger may be designed by direct design methods in accordance with American society of civil engineers (ASCE) standard practice for direct design of buried precast concrete pipe using standard installations (SIDD) 15 and shall conform to ASTM C1417. When the direct design method is employed, reports shall be provided to the engineer showing that:
- .5 The manufacturer has completed the reinforced concrete design by direct design methods in accordance with ASCE SIDD no. 15. That the product meets the design carried out by the original design engineer responsible for the project
- .6 All gaskets shall conform to CSA A257.3 (joints for circular concrete sewer and culvert pipe, manhole sections, and fittings using rubber gaskets) or ASTM C443 (joints for circular concrete sewer and culvert pipe, using rubber gaskets).
- .7 Mortar, if specifically required and approved for pipe joints by the engineer, shall consist of one part sulphate resistant cement type HS (type 50) in accordance with CSA A3001 or type v in accordance with ASTM C150 to two parts of clear sharp sand.

2.5 BURIED PVC WASTEWATER PIPE

- .1 All sanitary sewer pipe to be PVC SDR 35 conforming to polyvinyl chloride (PVC) to ASTM D3034, CSA B182.1 and B182.2.
- .2 Pipe to be separate gasket and integral bell system
- .3 All joints to meet requirements of specification for joints for drain and sewer plastic pipes using flexible elastomeric seals (ASTM 03212).
- .4 PVC pipe may be any color except blue.
- .5 PVC pipe to be as supplied by Ipex or approved equal.

2.6 WATER SERVICE

- .1 Water service pipe to be cross-linked polyethylene (pex) Ipex blue 904 SDR 9 (CTC) as supplied by Ipex, or approved equal.

2.7 WELL POWER/CONTROL CONDUIT AND RELATED ELECTRICAL

- .1 DB2 PVC conduit and fittings: for all underground conduit (as supplied by Ipex or approved equal). Minimum size to be ¾" (19mm), or larger (as required by manufacture recommendation or applicable codes and regulations).
- .2 Liquid tight flexible metallic conduit: in damp and wet location for connection to pumps, solenoid valves, and similar devices shall be made by using liquid tight metallic conduit. Provide a separate ground wire, independent of conduit, run inside conduit and bonded at both ends to enclosures. Maximum length of 24" (610mm).
- .3 All cable connecting to vibrating equipment, pumps or similar to be copper.
- .4 Contractor to obtain and pay for all necessary permits and authorizations. The cost of these will be considered incidental to the tender price for this work.
- .5 All materials, equipment, fittings and other furnishings supplied or required to undertake this work used shall be new and of specified quality, unless specifically authorized by the departments representative.
- .6 Contractor to create and submit a maintenance manual, including all: operation information and pump curves, operation manuals, equipment contact information, warrantee information (including the Contractor's warranty, site notes, commissioning information, contractor contact information).
- .7 All work and materials to be covered by a minimum one (1) year warranty from the time of final acceptance of the work, during this time the contractor shall replace at no cost identified defective work or equipment (provide the failure was not due to improper usage or normal wear and tear).

Part 3 Execution**3.1 EXCAVATION, TRENCHING AND BACKFILLING FOR PIPE AND BURIED UTILITIES**

- .1 Site preparation – remove trees, shrubs, vegetation, fences, and other obstructions, ice and snow, from surface to be excavated within limits indicated on the Drawings. Strip top soil from within limits of excavation and stockpile (complete with appropriate erosion and sedimentation protection, meeting the Departmental Representative's approval). For respreading after backfilling, avoid intermixing of subsoil fill materials with organic material from other forms of contamination.
- .2 Dewatering – keep excavation dry while Works are in progress. Dispose of water in a manner not detrimental to public health, the environment, public and private property or any portion of the work completed or under construction. Dewatering is considered incidental to the Contract Price and no additional payment will be made. Do not obstruct the flow of surface drainage or natural water courses.
- .3 Excavation – excavate only to the lines, levels, grades, and elevations indicated on the Drawings. Existing ground profiles are approximate only. If an open trench method is used for pipe installation, then:
 - .1 The Contractor shall confine their activities to the immediate area of the trench. All activities outside the trench boundaries shall be performed so as not to damage other existing features. Every effort shall be made to restrict the trench widths to minimize the area disturbed.

- .2 All excavation material shall be piled at least 1.0m clear of the trench top to prevent material from falling back into the excavation. The material shall be piled in such a manner that it will not endanger the work, or obstruct other work or Rights-of-way. Sufficient clear space must be left on one side of the trench to accommodate surveyor's stakes.
 - .3 Notify Departmental Representative when soil at proposed elevation of trench bottom appears unsuitable for backfill. Remove unsuitable material and replace with material approved by the Departmental Representative.
 - .4 Notify the Departmental Representative if new construction conflicts with a discovered obstruction. Allow sufficient time to consider alternative alignment to avoid conflict with obstruction. Modify alignment as directed by the Departmental Representative.
 - .5 Unless otherwise authorized by the Departmental Representative, do not excavate more than 30m of trench in advance of installation operations and do not leave open more than 15m of trench at end of day's operation.
 - .6 Place suitable excavated materials required for trench backfill in approved location.
 - .7 Dispose of surplus and unsuitable material at a location approved by the Departmental Representative.
 - .8 Excavate rock, if required, to a level of 150mm below the pipe invert, tank, pedestal, or other installed item.
 - .9 Where required due to removal of unsuitable material or unauthorized over excavation, bring bottom of excavation to design grade with approved material.
- .4 Backfilling – native soil shall be used as backfill material (other than under road as noted above). No boulders, rock, ice, snow, organic matter, or debris shall be permitted in the trench. These unsuitable materials shall be hauled away. All surplus excavated material shall also be hauled away, or disposed of as directed. In the event of deficiency of backfill material, suitable material shall be supplied by the Contractor at their expense.
- .1 The Contractor shall be responsible for adequate compaction of trenches and for the correction of settlement during the warranty period of the Contract. Mechanical compaction equipment shall not be used until there is sufficient cover to the pipe or item to prevent damage.
 - .2 All backfill shall be unfrozen and free of organics and delirious material. Backfill material shall be approved by the Departmental Representative prior to backfill and compaction. Minimum compaction shall be 98% SPD unless otherwise noted on the Drawings.
 - .3 The type of compaction equipment shall be chosen with regard to minimizing the vibration effect on nearby buildings and utilities. The Contractor shall inspect the condition of buildings prior to

construction. The Contractor is responsible for any damage caused to buildings during construction.

- .5 Testing – Compaction Results shall be based on a minimum of one density test per 10m of trench for each 0.3m of vertical backfill. Additional tests may be called for by the Departmental Representative as deemed necessary.
 - .1 If a density test indicates insufficient compaction at any depth, then two more densities, that are proportionally representative of trench length, shall be taken at that depth. If the average of these tests is below the required density, the trench shall be re-excavated and re-compacted to meet the specified density.
 - .2 This testing in no way relieves the Contractor of their maintenance responsibilities with respect to settlements as specified. The Contractor shall repair any settlement and damaged surface improvements due to the settlement that occurs during the warranty period.
 - .3 The cost of the initial testing shall be borne by the Contractor. Non-conformity with the specified density or moisture content shall constitute sufficient grounds for rejection of the Work.
 - .4 Compaction in the pipe zone (300mm above the obvert of the pipe and below) shall be 95% SPMDD. Compaction above the pipe zone shall be 98% SPMDD.
- .6 Restoration – Replace topsoil as directed by the Departmental Representative in accordance with the Contract Documents.

3.2 WASTEWATER TANK

- .1 Shop drawing submission – Contractor to submit shop drawings of proposed tank and electrical control system. Tank details, components and dimensions as shown in the Drawing details:
 - .1 Storage facilities and product handling and erection
 - .2 Openings, sleeves, inserts and related appurtenances as shown on the Drawings
 - .3 Manufacturer certified AASHTO load rating for depth of bury of tank shown on Drawings
 - .4 Each drawing submission shall bear stamp and signature of qualified Professional Engineer registered to practice in Alberta.
- .2 To install the tank, undertake any excavation, trenching and backfilling in accordance with safe excavation methods and in accordance with Section 22 48 00 Clauses 2.1 and 3.1.
- .3 Install tank, bedding material and all connections and appurtenances to manufacturer's specifications and in accordance with the Drawings.
 - .1 If a ZCL tank is used, the installation manual "Installation of ZCL Fibre Glass Underground Storage Tanks" or approved equal installation and testing requirements by other manufacturer as approved by the Departmental Representative.

- .2 If a FRP tank is to be installed, testing is to be pressure testing, as per the manufacturer's specifications and as approved by the Departmental Representative.

3.3 MANHOLE AND CATCH BASINS

- .1 Trench excavation, bedding, initial backfill, backfill and compaction as per Section 22 48 00 Clauses 2.1 and 3.1.
- .2 Set precast concrete base on a minimum of 150mm of granular bedding to depth, compacted to 98% Standard Proctor Density. Approved granular material (typically preferred option, subject to site conditions) with the following gradation:
 - .1 100% (by weight) passing through 20mm sieve
 - .2 0-10% (by weight) passing through 4.75mm sieve
 - .3 0-5% (by weight) passing through 2.5mm sieve
- .3 Set bottom section of precast units in bed of cement mortar and bond to concrete slab or base. Make each successive joint watertight using approved rubber ring gaskets or bituminous compound or combination thereof, as per manufacturer's recommendations.
- .4 Backfill entire disturbed area with approved self-compacting, granular backfill material to a depth of 100mm above the crown of any incoming pipes or connections. Upon engineering confirmation, approved backfill material can be used to backfill rest of excavation.
- .5 Set frame and cover to required elevation on no more than three (3) concrete rings.
- .6 Place manhole frame and cover on top section to an elevation 5mm below finished surface elevation and 10mm behind the face of curb, if applicable.
- .7 Clean units of debris and foreign materials. Remove fins and sharp projections. Prevent debris from entering system. Clean any debris that enter the manholes prior to completing the Works.

3.4 CONCRETE PIPE AND PIPE PRODUCTS

- .1 Preparation - clean pipes and fittings of debris and water before installation. Inspect materials for defects before installing. Remove defective materials from site.
- .2 Trenching and backfill - undertake any excavation, trenching and backfilling in accordance with safe excavation methods and in accordance with Section 22 48 00 Clauses 2.1 and 3.1 of this specification.
- .3 Installation - lay and join pipe in accordance with manufacturer's recommendations and handle pipe with approved equipment.
- .4 Lay pipes on prepared bed, true to line and grade with pipe inverts smooth and free of sags or high points. Ensure barrel of each pipe is in contact with shaped bed throughout its full length.
- .5 Commence laying at outlet and proceed in upstream direction with bell ends of pipe facing upgrade. Do not exceed maximum joint deflection or maximum bending radius recommended by pipe manufacturer.
- .6 Do not allow water to flow through pipes during construction except as may be permitted by engineer. Whenever work is suspended, install removable watertight bulkhead at open end of last pipe laid to prevent entry of foreign materials.

- .7 Position and join pipes by approved methods. Do not use excavating equipment to force pipe sections together. Install gaskets as recommended by manufacturer. Support pipes with hand slings or crane as required to minimize lateral pressure on gasket and maintain concentricity until gasket is properly positioned. Align pipes carefully before joining. Maintain pipe joints free from mud, silt, gravel and other foreign material. Avoid displacing gasket or contaminating with dirt or other foreign material. Remove disturbed or dirty gaskets; clean, lubricate and replace before joining is attempted. Apply sufficient pressure in making joints to ensure that joint is complete as outlined in manufacturers recommendations
- .8 At rigid structures (manholes, other pipes, etc), install pipe joints not more than 1.2 m from side of structure.
- .9 Block pipes as directed when any work stoppage occurs, to prevent creep during down time.
- .10 Plug lifting holes with approved prefabricated plugs set in non-shrink grout. Cut pipes as required for special inserts, fittings or closure pieces in a neat manner as recommended by pipe manufacturer without damaging pipe or its coating and to leave a smooth end at right angles to axis of pipe. Make watertight connections to manholes using suitable gaskets. If suitable gaskets cannot be used or are not available:
- .11 All pipe to bedding (installed 150mm above and below pipe zone) to be approved native material (free of organics, frozen material or delirious materials and approved by the engineer) or approved granular material (typically preferred option, subject to site conditions) with the following gradation:
 - .1 100% (by weight) passing through 20mm sieve
 - .2 0-10% (by weight) passing through 4.75mm sieve
 - .3 0-5% (by weight) passing through 2.5mm sieve
- .12 Rip rap - Class One rip rap (as per Alberta Transportation) to be placed at both culvert ends and extends for 1m in the direction of water flow. Rip rap is to be keyed into the ground by 100mm complete with non-woven geotextile fabric under entire rip rap footprint. Rip rap placement is considered incidental to the cost of installing the culvert and will not be paid for in addition, unless otherwise noted.
- .13 Inspection - the cost of flushing and video inspection of the entire length of installed pipe shall be considered incidental to the cost of installing the pipe. This must be completed to the satisfaction of the Departmental Representative prior to payment for line item.

3.5 BURIED PVC WASTEWATER PIPE

- .1 To install the pipe, undertake any excavation, trenching and backfilling in accordance with safe excavation methods and in accordance with section “excavation, trenching and backfilling” of this specification.
- .2 All pipe delivery and handling using approved equipment.
- .3 Pipe to be clean and fittings cleared of debris, prior to installation.
- .4 Pipe to be installed as per manufacture installation instruction (if supplied by Ipex: <http://www.ipexna.com/media/4425/sewer-piping-systems-installation-guide.pdf>)
- .5 All pipe to bedding (installed 150mm above and below pipe zone) to be approved native material (free of organics, frozen material or delirious materials and approved by the

engineer) or approved granular material (typically preferred option, subject to site conditions) with the following gradation:

- .1 100% (by weight) passing through 20mm sieve
- .2 0-10% (by weight) passing through 4.75mm sieve
- .3 0-5% (by weight) passing through 2.5mm sieve
- .6 Inspection - the cost of flushing and video inspection of the entire length of installed pipe shall be considered incidental to the cost of installing the pipe. This must be completed to the satisfaction of the engineer prior to payment for line item.
- .7 Removal or abandonment of existing wastewater line -
 - .1 If the existing wastewater main is to be abandoned in place:
 - .1 The piping is to have a minimum 1 meter length removed from the points of abandonment.
 - .2 The ends are to be sealed to prevent ground water migration.
 - .2 If the existing wastewater main is to be removed:
 - .1 Excavation and backfill shall be in accordance with “excavation, trenching and backfilling for pipe and buried utilities”.
 - .2 All compaction to be 98% SPDD unless otherwise specified, with fill being free of frost, rocks and organics.

3.6 WATER SERVICE

- .1 Piping to be installed as per the design drawings, following the trenching, bedding and compaction requirements found in the applicable section.
- .2 Piping and fittings are to be acceptable in accordance with manufactures requirements to the satisfaction of the department representative
- .3 Once all piping, valves and fittings have been installed to the satisfaction of the department representative, the water service is to be flushed, pressure tested and certified:
 - .1 Pressure test -
 - .1 Contractor to supply all equipment and water required to undertake pressure testing operation.
 - .2 Water to be supplied as clean and chlorinated, certified as potable (minimum 0.2mg/l free chlorine).
 - .3 After preliminary flushing, contractor to undertake a 2-hour pressure test at a pressure 1.5 times the standard operation pressure (not to exceed the ultimate pressure rating of the pipe).
 - .4 Once the system is pressurized, the system is not permitted to drop more than 34.75 kPa (5psi) to be considered a “pass”.
 - .5 The department representative is to witness the entire procedure, including inspection of the pressure gauges and pressure test equipment, prior to or after the test is completed.
 - .2 Flushing and testing -

- .1 Contractor to supply all equipment and water required to undertake flushing operation. It is the Contractor's responsibility to ensure the water service is not put into service until the satisfactory water test results have been received.
- .3 Disinfection flushing -
 - .1 Water used for disinfection flushing to be minimum 25mg/l free chlorine concentration (using a solution of calcium hypochlorite, confirming to AWWA B300-99 or AWWA B301-99).
 - .2 The solution shall be circulated to all extremities of the system to the satisfaction of the Departmental Representative (ensuring that all high points, potential air points, dead ends, etc. are circulated).
 - .3 The disinfection solution shall remain in place for a period of 24hrs, prior to discharge.
 - .4 During this period, all valves, air releases, and other actuators in the system shall be operated to ensure disinfection solution contact with all parts of the system (record of this to be noted in the Contractor's submittals with green ink on a drawing mark up).
- .4 Final flushing -
 - .1 Water to be supplied as clean and chlorinated, certified as potable (minimum 0.2mg/l free chlorine)
 - .2 Flushing to ensure full turn over of all disinfection water including all extremities of the system to the satisfaction of the Departmental Representative (ensuring that all high points, potential air points, dead ends, etc. are circulated)
 - .3 Flushing is to be continuous until all access points of the system can be field tested as:
 - .1 Residual chlorine of 0.2 mg/l or more
 - .2 Turbidity of 1.0 ntu or less
- .5 Bacterial and chlorine samples are to be taken at the time of the flushing being completed and submitted in accordance with a certified laboratories requirements (following the requirements of the City of Edmonton, or other approved process).
- .6 Flushing water to be directed to the blackwater system (if approved, with the contractor covering all associated hauling costs, if applicable) or dechlorinated using an approved procedure prior to discharge.
- .7 Minimum 5 days notice is to be given by the contractor to the Departmental Representative, prior to any of the above noted testing, QA/QC processes. The Departmental Representative is to witness the above noted testing, QA/QC processes, unless otherwise directed in writing to the Contractor.

3.7 WELL POWER/CONTROL CONDUIT AND RELATED ELECTRICAL**.1 Conduit -**

- .1 The Drawings show schematically, scope of works required. Contractor to provide all necessary tools, labour, transport, and facilities necessary to complete the electrical installation. Even if these Drawings do not specifically or fully show the full extent of efforts required to meet applicable codes, the Contractor is to provide all required facilities, labour and tools to undertake this work in a safe and compliant fashion.
- .2 All work to be completed in accordance with the current edition of the Canadian Electrical Code, National Building Code, and applicable Federal, Provincial and local jurisdiction codes and regulations.
- .3 In all empty conduits, install a 200lb (90kg) tensile strength polyethylene tow rope, secured at both ends.
- .4 Conduit to be electrically continuous throughout. Install a continuous, code sized insulated green, copper grounding wire, pulled with phase and/or neutral wires.
- .5 Conduits to be spaced minimum 12" (300mm) from a water line, unless otherwise directed by the department representative.
- .6 Conduit terminations at junction boxes/enclosed weather proof boxes, shall be made water tight, using specified hubs and connectors.
- .7 Install an expansion joint at any crossing of a building separation or expansion joint.
- .8 All floor penetrations are to be sealed and water tight. Maintain fire rating and protection as required. Fire safe all penetrations using 3m listed fire safe sealants and assemblies.
- .9 Installed conduits to be well protected during construction and metallic bushings ("pennies") to seal open ends.
- .10 Obtain a certificate of inspection and approval from the electrical inspection department having authority, submitting this to the Departmental Representative as soon as the work has been completed.
- .11 Coordinate work and site access with other trades and users of the site to avoid delays.
- .12 Report and touch up with matching colour and quality paint, any damaged surfaces, resulting from this work.
- .13 Do not permit waste to accumulate, remove from site as able to ensure a neat, tidy and safe work site.

.2 Cable -

- .1 Conductors shall not be installed until all work of any work that could cause damage, has been completed. Care shall be taken to ensure that no conductor, insulation, or similar is damaged when installed.

- .2 Insulation to be CSA approved, non-petroleum based and insulating pulling compound shall be used as required.
- .3 All cables to be pulled and tested as per manufacture recommendation and warrantee requirements.
- .4 All aspects of splicing and terminating shall be in accordance with published manufacture recommendations.
- .5 Make up all splices in boxes with approved connectors with separate tails of correct colour to be made up to splice. Provide minimum 6" (150mm) of extra length in box, after splice has been made.
- .6 All wire bundles in boxes, equipment enclosures, terminal cabinets, etc to be neatly bundled and clamped.

.3 Equipment -

- .1 All equipment, enclosures, raceways, fixtures, etc. shall be permanently grounded by provided code sized grounding wire
- .2 Contractor to submit shop drawings prior to ordering equipment, for review and approval by the Departmental Representative.

END SECTION

13 34 00 KIOSK CONSTRUCTION AND LANDSCAPING**Part 1 General****1.1 SUMMARY**

- .1 This section defines the procedures to be taken for the construction of the kiosk building and all related works at the Jasper East Gate.

1.2 REFERENCES

- .1 Jasper East Gate – Kiosk - Specification Manual
- .2 Kiosk Construction and Landscaping Drawings.

1.3 PRECEDENCE

- .1 When there is a conflict in the Contract Documents the precedence shall be as such from highest to lowest:
 - .1 Specifications
 - .2 Jasper East Gate – Kiosk - Specification Manual
 - .3 Drawings

1.4 MEASUREMENT AND PAYMENT PROCEDURES

- .1 The payment for the kiosk construction and landscaping shall be paid under “**Lump Sum – Kiosk Construction and Landscaping**” and shall include all the labour equipment, materials, and any other costs associated with the kiosk construction and landscaping.
- .2 Interim monthly payments will be made based on the percentage of the kiosk works completed. The percentage completed will be based on the months as-built schedule and determined by the Departmental Representative.
- .3 Traffic Control required for this Work shall be incidental to “**Lump Sum Price - Traffic Accommodation**” and no separate payment will be made to the Contractor.
- .4 Mobilization and demobilization required for this Work shall be incidental to “**Lump Sum Price – Mobilization / Demobilization**” and no additional payment will be made for remobilization of equipment if all milling work cannot be completed at once.
Environmental mitigations required in accordance with Section 01 35 43 –
- .5 Environmental Procedures, for the Work in this Section shall be incidental to the Contract and no separate payment shall be made to the Contractor.

1.5 INDIGENOUS CONTRACTORS

- .1 It is required that at least one of the following indigenous Contractors be engaged for the landscaping work outlined in this section;
 - .1 Bear Hills Industry
Matt Barich
Email: matt@bearhillsindltd.com

- Phone: 403-304-6828
- .2 Mur-Cal Services Ltd.
Murray Callihoo
Email: info@mur-cal.ca
Phone: 780-539-0928
- .3 ENOCH Construction Ltd
Summer Ebinger
Email: ecl@enochnation.ca
Phone: 780-470-5079
- .1 Aseniwuche Development Corporation
Jeanette Harnish
Email: jharnish@adcalberta.com
Phone: 780-827-9670

Part 2 Products

- .1 All products are to be in accordance with the Jasper East Gate – Kiosk – Specification Manual.

Part 3 Execution

- .1 Execution of the Contract Works will be in accordance with the Jasper East Gate – Kiosk – Specification Manual and Jasper East Gate – Kiosk - Drawings.

END SECTION

**KIOSK
SPECIFICATIONS
JASPER EAST GATE
Jasper, Alberta**

for:

Parks Canada

Issued for 100% and Building Permit
Project Number: PRO 1285

NORR

ARCHITECTS ENGINEERS PLANNERS

Suite 2300, 411 – 1st Street SE
Calgary, AB T2G 4Y5

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www.norr.com

SPECIFICATIONS GROUP**GENERAL REQUIREMENTS SUBGROUP**

DIVISION 01	GENERAL REQUIREMENTS
01 00 15	General Requirements

FACILITY CONSTRUCTION SUBGROUP

DIVISION 03	CONCRETE
03 10 00	Concrete Forming and Accessories
03 20 00	Concrete Reinforcing
03 30 00	Cast-in-Place Concrete

DIVISION 04	MASONRY
04 40 00	Stone Veneer

DIVISION 05	METALS
05 50 00	Metal Fabrications
05 51 00	Metal Stairs

DIVISION 06	WOOD, PLASTICS AND COMPOSITES
06 10 10	Rough Carpentry
06 17 53	Shop Fabricated Wood Trusses
06 40 00	Architectural Woodwork

DIVISION 07	THERMAL AND MOISTURE PROTECTION
07 21 13	Board Insulation
07 21 16	Blanket Insulation
07 21 19	Foam-in-Place Insulation
07 27 19	Air and Vapour Retarders
07 31 00	Synthetic Shingles
07 41 65	Preformed Metal Soffit Panels
07 62 00	Sheet Metal Flashings and Trim
07 71 23	Manufactured Gutters and Downspouts
07 84 00	Firestopping
07 92 00	Joint Sealing

DIVISION 08	OPENINGS
08 11 00	Metal Doors and Frames
08 30 50	Floor Hatch
08 52 00	Aluminum Windows
08 71 00	Door Hardware
08 80 50	Glazing

DIVISION 09	FINISHES
09 24 23	Portland Cement Stucco
09 29 00	Gypsum Board
09 65 16	Resilient Sheet Flooring
09 91 05	Re-Painting
09 91 10	Painting

Project No. PRO1285

DIVISION 10

10 11 00	Whiteboards and Tackboards
10 15 00	Exterior Signage
10 28 00	Washroom Accessories

SPECIALTIES**DIVISION 21**

21 05 01	Common Work Results – Mechanical
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MECHANICAL**DIVISION 22**

22 05 00	Common Work results for Plumbing
22 11 16	Domestic Water Piping
22 13 18	Drainage Waste and Vent Piping – Plastic
22 30 05	Domestic Water Heaters
22 42 01	Plumbing Specialties and Accessories
22 42 03	Commercial Washroom Fixtures
22 42 16	Commercial Lavatories and Sinks

PLUMBING**DIVISION 23**

23 01 31	Air Duct Cleaning for HVAC Systems
23 05 00	Common Work Results for HVAC
23 05 05	Installation of Pipework
23 05 13	Common Motor Requirements for HVAC Equipment
23 05 93	Testing, Adjusting and Balancing for HVAC
23 05 94	Pressure Testing for Ducted Air Systems
23 07 13	Duct Insulation
23 07 15	Thermal Insulation for Piping
23 31 13	Ductwork
23 33 00	Air Duct Accessories
23 33 14	Dampers Balancing
23 33 46	Flexible Ducts
23 33 53	Duct Liners
23 37 13	Diffusers, Registers and Grilles
23 37 20	Louvers, Intakes and Vents
23 51 00	Breeching, Chimneys and Stacks
23 54 16	Fuel Fired Furnaces

HEATING VENTILATION AND AIR CONDITIONING (HVAC)**DIVISION 26**

26 05 01	Common Work Results for Electrical
26 05 02	Electrical Basic Materials and Methods
26 05 26	Grounding
26 05 54	Identification of Electrical Systems
26 24 16	Panelboards
26 50 00	Lighting

ELECTRICAL**DIVISION 27**

27 05 00	Common Work Results for Communication
27 05 53	Identification for Communications
27 08 00	Commissioning and Testing for Communications
27 15 00	Communications Horizontal Cablings

COMMUNICATION

SITE AND INFRASTRUCTURE SUBGROUP

DIVISION 31

31 00 00

SITEWORK

Earthwork (Broad Scope)

END TABLE OF CONTENTS

1 SUMMARY OF WORK

- .1 Construction of new gate kiosk and required auxiliary work at East Gate of Jasper National Park, Alberta.
- .2 Work includes, but is not limited to the following:
 - .1 Construction of new kiosk building as indicated on drawings prepared by NORR Architects Engineers Planners and specified herein.
 - .2 Mechanical and electrical systems.
 - .3 Landscaping directly related to kiosk.
 - .4 Other items as indicated on drawings.

2 PROJECT CO-ORDINATION

2.1 Site Examination

- .1 Visit the site and compare drawings and specifications with existing conditions, including all conditions surrounding the site prior to submitting bids.
- .2 Failure to visit the site will not relieve the Contractor from supplying any materials or performing any work in accordance with drawings and specification, without additional cost the Departmental Representative.
- .3 Submission of bid will be deemed to be evidence that the Contractor has examined the site and is familiar with conditions under which work will be performed.

2.2 Co-ordination

- .1 Co-ordinate progress of the work, construction schedules, submittals, use of the site, temporary utilities, construction facilities and controls.
- .2 Ensure work is co-ordinated and scheduled to minimize conflicts between trades and to avoid delays.
- .3 Notify trades of readiness for their Work and to allow adequate time for preparation and installation.
- .4 Examine drawings, specifications, existing conditions and report to the Departmental Representative, in writing, any omissions or irregularities that may affect the performance of the work. In the absence of any such report, the Contractor and all trades will be held to have waived all claims to extra costs for performance of the work.
- .5 Supply all items to be built-in, including anchors, ties, nailing strips, blocks, bolts, sleeves and any other miscellaneous items, together with any templates, measurements and shop drawings.
- .6 Establish correct locations of sleeves, inserts, hangers, holes and chases.

2.3 Diagrammatic Locations

- .1 Check and verify all dimensions as work proceeds.
- .2 Un-dimensioned locations of equipment indicated or specified are to be considered as approximate. Confirm all un-dimensioned locations prior to beginning any installation.
- .3 Where locations or holes in structural elements may possibly affect the nature or strength, inform the Departmental Representative prior to beginning any work.
- .4 Inform Departmental Representative of impending installation of items of work that are diagrammatically indicated on the drawings, and obtain acceptance of actual locations.
- .5 Submit field drawings to indicate relative locations of various services and equipment as required by Departmental Representative.

2.4 Smoking

- .1 Do not allow any personnel to smoke in the building or on the surrounding site. Anyone found smoking will be immediately asked to leave the site.

2.5 Harassment

- .1 All personnel working at this site must comply with the following harassment guidelines to prevent conduct defined as harassment.
- .2 Harassment is defined as unwanted attention by actions or in oral, written, or graphic form. Any conduct which creates an offensive or intimidating environment is also considered Harassment.
- .3 All Subcontractors and Suppliers shall be familiar with these requirements and ensure that no conduct which could be considered as Harassment occurs on this Project.
- .4 All site offices, storage areas, and the entire construction site shall be deemed public spaces for the purposes of this definition.

2.6 Responsibility for Existing Property

- .1 Assume responsibility for the care, custody and control of property which is assigned for performance of the Work.
- .2 Assume responsibility for and repair damage to existing property attributable to performance of Work of this Contract.
- .3 Request permission to load materials on to the structure where such loading would possibly affect the nature or strength of the structure.

2.7 Cutting and Patching

- .1 Do not cut, bore or sleeve any structural elements without the written acceptance of Departmental Representative.
- .2 Submit written request in advance of cutting or alteration which affects the following:
 - .1 Structural integrity of any element of the Project,
 - .2 Integrity of weather-exposed or moisture-resistant elements,
 - .3 Efficiency, maintenance, or safety of any operational elements,
 - .4 Visual qualities of sight-exposed elements, or
 - .5 Work of Departmental Representative or separate contractor as applicable.
- .3 After uncovering, inspect conditions affecting performance of Work.
- .4 Beginning of cutting or patching means acceptance of existing conditions.
- .5 Perform cutting, fitting, and patching, including excavation and backfilling, to complete the Work.
- .6 Cut and drill with true, smooth edges and to minimum suitable tolerances. Do not oversize holes.
- .7 Perform work to avoid damage to other work.
- .8 Provide supports to assure structural integrity of surroundings devices and methods to protect other portions of project from damage.
- .9 Provide protection from elements for areas that may be exposed by uncovering work.
- .10 Prepare surfaces to receive patching and finishing.
- .11 Cut rigid materials using power saw or core drill, except as otherwise noted. Pneumatic or impact tools not allowed without approval.
- .12 Restore work with new products in accordance with the Contract Documents.

3 FIELD ENGINEERING

3.1 Laying Out of Work

- .1 Establish lines and levels, locate and layout, by instrumentation.
- .2 Verify all lines, levels, datum and dimensions shown on drawings and report errors or inconsistencies to the Departmental Representative prior to commencing work. Failure to do so does not relieve the Contractor from responsibility of correcting same.
- .3 Lay out work to lines and levels as indicated on drawings. In all cases, figured dimensions will overrule scaled dimensions.
- .4 Exercise every possible precaution to verify figures shown on drawings and to obtain from Departmental Representative any additional dimensions or information as required before laying out the work. Be responsible to rectify any errors or incorrect work due to failure to exercise such precautions.

4 PROJECT MEETINGS

4.1 Administrative

- .1 Schedule and administer project progress meetings throughout the course of the work as specified in Section 01 31 19.

5 SUBMITTALS

5.1 Administrative

- .1 Submit to the Departmental Representative submittals listed for review. Submit with reasonable promptness and in an orderly sequence so as not to cause delay in the Work. Failure to submit in ample time is not considered sufficient reason for an 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 the submittal until review is complete.
- .3 Review submittals prior to submission. Review by the Contractor represents that necessary requirements have been determined and verified, or will be, and that each submittal has been checked and coordinated with the requirements of the Work and the Contract Documents. Submittals not stamped, signed, dated and identified as to the specific project shall be returned without being examined and shall be considered rejected.
- .4 Review of shop drawings by the Departmental Representative is for the sole purpose of ascertaining conformance with the general design concept and for general arrangement only. This review does not mean approval of the detail design inherent in the shop drawings, responsibility for which remains with the Contractor submitting same. Such review does not relieve responsibility for errors, omissions or deviations in shop

drawings or samples or of responsibility for meeting all requirements of the Contract Documents, unless a deviation has been accepted in writing by the Departmental Representative.

.5 Verify field measurements and affected adjacent Work are coordinated.

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

5.2 Materials List

.1 Furnish a detailed list of materials and equipment complete with names of suppliers within five working days of Contract award.

5.3 Shop Drawings and Product Data

.1 Shop Drawings:

.1 Mark drawings with name of project, specification section number, drawing detail and sheet number referenced where subject of shop drawing is described and shown, and date shop drawing was prepared and/or revised.

.2 Where coordination requirements necessitate scope of shop drawing to include more than one item, label shop drawings with specification section number of dominant trade involved. "Dominant" shall be defined as greatest quantity, greatest cost, or principal detail subject of drawing, whichever may be appropriate.

.3 Shop drawings augment, but do not supersede the Contract Documents. Review of shop drawings does not imply acceptance of Work.

.4 Submit shop drawings for each requirement requested in specification sections and as the Departmental Representative may reasonably request. Submit six (6) copies of each drawing, eight (8) copies for mechanical, electrical and elevators.

.5 Prepare shop drawings using a qualified detailer.

.6 Submit six (6) copies of product data sheets or brochures for requirements requested in specification sections and as the Departmental Representative may reasonably request where shop drawings will not be prepared due to standardized manufacture of product.

.7 Clearly 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, clearly indicate that all such articles and equipment have been properly coordinated, regardless of the trade under which the adjacent articles or equipment will be supplied and installed. Indicate cross references to design drawings and specifications.

- .8 Provide a 75 mm x 75 mm free space for the application of the review stamp.
- .9 Where shop drawings vary from requirements of Contract Documents as result of standard shop practice, changes in materials and methods or other reason, clearly point out variations on shop drawings.
- .10 Adjustments made on shop drawings by the Departmental Representative are not affect the value of Work, request issue of a Change Order before proceeding with the Work.
- .11 Make changes in shop drawings as the Departmental Representative may require consistent with Contract Documents. When resubmitting, notify the Departmental Representative in writing of any revisions other than those requested.
- .12 If upon review by the Departmental Representative, no errors or omissions are discovered, or if only minor corrections are made, copies of the drawings shall be returned, reviewed, and fabrication and installation of the Work may proceed. If the shop drawings are rejected, noted copy will be returned and re-submission of corrected shop drawings, through the same procedure indicated above, shall be performed before fabrication and installation of Work may proceed.
- .13 Upon completion of the review, the Departmental Representative shall retain one print and forward the remaining copies to Contractor for distribution.
- .14 Identify details by reference to sheet and detail number shown on Contract Drawings.
- .15 Provide shop drawings for one trade as one complete set. Do not provide shop drawings in a "piece meal" fashion, i.e. provide miscellaneous metal shop drawings for different handrails at different times. Accompany shop drawings with letter of transmittal listing numbers and latest dates of drawings submitted.
- .16 Do not copy the contract documents for the purpose of shop drawing production, unless directed otherwise by the Departmental Representative.
- .17 Any proposed deviations from the Contract Documents must be boldly indicated as such on the shop drawings. No acceptance shall be inferred or assumed otherwise.

- .2 Product Data:
 - .1 Certain specification sections specify that manufacturers' standard schematic drawings, catalogue sheets, diagrams, schedules, performance charts, illustrations and other standard descriptive data will be accepted as shop drawings. Refer to individual trade sections for specific requirements.
 - .2 The above will only be accepted if they conform to the following:
 - .1 Delete information which is not applicable to project.
 - .2 Supplement standard information to provide additional information applicable to project.
 - .3 Show dimensions and clearances required.
 - .4 Show performance characteristics and capacities.
 - .5 Show wiring diagrams and controls where applicable.
 - .3 Manufacturer's standard schematic drawings:
 - .1 Modify drawings to delete information which is not applicable to the project.
 - .2 Supplement standard information to provide additional information applicable to the project.
 - .3 Manufacturer's catalogue sheets, brochures, diagrams, schedules, performance charts, illustrations, and other standard descriptive data.
 - .4 Clearly mark each copy to identify pertinent materials, products or models.
 - .5 Show dimensions and clearances required.
 - .6 Show performance characteristics and capacities.
 - .7 Show wiring diagrams and controls where applicable.

5.4 Samples

- .1 Submit for review samples in duplicate as the Departmental Representative may reasonably require or as requested in the respective specification sections.
- .2 Identification:
 - .1 Label samples with name of project, supplier's name, Subcontractor's name, generic name of item, manufacturer's name, brand name and model number.
 - .2 Accompany sample shipments with transmittal letter referencing name of project, drawing sheet detail, specification section and paragraph number, and same information with which sample itself is labelled.
- .3 Deliver samples prepaid to the Contractor's business address.
- .4 Provide samples of special products, assemblies, or components when so specified.

- .5 Submit samples with reasonable promptness and in an orderly sequence, so as to cause no delay in the Work. Failure to submit samples in ample time will not be considered sufficient reason for an extension of Contract Time and no claim for extension by reason of such default will be allowed. If requested, the Departmental Representative will assist in preparing a schedule fixing the dates for submission.
- .6 Submit samples in ample time for the Departmental Representative's review prior to quantity fabrication, or in the case of manufactured items, prior to placement of purchase orders.
- .7 Notify the Departmental Representative in writing, at the time of submission, of any deviations in samples from requirements of Contract Documents.
- .8 Make changes in samples which the Departmental Representative may require, consistent with Contract Documents.
- .9 Adjustments made on samples by the Departmental Representative are not intended to change the Contract Price. If adjustments affect the value of Work, state such in writing to the Departmental Representative prior to proceeding with the Work.
- .10 The accepted samples establish the material standards for the work. No deviation permitted after review of samples. Label samples as to origin and intended use in the work.

5.5 Operation and Maintenance Manuals

- .1 Manual:
 - .1 An organized compilation of operating and maintenance data including detailed technical information, documents, and records describing operation and maintenance of individual products or systems as specified in individual sections.
 - .2 Divide the manual into three volumes to address care taking, shop drawings, and mechanical and electrical systems as noted in this section.
- .2 General
 - .1 Assemble, co-ordinate, bind and index required data into Operation and Maintenance Manual.
 - .2 Submit complete operation and maintenance manual to Departmental Representative two (2) weeks prior to application for Substantial Performance.
 - .3 Submit one (1) copy of each required volume in English language language and one (1) pdf copy on a CD.
 - .4 Organize data into systems and not in numerical order as contract specifications.
 - .5 Label each section with tabs protected with celluloid covers fastened to hard paper dividing sheets.
 - .6 Type lists and notes.

.7 Drawings, diagrams and manufacturers literature must be legible.

.3 Binders

.1 Binders: 3 "D" ring type binders bound with heavy vinyl, with clear vinyl pocket on front cover and spine, sized for 215 x 280 mm paper. Binders must not exceed 75 mm thick or be more than 2/3 full. Include a slip sheet in vinyl pockets indicating the following only:

Name of Project.

Date of Project Completion

Volume 1 – Record Documents, or Volume 2 – Maintenance Documents

Submissions with any additional information will be rejected by the Departmental Representative.

.4 Binder contents:

.1 Record Documents by Specification Division: Shop drawings and product submittals shall contain the following:

Cover sheet containing:

Date submitted.

Project title, location and project number.

Table of Contents of individual binder.

Bind separately one complete set of reviewed final shop drawings and product data in English language only.

.2 Maintenance Documents by Specification Division: Care taking and cleaning instructions for finish materials, and operating and maintenance instructions for mechanical and electrical systems, and shall contain the following:

Cover sheet containing:

Date submitted.

Project title, location and project number.

Names and addresses of Contractor, and all Subcontractors.

Table of Contents of all binders.

Warranties, guaranties relating to equipment.

Copies of approvals, and certificates.

Manufacturer's recommended care taking practices for specified interior and exterior finishes.

Manufacturer's recommended cleaners and equipment required for care taking.

List of all finish materials and locations used on the project, relate actual materials used with specified materials.

List of suppliers, phone numbers and addresses.

All warranties, guaranties relating to care taking materials Operation data to include:

Control schematics for each system including environmental controls.

Description of each system and its controls.

Description of operation of each system at various loads together with reset schedules and seasonal variances.

Operation instruction for each system and each component.

Description of actions to be taken in event of equipment failure.

.3 Maintenance data shall include:

Cleaning and maintenance of all finishes and surfaces.

Servicing, maintenance, operation and troubleshooting instructions for each item of equipment.

Data to include schedules of tasks, frequency, and tools required and task time.

.4 Performance data to include:

Equipment manufacturer's performance data sheets with point of operation as left after facility systematic testing & balancing is complete.

Equipment performance verification test results.

Special performance data as specified elsewhere.

.5 Approvals

.1 Submit draft Operation and Maintenance Manual to Departmental Representative for approval. Submission of individual data will not be accepted unless so directed by Departmental Representative.

.2 Make changes as required and resubmit as directed by Departmental Representative

5.6 Record Drawings

.1 Departmental Representative will provide one set of prints for record drawing purposes.

.2 Maintain project record drawings and record accurately deviations from Contract documents.

.3 Make recordings immediately after the respective Work is completed and not less than once a week. Each recording shall be dated.

.4 Mark changes in red.

.5 Record following information:

.1 Depths of various elements of foundation in relation to main floor slab datum and survey monument.

.2 Horizontal and vertical location of underground utilities and appurtenances referenced to permanent surface improvement.

.3 Location of internal utilities and appurtenances concealed in construction, referenced to visible and accessible features of structure.

- .4 Field changes of dimension and detail.
- .5 Changes made by Change Order or Field Order.
- .6 Drawing format:
 - .1 At completion of project and prior to final inspection, submit record prints to Departmental Representative.
 - .2 Substantial Performance of the Contract is dependent upon submission of record drawing information.
 - .3 Contractor will be responsible for providing accurate as-built information. Where the Departmental Representative finds that information provided by the Contractor is inaccurate through testing or site investigation, Contractor will be responsible for paying for updating Departmental Representative's Record Drawings.

6 SCHEDULES

6.1 Schedules Required

- .1 Submit schedules as specified in Section 01 32 16.07

7 QUALITY CONTROL

7.1 Products and Materials

- .1 Quality:
 - .1 Products, materials and equipment incorporated into the work shall be new, not damaged or defective and of the best quality consistent with the Contract Documents and for the purpose intended. If requested, furnish evidence as to type, source and quality of products provided.
 - .2 Defective products, whenever identified prior to Total Performance of the work, will be rejected, regardless of previous inspections. Inspection does not relieve responsibility, but is a 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 any dispute arise as to the quality or fitness of products, the decision rests strictly with the Departmental Representative based upon the requirements of the Contract Documents.
 - .4 Unless otherwise specified, maintain uniformity of manufacture for any particular or like item throughout the 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.
- .2 Availability:
 - .1 Immediately upon signing the Contract, review product delivery requirements and anticipate foreseeable supply delays for any item. Notify Departmental Representative in writing of any anticipated delays in sufficient time to allow for substitution or other remedial work without delaying performance of the work.
 - .2 In the event of failure to notify Departmental Representative in sufficient time and should it appear that work may be delayed for such reason, the Departmental Representative reserves the right to substitute more readily available products of similar character, at no increase in Contract Price.

7.2 Storage, Handling and Protection

- .1 Handle and store products in a manner to prevent damage, deterioration and soiling and in accordance with manufacturer's instructions when applicable.
- .2 Store packaged or bundled products in original, undamaged condition with manufacturer's seals and labels intact. Do not remove from packaging or bundling until required for incorporation into the work.
- .3 Store products subject to damage from weather in weatherproof enclosures.
- .4 Store wood products on solid supports and keep clear of ground. Slope to shed moisture.
- .5 Store and mix paints in a heated and ventilated area. Remove oily rags and other combustible debris from site daily. Take precautions to prevent spontaneous combustion.

7.3 Manufacturer's Instructions

- .1 Unless specified otherwise, 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 manufacturer.
- .2 Notify the Departmental Representative in writing, of conflicts between the specifications and manufacturer's instructions, so that the Departmental Representative may establish a course of action.
- .3 Remove and reinstall improperly installed or erected products at no increase in Contract Price.

7.4 Workmanship

.1 General:

- .1 Work shall be executed by workers experienced and skilled in their respective duties for which they are employed. Immediately notify the Departmental Representative if required work is such as to make it impractical to achieve required results.
- .2 Decisions as to the quality or fitness of workmanship in cases of dispute rests solely with the Departmental Representative.

.3 Coordination:

- .1 Coordinate and ensure cooperation of workers in laying out work. Maintain efficient and continuous supervision.
- .2 Be responsible for coordination and placement of openings, sleeves and accessories.

.4 Fastenings:

- .1 Provide metal fastenings and accessories in the 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 dipped galvanized steel fasteners and anchors for securing exterior work, unless indicated otherwise.
- .4 Space anchors within their load limits 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 that cause spalling or cracking of material to which anchorage is made is not acceptable.

8 CONSTRUCTION FACILITIES AND TEMPORARY CONTROLS

8.1 Installation and Removal

- .1 Provide construction facilities and temporary controls in order to execute the work expeditiously.
- .2 Remove from site all such work after use.
- .3 Remove barriers prior to completion and final acceptance. Patch and repair surfaces to original condition damaged by erection of barriers.

8.2 Guard Rails and Barricades

- .1 Provide all other temporary safeguards and protection to adequately protect against accident or injury to workers or other personnel on the site.
- .2 Neatly assemble and firmly brace.
- .3 Maintain as required during construction period.
- .4 Remove barriers prior to completion and final acceptance. Patch and repair surfaces to original condition damaged by erection of barriers.

8.3 Scaffolding and Tools

- .1 Provide and maintain scaffolding, ramps, ladders, swing stages, platforms, temporary stairs, tools required for the completion of the Work, and coordinate all types of scaffolding, etc., required by various trades.
- .2 Subcontractors are responsible for their own scaffolding, swing stages.

8.4 Equipment/Tool/Materials Storage

- .1 Provide and maintain, in a clean and orderly condition, lockable storage lockers or storage area suitable for storage of tools, equipment and materials.
- .2 Do not deliver materials to site until work has progressed enough for immediate installation.
- .3 Padlocked temporary doors to be installed for security.

8.5 Protection

- .1 Take precautions at all times to protect persons, including the public, Contractor's employees, subcontractor's and their employees, and property affected in any way by the work. Especially guard against or eliminate hazardous conditions.
- .2 Protect surrounding property from damage during performance of the Work.
- .3 Be responsible for damage incurred.

8.6 Protection of Building Finishes and Equipment

- .1 Provide protection for finished and partially finished building finishes and equipment during performance of the work.
- .2 Be responsible and pay all costs for repair of damage incurred due to lack of or improper protection.

8.7 Project Cleanliness

- .1 Maintain the Work in tidy condition, free from the accumulation of waste products and debris.
- .2 Maintain areas free of dust and other contaminants during finishing operations.
- .3 Store waste materials within the confines of the site hoarding.

8.8 Completion

- .1 On completion of the work, remove all temporary protection erected under the section, make good all damage to this work and adjoining work resulting from the execution of the work, and remove from the premises all surplus materials and debris, and all tools, plant, and equipment. Leave the building and site in a clean tidy condition satisfactory to the Departmental Representative.

9 SAFETY PROGRAM

9.1 General

- .1 Conform to the requirements of Section 01 35 29.06.

END OF SECTION

Part 1 General**1.1 REFERENCES**

- .1 Canadian Standards Association (CSA)
 - .1 CSA-A23.1- Concrete Materials and Methods of Concrete Construction.
 - .2 CSA-A23.2- Test Methods and Standard Practices for Concrete
 - .3 CSA-S269.3 – Concrete Formwork
 - .4 CSA O121, Douglas Fir Plywood.
 - .5 CSA-O86 Engineering Design in Wood
 - .6 CSA O151, Canadian Softwood Plywood.
 - .7 CSA O153, Poplar Plywood.
 - .8 CAN3-O188.0, Standard Test Methods for Mat-Formed Wood Particleboards and Waferboard.
 - .9 CSA O437, Standards for OSB and Waferboard.
 - .10 CSA S269.1, Falsework for Construction Purposes.
 - .11 CAN/CSA-S269.3, Concrete Formwork.
- .2 A copy of A23.1 and A23.2 shall be kept by the Contractor on site for the duration of the work and be made available for reference.

1.2 SHOP DRAWINGS

- .1 Submit shop drawings for formwork and falsework.
- .2 Indicate method and schedule of construction, shoring, stripping and re-shoring procedures, materials, arrangement of joints, special architectural exposed finishes, ties, liners, and locations of temporary embedded parts.
- .3 Indicate formwork design data, such as permissible rate of concrete placement, and temperature of concrete, in forms.
- .4 Indicate sequence of erection and removal of formwork/falsework.
- .5 Each shop drawing submission shall bear stamp and signature of qualified professional engineer registered or licensed in Province of Alberta, Canada.

Part 2 Products**2.1 MATERIALS**

- .1 Form Material
 - .1 For concrete without special architectural features, use wood and wood product formwork materials to CSA-O121, CSA-O86.1, CSA O437, Series CSA-O153.
 - .2 For concrete with special architectural features, use formwork materials to CSA-A23.1 and CSA-A23.2.

- .3 Exposed surfaces - metal, plywood or plywood lined. Plywood to conform to the Standard.
- .4 Unexposed surfaces - metal, plywood, or wood lumber to conform to the Standard.
- .5 Plywood and wood formwork materials shall, conform to the Standard, be free from warp and sawn straight so that lines and shapes will be accurately retained.
- .6 Un-lined forms for unexposed surfaces shall be made with a good grade of lumber or plywood and fitted so that there will be no leakage of mortar.
- .7 Use metal forms, plywood lined forms or plywood forms of sufficient structural strength for exposed surfaces. Plywood for lining shall be GIS exterior grade fir plywood with waterproof glue.
- .8 Proprietary and/or modular forming systems shall be designed such that they do not interfere with the specified placement of reinforcement or other embedded hardware and must be pre-approved by the Consultant.
- .2 Ties and Spreaders
 - .1 Use metal form ties that are adjustable in length to permit tightening of forms. Use only the snap-off type of form ties which will permit no metal within 25mm (1") of the concrete surface after removal. Twisted wire form ties will not be accepted.
 - .2 Wood spreaders inside wall forms will not be permitted.
- .3 Form Release and Stripping Agents
 - .1 Use a non-staining, non-toxic, biodegradable, low VOC form release agent that is compatible with any finishes specified elsewhere in the contract documents.
- .4 Void Form
 - .1 Void form shall be of a deteriorating material.

Part 3 Execution

3.1 GENERAL

- .1 All phases of concrete formwork construction shall be in accordance with the Standard unless otherwise specified herein or on the drawings. Only workers who are skilled and experienced in their trade shall do the work.

3.2 LINES AND LEVELS

- .1 Verify lines, levels and column centres before proceeding with work and ensure that dimensions agree with drawings.
- .2 Co-ordinate and co-operate with all other trades in forming and setting of recesses, chases, sleeves, inserts, bolts, and hangers.

3.3 DESIGN OF FORMWORK, FALSEWORK AND RESHORING

- .1 The Contractor shall assume full responsibility for the structural adequacy of the forms to withstand all concrete, environmental, and construction loads.

- .2 As a minimum, the work shall conform to CSA-A23.1, Section 6.5 for regular work and Section 8.3.4 for architectural concrete.
- .3 Where concrete is exposed to view, forms are to be laid out so that joints are kept to a minimum and located in an orderly and symmetrical arrangement wherever possible. Form ties shall be evenly spaced and located in straight horizontal and vertical lines. Spacing and location of form tie holes shall be detailed by the Contractor and approved. See also the architectural drawings and specifications for any special requirements for architectural concrete.
- .4 The strength and rigidity of forms shall be such that they will not leak mortar or result in visible irregularities in the finished concrete. In addition, the deflection of facing materials between studs, as well as the deflection of studs and walers, shall not exceed 0.0025 times the span.
- .5 Forms shall be so constructed that the finished concrete will conform to the shape, dimensions and tolerances as specified in the Standard or on the structural drawing, whichever is most rigorous. They shall also incorporate the cambers specified on the structural drawings. Movement resulting from form support deflection, closure of form joints, and elastic shortening of forms and shoring, must be calculated and added to the cambers indicated on the drawings.
- .6 Construct forms so that they may be dismantled and removed without damaging the concrete.
- .7 The Contractor shall submit details of the sequence and extent of formwork removal and re-shoring to the Departmental Representative for review. Such details shall include magnitude of loads and location of all reshores at each level. Forms shall not be removed or adjusted until the review is complete. Such review does not relieve the Contractor of responsibility for formwork and safety during construction.
- .8 Set shores on wedges or use adjustable shores so they may be removed without causing undue strains in the concrete.
- .9 Do not exceed the safe capacity of the structure with any construction or shoring loads. The safe capacity of the structure may be taken as the design live load, as indicated on the structural drawings, multiplied by the ratio of the concrete strength at the time of loading to the specified concrete strength, but not greater than 1.0.

3.4 FABRICATION AND ERECTION

- .1 Verify lines, levels and centres before proceeding with formwork/falsework and ensure dimensions agree with drawings.
- .2 Obtain approval or use of earth forms framing openings not indicated on drawings.
- .3 Hand trim sides and bottoms and remove loose earth from earth forms before placing concrete.
- .4 Fabricate and erect falsework in accordance with CSA S269.1 and COFI Exterior Plywood for Concrete Formwork.

- .5 Refer to architectural drawings for concrete members requiring architectural exposed finishes.
- .6 Do not place shores and mud sills on frozen ground.
- .7 Provide site drainage to prevent washout of soil supporting mud sills and shores.
- .8 Fabricate and erect formwork in accordance with CAN/CSA-S269.3 to produce finished concrete conforming to shape, dimensions, locations and levels indicated within tolerances required by CSA-A23.1 and CSA-A23.2.
- .9 Align form joints and make watertight. Keep form joints to minimum.
- .10 Form chases, slots, openings, drips, recesses, expansion and control joints as indicated.
- .11 Construct forms for architectural concrete, and place ties as indicated and/or as directed. Joint pattern not necessarily based on using standard size panels or maximum permissible spacing of ties.
- .12 Build in anchors, sleeves, and other inserts required to accommodate Work specified in other sections. Assure that all anchors and inserts will not protrude beyond surfaces designated to receive applied finishes, including painting.
- .13 Sleeves and openings shown on the structural drawings must be confirmed with mechanical, electrical and architectural drawings. Any discrepancies are to be reported.
- .14 Sleeves and openings not shown on the structural drawings must be approved.
- .15 Keep all untreated forms moist to prevent shrinkage prior to placing of concrete and wet the surface at time of placing.
- .16 Treated formwork surfaces shall have the approved form coating applied in accordance with the manufacturer's recommendations, prior to placing reinforcing steel. Remove any excess form coating.

3.5 TOLERANCES

- .1 The tolerances for all concrete work shall conform to the requirements of the Standard and Drawings.

3.6 PRODUCT HANDLING

- .1 Protect formwork materials before, during and after installation and protect installed work and materials of other trades.
- .2 In the event of damage, immediately make required repairs or replacements necessary to approval at no extra cost.

3.7 REMOVAL AND RESHORING

- .1 Forms shall not be removed until concrete has attained sufficient strength that no damage to strength or continuity of concrete will occur when forms are removed. Time for formwork removal of suspended concrete shall be approved.
- .2 Prying against face of concrete to remove forms is not allowed, only wooden wedges shall be used.
- .3 Removal of form ties shall be done carefully to avoid marking concrete and to allow for patching. Grout bottom of form tie hole to prevent rust staining.
- .4 Remove formwork when concrete has reached its design strength or minimum approved period, whichever comes later, and replace immediately with adequate reshoring.
- .5 Provide all necessary reshoring of members where early removal of forms may be required or where members may be subjected to additional loads during construction as required.
- .6 Space reshoring in each principal direction at not more than 3000 mm apart.
- .7 Re-use formwork and falsework subject to requirements of CSA-A23.1 and CSA-A23.2.

END OF SECTION

Part 1 General**1.1 REFERENCES**

- .1 American Concrete Institute (ACI)
 - .1 SP-66-04, ACI Detailing Manual 2004.
- .2 ASTM International
 - .1 ASTM A82/A82M-[07], Standard Specification for Steel Wire, Plain, for Concrete Reinforcement.
 - .2 ASTM A185/A185M 07, Standard Specification for Steel Welded Wire Reinforcement, Plain, for Concrete.
- .3 CSA International
 - .1 CSA-A23.1-14 A23.2-14 Concrete Materials and Methods of Concrete Construction/Test Methods and Standard Practices for Concrete.
 - .2 CAN/CSA-A23.3-14 Design of Concrete Structures.
 - .3 CSA-G30.18-09 (R2014), Carbon Steel Bars for Concrete Reinforcement.
 - .4 CSA-G40.20/G40.21-13 General Requirements for Rolled or Welded Structural Quality Steel/Structural Quality Steel.
 - .5 CSA W186-M1990(R2012), Welding of Reinforcing Bars in Reinforced Concrete Construction.
- .4 Reinforcing Steel Institute of Canada (RSIC)
 - .1 RSIC-[2004], Reinforcing Steel Manual of Standard Practice.

1.2 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Submit in accordance with Section 01 00 15.
- .2 Prepare reinforcement drawings in accordance with RSIC Manual of Standard Practice.
- .3 Shop Drawings:
 - .1 Submit drawings stamped and signed by professional engineer registered or licensed in Province Alberta of Canada.
 - .1 Indicate placing of reinforcement and:
 - .1 Bar bending details.
 - .2 Lists.
 - .3 Quantities of reinforcement.
 - .4 Sizes, spacings, locations of reinforcement and mechanical splices if approved by Consultant, with identifying code marks to permit correct placement without reference to structural drawings.
 - .5 Indicate sizes, spacings and locations of chairs, spacers and hangers.

- .2 Detail lap lengths and bar development lengths to CAN/CSA-A23.3, unless otherwise indicated.
 - .1 Provide type B unless otherwise indicated.
- .4 When Chromate solution is used as replacement for galvanizing non-prestressed reinforcement, provide product description for review by Departmental Representative prior to its use.

1.3 QUALITY ASSURANCE

- .1 Submit in accordance with Section 01 00-15 – Quality Control.
 - .1 Mill Test Report: upon request, provide Departmental Representative with certified copy of mill test report of reinforcing steel, minimum 4 weeks prior to beginning reinforcing work.
 - .2 Upon request submit in writing to Departmental Representative proposed source of reinforcement material to be supplied.

1.4 DELIVERY, STORAGE AND HANDLING

- .1 Deliver, store and handle materials in accordance with Section 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 Replace defective or damaged materials with new.

Part 2 Products

2.1 MATERIALS

- .1 Substitute different size bars only if permitted in writing by Departmental Representative.
- .2 Reinforcing steel: billet steel, grade 400, deformed bars to CSA-G30.18, unless indicated otherwise.
- .3 Reinforcing steel: weldable low alloy steel deformed bars to CSA-G30.18.
- .4 Welded steel wire fabric: to ASTM A185/A185M.
 - .1 Provide in flat sheets only.
- .5 Welded deformed steel wire fabric: to ASTM A82/A82M.
 - .1 Provide in flat sheets only.
- .6 Chairs, bolsters, bar supports, spacers: to CSA-A23.1/A23.2.
- .7 Mechanical splices: subject to approval of Consultant.
- .8 Plain round bars: to CSA-G40.20/G40.21.

2.2 FABRICATION

- .1 Fabricate reinforcing steel in accordance with CSA-A23.1/A23.2 Reinforcing Steel Manual of Standard Practice by the Reinforcing Steel Institute of Canada.
 - .1 SP-66 unless indicated otherwise.
- .2 Obtain Departmental Representative's written approval for locations of reinforcement splices other than those shown on placing drawings.
- .3 Upon approval of Departmental Representative, weld reinforcement in accordance with CSA W186.
- .4 Ship bundles of bar reinforcement, clearly identified in accordance with bar bending details and lists.

2.3 SOURCE QUALITY CONTROL

- .1 Upon request, provide Departmental Representative with certified copy of mill test report of reinforcing steel, showing physical and chemical analysis, minimum 4 weeks prior to beginning reinforcing work.
- .2 Upon request inform Departmental Representative of proposed source of material to be supplied.

Part 3 Execution**3.1 FIELD BENDING**

- .1 Do not field bend or field weld reinforcement except where indicated or authorized by Departmental Representative.
- .2 When field bending is authorized, bend without heat, applying slow and steady pressure.
- .3 Replace bars, which develop cracks or splits.

3.2 PLACING REINFORCEMENT

- .1 Place reinforcing steel as indicated on placing drawings in accordance with CSA-A23.1/A23.2.
- .2 Use plain round bars as slip dowels in concrete.
 - .1 Paint portion of dowel intended to move within hardened concrete with one coat of asphalt paint.
 - .2 When paint is dry, apply thick even film of mineral lubricating grease.
- .3 Prior to placing concrete, obtain Departmental Representative's approval of reinforcing material and placement.
- .4 Ensure cover to reinforcement is maintained during concrete pour.
- .5 Protect paint coated portions of bars with covering during transportation and handling.

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.

END OF SECTION

Part 1 General**1.1 REFERENCES**

- .1 Abbreviations and Acronyms:
 - .1 Portland Cement: hydraulic cement, blended hydraulic cement (XXb - b denotes blended) and Portland-limestone cement.
 - .1 Type GU, GUb and GUL - General use cement.
- .2 Reference Standards:
 - .1 ASTM International
 - .1 ASTM C260/C260M-[10a], Standard Specification for Air-Entraining Admixtures for Concrete.
 - .2 ASTM C309-[07], Standard Specification for Liquid Membrane-Forming Compounds for Curing Concrete.
 - .3 ASTM C494/C494M-[10a], Standard Specification for Chemical Admixtures for Concrete.
 - .4 ASTM C1017/C1017M-[07], Standard Specification for Chemical Admixtures for Use in Producing Flowing Concrete.
 - .5 ASTM D412-[06ae2], Standard Test Methods for Vulcanized Rubber and Thermoplastic Elastomers-Tension.
 - .6 ASTM D624-[00(2007)], Standard Test Method for Tear Strength of Conventional Vulcanized Rubber and Thermoplastic Elastomer.
 - .7 ASTM D1751-[04(2008)], Standard Specification for Preformed Expansion Joint Filler for Concrete Paving and Structural Construction (Nonextruding and Resilient Bituminous Types).
 - .8 ASTM D1752-[04a(2008)], Standard Specification for Preformed Sponge Rubber Cork and Recycled PVC Expansion Joint Fillers for Concrete Paving and Structural Construction.
 - .2 Canadian General Standards Board (CGSB)
 - .1 CAN/CGSB-37.2-[M88], Emulsified Asphalt, Mineral Colloid-Type, Unfilled, for Dampproofing and Waterproofing and for Roof Coatings.
 - .2 CAN/CGSB-51.34-[M86(R1988)], Vapour Barrier, Polyethylene Sheet for Use in Building Construction.
 - .3 CSA International
 - .1 CSA A23.1/A23.2-14, Concrete Materials and Methods of Concrete Construction/Methods of Test and Standard Practices for Concrete.
 - .2 CSA A283-06 (R2016), Qualification Code for Concrete Testing Laboratories.
 - .3 CSA A3000-13, Cementitious Materials Compendium (Consists of A3001, A3002, A3003, A3004 and A3005).

1.2 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Provide submittals in accordance with Section 01 00 15.
- .2 At least 4 weeks prior to beginning Work, provide Departmental Representative with samples of materials proposed for use as follows:
 - .1 5 L of curing compound.
 - .2 1 m length of each type of joint filler.
 - .3 1 m length of each type of waterstops.
 - .4 3 kg of each type of supplementary cementing material.
 - .5 10 kg of each type of blended hydraulic cement.
 - .6 5 kg of each admixture.
 - .7 1 kg of each fine and coarse aggregate.
- .3 Provide testing results for review by Departmental Representative and do not proceed without written approval when deviations from mix design or parameters are found.
- .4 Concrete pours: provide accurate records of poured concrete items indicating date and location of pour, quality, air temperature and test samples taken as described in PART 3 - FIELD QUALITY CONTROL.
- .5 Concrete hauling time: provide for review by Departmental Representative deviations exceeding maximum allowable time of 120 minutes for concrete to be delivered to site of Work and discharged after batching.

1.3 QUALITY ASSURANCE

- .1 Quality Assurance: in accordance with Section 01 15 00 - Quality Control.
- .2 Provide Departmental Representative, minimum 4 weeks prior to starting concrete work, with valid and recognized certificate from plant delivering concrete.
 - .1 Provide test data and certification by qualified independent inspection and testing laboratory that materials and mix designs used in concrete mixture will meet specified requirements.
- .3 Minimum 4 weeks prior to starting concrete work, provide proposed quality control procedures for review by Departmental Representative on following items:
 - .1 Falsework erection.
 - .2 Hot weather concrete.
 - .3 Cold weather concrete.
 - .4 Curing.
 - .5 Finishes.
 - .6 Formwork removal.
 - .7 Joints.
- .4 Quality Control Plan: provide written report to Departmental Representative verifying compliance that concrete in place meets performance requirements of concrete as established in PART 2 - PRODUCTS.

1.4 DELIVERY, STORAGE AND HANDLING

- .1 Delivery and Acceptance Requirements:
 - .1 Concrete hauling time: deliver to site of Work and discharged within 120 minutes maximum after batching.
 - .1 Do not modify maximum time limit without receipt of prior written agreement from concrete producer as described in CSA A23.1/A23.2.
 - .2 Deviations to be submitted for review by Departmental Representative.
 - .2 Concrete delivery: ensure continuous concrete delivery from plant meets CSA A23.1/A23.2.

Part 2 Products**2.1 DESIGN CRITERIA**

- .1 Performance: to CSA A23.1/A23.2, and as described in MIXES of PART 2 - PRODUCTS.

2.2 PERFORMANCE CRITERIA

- .1 Quality Control Plan: ensure concrete supplier meets performance criteria of concrete as established by Departmental Representative and provide verification of compliance as described in PART 1 - QUALITY ASSURANCE.

2.3 MATERIALS

- .1 Portland Cement: to CSA A3001, Type GU.
- .2 Water: to CSA A23.1.
- .3 Aggregates: to CSA A23.1/A23.2.
- .4 Admixtures:
 - .1 Air entraining admixture: to CAN3-A266.1.
 - .2 Chemical admixture: to CAN3-A266.2
- .5 Curing compound: to CSA A23.1/A23.2.
- .6 Polyethylene film: 150 micrometre thickness, to CAN/CGSB-51.34.

2.4 MIXES

- .1 Alternative 1 - Performance Method for specifying concrete: to meet performance criteria to CSA A23.1/A23.2.
 - .1 Ensure concrete supplier meets performance criteria as established below and provide verification of compliance as in Quality Control Plan.
 - .2 Provide concrete mix to meet the Performance Alternative outlined in Table 5 of CAN/CSA-A23.1
 - .3 Provide concrete mix to meet following hard state requirements:
 - .1 Durability and class of exposure: C-1
 - .2 Compressive strength at 28 days age: 35 Mpa minimum.

- .4 Provide quality management plan to ensure verification of concrete quality to specified performance.
- .5 Concrete supplier's certification: both batch plant and materials meet CSA A23.1 requirements.

Part 3 Execution**3.1 PREPARATION**

- .1 Obtain Departmental Representative's written approval before placing concrete.
 - .1 Provide 24 hours minimum notice prior to placing of concrete.
- .2 Place concrete reinforcing in accordance with Section 03 20 00 - Concrete Reinforcing.
- .3 During concreting operations:
 - .1 Development of cold joints not allowed.
 - .2 Ensure concrete delivery and handling facilitates placing with minimum of re-handling, and without damage to existing structure or Work.
- .4 Pumping of concrete is permitted only after approval of equipment and mix.
- .5 Ensure reinforcement and inserts are not disturbed during concrete placement.
- .6 Prior to placing of concrete obtain Departmental Representative's approval of proposed method for protection of concrete during placing and curing in adverse weather.
- .7 Protect previous Work from staining.
- .8 Clean and remove stains prior to application for concrete finishes.
- .9 Maintain accurate records of poured concrete items to indicate date, location of pour, quality, air temperature and test samples taken.
- .10 In locations where new concrete is dowelled to existing work, drill holes in existing
- .11 Do not place load upon new concrete until authorized by Departmental Representative.

3.2 INSTALLATION/APPLICATION

- .1 Do cast-in-place concrete work to CSA A23.1/A23.2.
- .2 Sleeves and inserts:
 - .1 Do not permit penetrations, sleeves, ducts, pipes or other openings to pass through joists, beams, column capitals or columns, except where indicated or approved by Departmental Representative.
 - .2 Where approved by Departmental Representative, set sleeves, ties, pipe hangers and other inserts and openings as indicated or specified elsewhere.
 - .3 Sleeves and openings greater than 100 x 100 mm not indicated, must be reviewed by Consultant.
 - .4 Do not eliminate or displace reinforcement to accommodate hardware. If inserts cannot be located as specified, obtain written approval of modifications from Consultant before placing of concrete.
 - .5 Confirm locations and sizes of sleeves and openings shown on drawings.

- .6 Set special inserts for strength testing as indicated and as required by non-destructive method of testing concrete.
- .3 Anchor bolts:
 - .1 Set anchor bolts to templates in co-ordination with appropriate trade prior to placing concrete.
 - .2 Grout anchor bolts in preformed holes or holes drilled after concrete has set only after receipt of written approval from Departmental Representative.
 - .1 Formed holes: 100 mm minimum diameter.
 - .2 Drilled holes: to manufacturers' recommendations.
 - .3 Protect anchor bolt holes from water accumulations, snow and ice build-ups.
 - .4 Set bolts and fill holes with epoxy grout.
 - .5 Locate anchor bolts used in connection with expansion shoes, rollers and rockers with due regard to ambient temperature at time of erection.
- .4 Drainage holes and weep holes:
 - .1 Form weep holes and drainage holes in accordance with Section 03 10 00 - Concrete Forming and Accessories. If wood forms are used, remove them after concrete has set.
 - .2 Install weep hole tubes and drains as indicated.
- .5 Grout under base plates using procedures in accordance with manufacturer's recommendations which result in 100 % contact over grouted area.
- .6 Finishing and curing:
 - .1 Finish concrete to CSA A23.1/A23.2.
 - .2 Use procedures as reviewed by noted in CSA A23.1/A23.2 to remove excess bleed water. Ensure surface is not damaged.
 - .3 Use curing compounds compatible with applied finish on concrete surfaces. Provide written declaration that compounds used are compatible.
 - .4 Provide screed is to be applied.
 - .5 Provide screed finish unless otherwise indicated.
 - .6 Rub exposed sharp edges of concrete with carborundum to produce 3 mm minimum radius edges unless otherwise indicated.
- .7 Waterstops:
 - .1 Install waterstops to provide continuous water seal.
 - .2 Do not distort or pierce waterstop in way as to hamper performance.
 - .3 Do not displace reinforcement when installing waterstops.
 - .4 Use equipment to manufacturer's requirements to field splice waterstops.
 - .5 Tie waterstops rigidly in place.
 - .6 Use only straight heat sealed butt joints in field.
 - .7 Use factory welded corners and intersections unless otherwise approved by Departmental Representative.
- .8 Joint fillers:

- .1 Furnish filler for each joint in single piece for depth and width required for joint, unless otherwise authorized by Consultant.
 - .2 When more than one piece is required for joint, fasten abutting ends and hold securely to shape by stapling or other positive fastening.
 - .3 Locate and form expansion joints as indicated.
 - .4 Install joint filler.
 - .5 Use 12 mm thick joint filler to separate slabs-on-grade from vertical surfaces and extend joint filler from bottom of slab to within 12 mm of finished slab surface unless indicated otherwise.
- .9 Dampproof membrane:
- .1 Install dampproof membrane under concrete slabs-on-grade inside building.
 - .2 Lap dampproof membrane minimum 150 mm at joints and seal.
 - .3 Seal punctures in dampproof membrane before placing concrete.
 - .4 Use patching material at least 150 mm larger than puncture and seal.

3.3 SURFACE TOLERANCE

- .1 Concrete tolerance to CSA A23.1.

3.4 FIELD QUALITY CONTROL

- .1 Site tests: conduct tests as follows and submit report as described in PART 1 - ACTION AND INFORMATIONAL SUBMITTALS.
 - .1 Concrete pours.
 - .2 Slump.
 - .3 Air content.
 - .4 Compressive strength at 28 days.
 - .5 Air and concrete temperature.
- .2 Inspection and testing of concrete and concrete materials will be carried out by testing laboratory designated to CSA A23.1/A23.2.
 - .1 Ensure testing laboratory is certified to CSA A283.
- .3 Ensure test results are distributed for discussion at pre-pouring concrete meeting between testing laboratory and Departmental Representative
- .4 Departmental Representative will pay for costs of tests as specified in Section 01 00 15.
- .5 Departmental Representative will take additional test cylinders during cold weather concreting. Cure cylinders on job site under same conditions as concrete which they represent.
- .6 Non-Destructive Methods for Testing Concrete: to CSA A23.1/A23.2.
- .7 Inspection or testing by Departmental Representative will not augment or replace Contractor quality control nor relieve Contractor of his contractual responsibility.

3.5 CLEANING

- .1 Clean in accordance with Section 01 00 15.

END OF SECTION

Part 1. General**1.1 REFERENCES**

- .1 Canadian Standards Association (CSA):
 - .1 CSA A179-04, Mortar and Grout for Unit Masonry
 - .2 CSA A370-04, Connectors for Masonry
 - .3 CSA A371-04, Masonry Construction for Buildings.
- .2 American Society for Testing of Materials (ASTM):
 - .1 ASTM C568-99, Limestone Building Stone.
 - .2 ASTM C119-03, Standard Terminology Relating to Dimension Stone
 - .3 ASTM C170-90(1999), Standard Test Method for Compressive Strength of Dimension Stone
 - .4 ASTM C9987(2000), Standard Test Method for Modulus of Rupture of Dimension Stone
 - .5 ASTM C97-02, Standard Test Methods for Absorption and Bulk Specific Gravity of Dimension Stone

1.2 SUBMITTALS

- .1 Comply with requirements of Section 01 00 15.
- .2 Submit laboratory test reports certifying compliance of mortar ingredients with specification requirements.
- .3 Submit complete cutting and setting drawings for all stone work. Show in detail the sizes, sections and dimensions of stone, the arrangement of joints and bonding, anchoring and other necessary details.
- .4 Submit test reports covering conformance of stone to ASTM Standards.

1.3 QUALITY ASSURANCE

- .1 Fabricate stone, detail and fabricate supports, and do masonry work in accordance with CSAA371 except where specified otherwise.
- .2 Do masonry reinforcing and tying in accordance with CSAA370 unless specified otherwise.
- .3 Make and use mortar in accordance with CSA A179 unless specified otherwise.

1.4 PRODUCT DELIVERY, STORAGE AND HANDLING

- .1 Deliver materials to job site in dry condition.
- .2 Keep materials dry until use.
- .3 Store materials under waterproof cover on pallets or plank platforms held off ground.

1.5 ADVERSE WEATHER REQUIREMENTS

- .1 In cold weather conform to Clause 5.15.2 of CSAA371 and maintain temperature of mortar between 5 degrees C and 50 degrees C until used.
- .2 In hot weather protect freshly laid masonry from drying too rapidly, by means of waterproof, nonstaining coverings.

1.6 PROTECTION

- .1 Keep masonry dry using coverings that extend over walls and down sides sufficiently to protect walls from wind driven rain, until masonry work is completed and protected by flashings or other permanent construction.
- .2 Protect masonry and other work from marking and other damage. Protect completed work from mortar droppings. Use nonstaining coverings.

Part 2. Products**2.1 STONE**

- .1 Washed River Stone Veneer: .locally obtained natural stone veneer, random sized.

2.2 MORTAR

- .1 Cement: Medusa or other white, non staining cement approved by the stone supplier and conforming to ASTM C91.
- .2 Sand: to CSA A179, white, 100% passing a #16 sieve.
- .3 Use same brands of materials and source of aggregate for entire project. Ensure that all materials are free of salts or other soluble matter injurious to stone.
- .4 Mortar colour: metallic oxide pigment manufactured by Northern Pigments, in colour as indicated on Drawings.
- .5 Mortar, nonstaining, for setting: 1 part cement, 1 part lime, six parts sand.
- .6 Mortar, nonstaining, for pointing: 1 part cement, 2 parts sand, sufficient lime or lime putty to make a very stiff, just workable mix, and sufficient mortar colour to match mortar for stone.

2.3 ACCESSORY MATERIALS

- .1 All metal connectors and anchors: to CSAA370 and A371, stainless steel.
- .2 Sealer: Type as recommended by stone manufacturer.

Part 3. Execution

3.1 INSTALLATION

- .1 Clean stones by washing with water before laying.
- .2 Set stone in accordance with reviewed setting drawings. Review any modifications required to accommodate field tolerances or unexpected conditions with the Consultant before proceeding.
- .3 Build masonry plumb, level, and true to line.
- .4 Prop and anchor projecting stones and shore masonry over openings until wall above is set.
- .5 Fill all voids between stones and at the back solidly with mortar.
- .6 If mortar is not sufficiently stiff to support them set large stones on water soaked softwood wedges or with lead pads to support them in proper alignment until mortar has set. Remove wedges when dry, do not break off.
- .7 Make joints uniform in size, about 6 mm (1/4") wide, except as otherwise indicated.
- .8 After setting stone, rake mortar out to a depth of 20 mm (3/4") to allow for pointing.
- .9 Remove mortar droppings from face of stone before mortar is set. Sponge stone free of mortar along joints as work progresses.
- .10 Brush raked out joints clean, remove wedges, and fill joints with pointing mortar, pack it and work it into joints and finish with a concave pointing tool.

3.2 BUILDING-IN

- .1 Build in items required to be built into masonry.
- .2 Prevent displacement of builtin items during construction. Check plumb, location and alignment frequently, as work progresses.

3.3 CLEANING AND PROTECTION

- .1 After mortar has completely set brush stone work with stiff brush using minimal amounts of water if needed. Do not use wire brushes or water soluble cleaning compounds.
- .2 Seal clean stone surfaces with recommended sealer.
- .3 Cover projections and exposed corners with boards until other work is sufficiently completed to minimize risk of damage.

END OF SECTION

Part 1 General**1.1 REFERENCES**

- .1 American Society for Testing and Materials International, (ASTM)
 - .1 ASTM A36/A36M04 Standard Specification for Carbon Structural Steel
 - .2 ASTM A10803 Steel Bars, Carbon, ColdFinished, Standard Quality
 - .3 ASTM A123/A12302 Zinc (Hot Galvanized) Coatings on Products Fabricated from Rolled, Pressed and Forged Steel Shapes, Plates, Bars and Strip
 - .4 ASTM A30704 Specification for Carbon Steel Bolts and Studs, 60,000 psi Tensile Strength
 - .5 ASTM A325M04b Specification for HighStrength Bolts for Structural Steel Joints
 - .6 ASTM A38503 HighQuality Zinc Coatings (Hot Dip)
 - .7 ASTM A78001 Repair of Damaged HotDipped Galvanized Coatings
- .2 Canadian General Standards Board (CGSB)
 - .1 CAN/CGSB-1.40, Anti-corrosive Structural Steel Alkyd Primer.
 - .2 CAN/CGSB-1.181, Ready-Mixed, Organic Zinc-Rich Coating.
- .3 Canadian Standards Association (CSA International)
 - .1 CAN/CSAS1601 Limit States Design of Steel Structures
 - .2 CAN/CSAG164M92 (R2003) Hot-Dip Galvanizing of Irregularly Shaped Articles
 - .3 CAN3G30.18M92 (R2002) Billet Steel Deformed Bars for Concrete Reinforcement
 - .4 CAN/CSAG40.20/G40.2104 General Requirements for Rolled or Welded Structural Quality Steel/Structural Quality Steels
 - .5 CSA W47.103 Certification of Companies for Fusion Welding of Steel Structures
 - .6 CSA W59M03 Welded Steel Construction (Metal Arc Welding)
 - .7 CSA W178.102 Certification of Welding Inspection Organizations
- .4 The Environmental Choice Program
 - .1 CCD-047a-[98], Paints, Surface Coatings.
 - .2 CCD-048-[98], Surface Coatings - Recycled Water-borne.
- .5 The Society for Protective Coatings (SSPC)/National Association of Corrosion Engineers (NACE International):

- .1 SSPC Surface Preparation Guidelines:
 - .1 SSPCSP2 Hand Tool Cleaning
 - .2 SSPCSP3 Power Tool Cleaning
 - .3 SSPCSP5/NACE No.1 White Metal Blast Cleaning
 - .4 SSPCSP6/NACE No. 3 Commercial Blast Cleaning
- .2 Application, Inspection and Quality Control Guidelines.

1.2 SUBMITTALS

- .1 Comply with requirements of Section 01 00 15.
- .2 Product Data:
 - .1 Submit manufacturer's printed product literature, specifications and data sheets
 - .2 Submit two copies of WHMIS MSDS - Material Safety Data Sheets in accordance. Indicate VOC's for finishes, coatings, primers and paints.
- .3 Shop Drawings
 - .1 Provide shop drawings showing assembly and installation details, and the method and locations of all exposed fastenings. Verify all dimensions with site conditions before fabricating.
 - .2 For items where design is delegated to fabricator, provide shop drawings signed and sealed by the professional engineer registered in Province of Work, responsible for the design.

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 Fabricator Qualifications: A firm experienced in producing metal fabrications similar to those indicated for this Project and with a record of successful inservice performance, as well as sufficient production capacity to produce required units.
- .4 Welding: Qualify procedures and personnel according to the following:
 - .1 Welders shall be qualified by Canadian Welding Bureau for classification of work being performed.
 - .2 The fabricator shall be certified to CSA W47.1, Division 1 or 2.1.
 - .3 Do welding inspection to CSA W178.
 - .4 Resistance welding: To CSA W55.3.
 - .5 Fusion welding: To CSA W59.

1.4 DELIVERY, STORAGE, AND HANDLING

- .1 Exercise due care in storing, handling and erecting all materials and support all materials properly at all times so that no piece will be bent, twisted or otherwise damage structurally or visibly.
- .2 Correct damaged material and where the Consultant deems damage irreparable, replace the affected items at no additional expense to the Consultant or Owner.
- .3 Apply protective covering to face of all exposed finished metalwork before it leaves shop, covering to remain until item installed.
- .4 Fabricate large assemblies so they can be safely and easily transported and handled to their place of installation.

1.5 WASTE MANAGEMENT AND DISPOSAL

- .1 Remove from site and dispose of packaging materials at appropriate recycling facilities.
- .2 Collect and separate for disposal paper, plastic, polystyrene, corrugated cardboard packaging material for recycling in accordance with Waste Management Plan.

Part 2 Products**2.1 MATERIALS**

- .1 Steel Materials:
 - .1 Steel plate: Conform to CSAG40.20/CSAG40.21, Grade 300W, thicknesses and dimensions as indicated on Drawings.
 - .2 Hollow structural sections and Rolled steel sections: Conform to CSAG40.20/CSAG40.21, Grade 350W, for thicknesses and dimensions as indicated on Drawings.
- .2 Accessories:
 - .1 Protective film: Treated paper or clear plastic, selfadhesive release type as recommended by Architectural metal fabricator, to protect finished metals. Film to be easily removable without damaging finished surfaces.
 - .2 Sealants: Specified under Section 07 92 00.
 - .3 Reinforcing bars: Conform to CAN3G30.16M1977, Grade 400.
 - .4 Bolts: Conform to ASTM A325.
 - .5 Adhesives: High-pressure bonding type, suitable for materials being bonded. Contact adhesives not acceptable.

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 round oval headed screws on items requiring assembly by screws or as indicated. Use screws for interior metal work. Use welded connections exterior metal work unless otherwise approved by Departmental Representative.
- .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. Seal exterior steel fabrications to provide corrosion protection in accordance with CAN3S16.1.
- .5 Welding is to conform to CSA W59 and the fabricator certified to CSA W47.1.
- .6 File or grind all exposed welds smooth and flush. Repair or fill all pits, cracks and holes. Grind and polish all handrails to a smooth, even surface. Smooth all inside corners and return.
- .7 Insulate when necessary to prevent electrolysis due to metal-to-metal contact or metal to masonry or concrete contact. Use bituminous paint or other approved method.
- .8 Provide fastenings, including anchor bolts, bolts, lag screws, expansion bolts, straps, brackets, etc. required for the fabrication and erection of work of this Section.
- .9 Refer to Architectural and Structural Drawings for metal fabrication details.

2.3 FINISHES

- .1 Unless otherwise indicated provide hot-dip galvanized finish to components.
- .2 Prior to priming steel, prepare all surfaces in conformance with SSPC SP3 Power Tool Cleaning for non exposed locations.
- .3 Shop paint primer: to CAN/CGSB1.40, conforming to CAN/CSAG40.20/ CAN/CSAG40.21, except surfaces receiving nelson studs and steel supporting second floor receiving sprayed fire proofing. Apply primer to properly prepared surfaces at temperature above 7°C. Leave surfaces to be welded unprimed.
- .4 Hot-dip galvanizing: galvanize steel, where indicated, to ASTM A123, minimum zinc coating of 600 g/m² (severe, unprotected exposures)
- .5 Electrolytic galvanizing: galvanize steel, where indicated, to ASTM A591, minimum zinc coating of 180 g/m² (non-severe, unprotected exposures)
- .6 Wipe coat galvanizing: galvanize steel, where indicated to CSA G189, minimum zinc coating of 75 g/m² (non-severe, protected exposures)
- .7 Touch up galvanized surfaces with zinc-rich coating to CGSB 1.181
- .8 Zinc-Rich Paint: Conforming to CGSB 1.181.

- .1 Clean metal to equivalent of commercial sand blast SSPCSP6 and remove sandblast in residue.
- .2 Apply one coat of zinc-rich paint to all surfaces exposed after assembly to minimum dry film thickness of 60 µm [(2.5 mil)]. Apply coating immediately after cleaning.
- .9 Isolation Coating: Apply an isolation coating to contact surfaces of following components in contact with cementitious materials and dissimilar metals except stainless steel:
 - .1 Exterior components
 - .2 Interior components exposed to high humidity conditions.

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 where burned by field welding.

END OF SECTION

Part 1. General**1.1 SECTION INCLUDES**

- .1 Steel stair frame of structural sections.
- .2 Integral balusters and handrailing.

1.2 REFERENCES

- .1 ASTM A53/A53M-07 - Pipe, Steel, Black and Hot-Dipped Zinc Coated, Welded and Seamless.
- .2 ASTM A153/A153M-05 - Zinc Coating (Hot-Dip) on Iron and Steel Hardware.
- .3 ASTM A307-07b - Carbon Steel Bolts and Studs, 60 000 PSI Tensile Strength.
- .4 ASTM A500/A500M-07 - Cold-Formed Welded and Seamless Carbon Steel Structural Tubing in Rounds and Shapes.
- .5 ASTM A501-07 - Hot-Formed Welded and Seamless Carbon Steel Structural Tubing.
- .6 ASTM A653/A653M – 08 - Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.
- .7 ASTM A666-03 - Annealed or Cold-Worked Austenitic Stainless Steel Sheet, Strip, Plate, and Flat Bar.
- .8 CAN/CGSB-1.40-97 - Anticorrosive Structural Steel Alkyd Primer.
- .9 CAN/CGSB-1.181-99 - Ready-Mixed Organic Zinc-Rich Coating.
- .10 CAN/CSA-G40.20-04/G40.21-04 - General Requirements for Rolled or Welded Structural Quality Steel/Structural Quality Steel.
- .11 CSA-W47.1-03 - Certification of Companies for Fusion Welding of Steel Structures.
- .12 CSA-W47.2-M1987 (R2008) - Certification of Companies for Fusion Welding of Aluminum.
- .13 CSA-W48-06 - Filler Metals and Allied Materials for Metal Arc Welding
- .14 CSA-W55.3-1965(R2003) - Resistance Welding Qualification Code for Fabricators of Structural Members Used in Buildings.
- .15 CSA-W59-03 - Welded Steel Construction (Metal Arc Welding).
- .16 NAAMM AMP 510-92 - Metal Stairs Manual.
- .17 NAAMM MBG 531-00 - Metal Bar Grating Manual.
- .18 SSPC (The Society for Protective Coatings) (formerly SSPC - Steel Structures Painting Council) - Steel Structures Painting Manual.

1.3 PERFORMANCE REQUIREMENTS

- .1 Fabricate stair assembly to support a uniform live load of 4.7kPa and a concentrated load of 14kPa with deflection of stringer or landing framing not to exceed 1/180 of span. Test in accordance with ASTM A935.
- .2 Railing assembly, wall rails, and attachments to resist lateral force of 333N at any point without damage or permanent set. Test in accordance with ASTM A935.

- .3 Fabricate stair assembly to NAAMM - Metal Stairs Manual, Industrial Class

1.4 SUBMITTALS

- .1 Comply with requirements of Section 01 00 15.
- .2 Shop Drawings: Indicate profiles, sizes, connection attachments, reinforcing, anchorage, size and type of fasteners, and accessories.
- .3 Indicate welded connections using standard welding symbols. Indicate net weld lengths.

1.5 QUALITY ASSURANCE

- .1 Prepare Shop Drawings under direct supervision of a Professional Structural Engineer experienced in design of this work and licensed at the place where the Project is located.
- .2 Welders' Certificates: certifying welders employed on the Work, verifying qualification within the previous 12 months to CSAW47.1 and/or CSA W55.3.

Part 2. Products

2.1 MATERIALS

- .1 Steel Sections and Plates: CAN/CSA G40.20/G40.21, Grades as noted on Structural Drawings.
- .2 Steel Pipe: ASTM A53/A53M, Grade B Schedule 40, standard weight prime finish.
- .3 Sheet Steel: ASTM A653/A653M, Grade B Structural Quality with 380 g/sq m galvanized coating.
- .4 Bolts, Nuts, and Washers: ASTM A307, hot dip galvanized.
- .5 Exposed Mechanical Fastenings: Flush countersunk screws or bolts; consistent with design of stair structure.
- .6 Welding Materials: Type required for materials being welded.
- .7 Shop and Touch Up Primer: CAN/CGSB 1.40.

2.2 COMPONENTS

- .1 Gratings: NAAMM MBG 531: Steel, welded, with checker plate nosings; sizes as indicated on Drawings
- .2 Handrail Brackets: to ASTM A47,75 mm dimension from wall to center line of handrail.

2.3 FABRICATION GENERAL

- .1 Fit and shop assemble components in largest practical sections, for delivery to site.
- .2 Fabricate components with joints tightly fitted and secured.
- .3 Continuously seal joined pieces by continuous welds.
- .4 Grind exposed joints flush and smooth with adjacent finish surface. Make exposed joints butt tight, flush, and hairline. Ease exposed edges to small uniform radius.
- .5 Exposed Mechanical Fastenings: Flush countersunk screws or bolts; unobtrusively located; consistent with design of component, except where specifically noted otherwise.

- .6 Supply components required for anchorage of fabrications. Fabricate anchors and related components of same material and finish as fabrication, except where specifically noted otherwise.
- .7 Accurately form components required for anchorage of stairs, landings and railings to each other and to building structure.

2.4 FABRICATION - OPEN GRATING STAIRS AND LANDINGS

- .1 Fabricate treads welded steel bars, welded to supports; galvanized finish.
- .2 Form hollow stringers with rolled steel channels; galvanized finish.
- .3 Form landings same as treads; galvanized finish. Reinforce underside to attain design load requirements.
- .4 Refer to Drawings for stair details.

2.5 FINISHES

- .1 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 Prime paint items with two coats of red oxide primer.

Part 3. Execution

3.1 EXAMINATION

- .1 Verify that field conditions are acceptable and are ready to receive work.

3.2 PREPARATION

- .1 Clean and strip primed steel items to bare metal where site welding is required.
- .2 Supply items required to be cast into concrete or embedded in masonry with setting templates.

3.3 INSTALLATION

- .1 Install components plumb and level, accurately fitted, free from distortion or defects.
- .2 Provide anchors, plates, angles, hangers, and struts required for connecting stairs to structure.
- .3 Allow for erection loads, and for sufficient temporary bracing to maintain true alignment until completion of erection and installation of permanent attachments.
- .4 Field weld components indicated on shop drawings. Perform field welding in accordance with CSA W59.
- .5 Field bolt and weld to match shop bolting and welding. Conceal bolts and screws whenever possible. Where not concealed, use flush countersunk fastenings.
- .6 Mechanically fasten joints butted tight, flush, and hairline. Grind welds smooth and flush.
- .7 Obtain approval prior to site cutting or creating adjustments not scheduled.
- .8 After erection, prime welds, abrasions, and surfaces not shop primed, except surfaces to be in contact with concrete.

3.4 ERECTION TOLERANCES

- .1 Maximum Variation from Plumb: 6 mm per storey, noncumulative.
- .2 Maximum Offset from True Alignment: 6 mm.

END OF SECTION

Part 1 General**1.1 REFERENCES**

- .1 American Society for Testing and Materials (ASTM)
 - .1 ASTM D1761, Standard Test Methods for Mechanical Fasteners in Wood.
 - .2 ASTM D5456, Specification for Evaluation of Structural Composite Lumber Products.
- .2 Canadian General Standards Board (CGSB)
 - .1 CAN/CGSB-71.26, Adhesive for Field-Gluing Plywood to Lumber Framing for Floor Systems.
- .3 Canadian Standards Association (CSA)
 - .1 CAN/CSA-086 – Engineering Design in Wood.
 - .2 CSA O112 Series, CSA Standards for Wood Adhesives.
 - .3 CSA O121, Douglas Fir Plywood.
 - .4 CAN/CSA-O141, Softwood Lumber.
 - .5 CSA O151, Canadian Softwood Plywood.
 - .6 CAN/CSA-O325, Construction Sheathing.
 - .7 CAN3-O437, Standards on OSB and Waferboard.
 - .8 CSA O80.20, Fire-Retardant Treatment of Lumbering Pressure Processes. This Standard applies to the fire-retardant treatment of lumber by pressure processes. Fire-Retardant Treatment of Lumber by Pressure Processes. This is not a stand alone specification.
 - .9 CSA O80.27, Fire-Retardant Treatment of Plywood by Pressure Processes. This Standard covers the fire-retardant treatment of Douglas Fir, hardwood, softwood, and Poplar plywood by pressure processes. Fire-Retardant Treatment of Plywood by Pressure Processes. This not a stand alone specification.
 - .10 CSA O322, Procedure for Certification of Pressure-Treated Wood Materials for Use in Preserved Wood Foundations.
- .4 National Lumber Grades Authority (NLGA)
 - .1 Standard Grading Rules for Canadian Lumber.
- .5 American Wood-Preservers' Association (AWPA)
 - .1 AWPA M2, Standard Inspection of Treated Wood Products.
 - .2 AWPA M4, Standard for the Care of Preservative-Treated Wood Products.

1.2 DESIGN REQUIREMENTS

- .1 Unless otherwise noted, connections shall be designed by the Contractor to the reference Standards by the Specialty Structural Engineer.
- .2 Design details and connections in accordance with requirements of CAN/CSA-O86 to resist forces, moments, shears and allow for movements indicated.

- .3 Where connections are detailed, use connection of the type and detail shown on the drawings. Modifications to the specified connection types and details will not be permitted without prior approval.
- .4 Connections for wind or seismic lateral load-resisting elements, such as bracing and drag struts, and others so noted on the structural drawings may be designed as bearing connections but shall be pre-tensioned.
- .5 Use standard connection types where connections are not detailed on the structural drawings.
- .6 Design shall be for the forces and loads shown on the drawings and shall allow for the effects of beam deflections. If forces or loads are not given, the connection shall be designed for the maximum uniform distributed load that the member can carry for the span shown.
- .7 Structural members spliced for ease of fabrication or transportation shall have splices designed to develop the full strength and stiffness of the member. Splices shall be subject to non-destructive testing. The cost for such testing shall be borne by the Contractor.
- .8 Shear connections: Select or design connections to support reaction from maximum uniformly distributed load that can be safely supported by beam in bending, provided no point loads act on beam, when shears are not indicated.
- .9 Submit sketches and design calculations stamped and signed by qualified professional engineer licensed in Province of Alberta, Canada for non standard connections.

1.3 QUALITY ASSURANCE

- .1 Lumber by grade stamp of an agency certified by Canadian Lumber Standards Accreditation Board.
- .2 Plywood, particleboard, OSB and wood based composite panels in accordance with CSA and ANSI standards.

1.4 SHOP DRAWINGS

- .1 Submit “design” drawings for review summarizing the proposed connection details to be used on the project. These drawings to be prepared by, or under supervision of, the Specialty Structural Engineer and submitted for review before start of shop drawing production. These design drawings shall show the complete connection and:
 - .1 How the connection assembly fits with the connected members.
 - .2 Sizes of engineered wood products and structural composite lumber complete with connection.
 - .3 Capacities of the connection.
 - .4 Assumed eccentricities, lines of action of forces, etc.

- .2 Submit shop drawings prepared under direction of the Specialty Structural Engineer. Drawings of components and connections designed by the Contractor shall be sealed and signed by this Specialty Structural Engineer or a letter shall be submitted at the end of the project signed and sealed by this Specialty Structural Engineer. The letter shall identify what was designed by the Specialty Structural Engineer and list the final shop drawings by number with dates and revision numbers.
- .3 Shop drawings shall show complete shop and erection details necessary for fabrication and erection of the component parts of the structure, including cuts, copes, connections, holes, fasteners, splices and location, type, size and extent of all connections. Splices not shown on the shop drawings will be rejected.
- .4 Provide a shop drawing clearly locating all anchor bolts, embedded plates, baseplates, etc.
- .5 Provide setting drawings, templates and directions for the installation of anchor bolts, plates and other devices.
- .6 Review of the shop drawings is intended as an assistance to the Contractor and does not relieve the Contractor of his responsibility for the completeness or accuracy of his work and its conformance with the contract documents.
- .7 Fabrication that commences prior to shop drawing review is at the risk of the Contractor.
- .8 Clearly identify on the shop drawing all revisions, changes, or modifications.
- .9 Resubmit reviewed shop drawings where noted in the review stamp, or when the Contractor makes revisions for his own purposes.
- .10 Allow at least two (2) weeks for shop drawing review.
- .11 Structural drawings are not prepared to be used as erection or shop drawings.

1.5 SUPPLY OF ALTERNATE PRODUCTS

- .1 Should the sections shown on the drawings not be procurable, or should substitution for those sections be desired, sections of equivalent strength, may be substituted if approved. In such cases full particulars, thereof must be submitted prior to the closing of Bid. Material substitutions after the closing of Bid, if accepted, will be at the Contractor's cost.

1.6 FIELD REVIEW

- .1 The Specialty Structural Engineer responsible for shop drawings, or the Specialty Structural Engineer's representative, shall visit the site to review in place the connections and components designed by that Specialty Structural Engineer. The Specialty Structural Engineer shall be satisfied or take steps to ensure that these connections and components substantially comply with the Specialty Structural Engineer's design. The Specialty Structural Engineer shall then provide a sealed and signed letter to this effect.

- .2 The Contractor shall advise the Specialty Structural Engineer of the scheduling of all field work pertaining to this Project. The Contractor shall permit the Specialty Structural Engineer full access to the site, for the purpose of carrying out his work and he shall provide assistance required to aid in the performance of the inspection.
- .3 Provide safe access and working areas for field review on site, as required by the Specialty Structural Engineer.
- .4 Submit field review reports within 1 week of completion of inspection.

Part 2 Products

2.1 BUILDING FRAMING AND STRUCTURAL MATERIALS

- .1 Lumber: unless specified otherwise, softwood, S4S, moisture content 19% (S-dry) or less in accordance with following standards:
 - .1 CAN/CSA-O141.
 - .2 NLGA Standard Grading Rules for Canadian Lumber.
- .2 Glued end-jointed (finger-jointed) lumber is not acceptable.
- .3 Laminated Veneer Lumber (LVL) Beams in accordance with ASTM D5456: LVL 2.0E (13,800MPa) with vertical laminations and depths indicated on the structural drawings.
- .4 Roof, and Exterior Wall Sheathing to be Tongue and Groove Plywood, thickness to be indicated on the structural drawings.
- .5 Furring, blocking, nailing strips, grounds, rough bucks, cants, curbs, fascia backing and sleepers:
 - .1 S4S for members receiving finishes, S2S or S4S for members not receiving finishes.
 - .2 Board sizes: Spruce, pine, fir (SPF) species, No. 2 grade or better.
 - .3 Dimension sizes: Spruce, pine, fir (SPF) species, No. 2 grade or better.
 - .4 Post and timbers sizes: Spruce, pine, fir (SPF) species, No. 2 grade or better.

2.2 PANEL MATERIALS

- .1 Plywood, OSB and wood based composite panels: to CAN/CSA-O325.0.
- .2 Douglas fir plywood (DFP): to CSA O121, standard construction.
- .3 Canadian softwood plywood (CSP): to CSA O151, standard construction.
- .4 Poplar plywood (PP): to CSA O153, standard construction.

2.3 ACCESSORIES

- .1 General purpose adhesive: to CSA O112 Series.

- .2 Nails, spikes and staples: galvanized.
- .3 Bolts: Galvanized 12.7 mm diameter unless indicated otherwise, complete with galvanized nuts and washers.
- .4 Proprietary fasteners: toggle bolts, expansion shields and lag bolts, screws and lead or inorganic fibre plugs, explosive actuated fastening devices, recommended for purpose by manufacturer. All proprietary fasteners to be galvanized or stainless steel.
- .5 Joist hangers: minimum 1 mm thick sheet steel with galvanized ZF001 coating designation.
- .6 Roof sheathing H-Clips: formed "H" shape, thickness to suit panel material.
- .7 Damp Proofing Membrane: polyethylene film: to CAN/CGSB-51.34, Type 1, 0.15 mm thick.

2.4 FASTENER FINISHES

- .1 Galvanizing: to CAN/CSA-G164, use galvanized fasteners for all interior and exterior work, pressure-preservative treated lumber as indicated on drawings.

2.5 WOOD PRESERVATIVE

- .1 Preservative: to CSA-O80 Series, Alkaline Copper Quaternary (ACQ) tinted green.

Part 3 Execution

3.1 PREPARATION

- .1 Store wood products as to avoid damage and keep clean.

3.2 FRAMING MEMBERS

- .1 Comply with requirements of NBC Part 9 supplemented by following paragraphs.
- .2 Install members true to line, levels and elevations, square and plumb. Erect all framing materials forming subsurfaces for wood finishes, drywall, etc. to be straight in any plain with a tolerance of 6 mm in 3 m non cumulative.
- .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 Ensure that all members are framed, anchored, tied and braced together to provide the strength and rigidity necessary for their end purposes.

- .7 Ensure that at least 50% of length of fasteners penetrate wood materials to which fasteners are secured.
- .8 Secure exterior stud wall sole plates bolted on foundations in strict accordance with design requirements.
- .9 Brace all framing temporarily in place, until braced by complete framing and sheathing.
- .10 Construct openings in stud walls wider than stud spacing by doubling jamb studs with full length cripples having full bearing at bottom of opening and providing minimum 38 mm full bearing for lintel.
- .11 Construct lintels over openings in stud walls with framing lumber set on edge and continuous solid lumber or fir sheathing plywood spacer, spiked together to make up full stud wall thickness, as indicated on structural drawings.
- .12 Provide built-up stud columns at each bearing for built-up timber beam unless noted otherwise. Each built-up column shall consist of the same number of wood studs as the number of wood framing members in each built-up timber beam, unless otherwise noted.
- .13 Double up sill plates at window and similar openings wider than 800 mm in stud walls, provide bearing cripples at jamb studs for sill plate support similar as specified for lintel support preceding.
- .14 Provide 38 x 150 solid wood blocking in walls to receive washroom accessories, handrails, upper casework, etc. as shown on drawings

3.5 ROOF FRAMING

- .1 Set roof framing with crown up, minimum 3" birds mouth cut at wall solid support at intermediate beams, vertical cut at ridge to fit ridge board.
- .2 Cut all eaves plumb vertical and true to line.
- .3 Spike all rafters to wall plates, dwarf walls, trusses, ridges, valleys. Install and secure all blocking, bridging, framing. Provide continuous solid blocking for fascia and soffit.
- .4 Provide a minimum of 2 - 38 x 235 mm timber framing members on each side of roof openings, unless noted otherwise. Extend these framing members on two parallel sides of the opening to bear on the nearest adjacent bearing truss or beam.

3.5 ROOF FASCIAS, NAILERS, CURBS

- .1 Install furring and blocking as required to space-out and support casework, cabinets, wall and ceiling finishes, facings, fascia, soffit, siding [electrical equipment mounting boards], and other work as required.
- .2 Install furring to support siding applied vertically [where there is no blocking and] where sheathing is not suitable for direct nailing.
- .3 Align and plumb faces of furring and blocking to tolerance of 1:600.
- .4 Install wood fascia backing, nailers, curbs, roof spacers and other wood supports for roofing and sheet metal work, insulation, blocking, as indicated.
- .5 Secure with galvanized nails. Locate fastenings within 300 mm from ends and uniformly spaced between. Space nails at 200 mm centres except where indicated otherwise.

3.7 ROUGH BUCKS, NAILERS

- .1 Install rough bucks, nailers and linings to rough openings as required to provide backing for frames and other work.
- .2 Install wood cants, fascia backing, nailers, curbs and other wood supports as required and secure using steel fasteners.
- .3 Install sleepers as indicated.
- .4 Except where indicated otherwise use material at least 38 mm thick secured with 9 mm bolts located within 300 mm from ends of members and uniformly spaced at 1200 mm between.
- .5 Countersink bolts where necessary to provide clearance for other work.

3.3 ERECTION

- .1 Countersink bolts where necessary to provide clearance for other work.
- .2 Use nailing disks for soft sheathing as recommended by sheathing manufacturer.
- .3 Install damp proofing membrane between sole plate of stud walls set on slabs on grade and foundations, 300 mm wide, continuous with 200 mm laps, turned up inside, down on outside of wall, stamped in place both sides to studs, lapped over a vapour barrier where such is applied.
- .4 Obtain permission from Building Inspector of local authority having jurisdiction, before covering fire stop bridging with other materials.
- .5 Limit all other vertically continuous stud spaces exceeding 3 m in height by installing horizontal fire stop bridging of same size as studs at strategic points between studs.

- .6 Install horizontal fire stop bridge of same material as studs, between all studs at springing points of ceiling, where studs wall spaces extend continuously beyond edge of ceiling, and as detailed.
- .7 Use dust collectors and high quality respirator masks when cutting or sanding wood panels.

3.4 ROOF SHEATHING

- .1 Install roof sheathing in accordance with requirements of NBC.
- .2 Install roof plywood sheathing across wood trusses, rafters and joists.
- .3 Nail securely to joists, rafters, trusses, blocking. Use approved H clips at horizontal joints where no solid blocking under.
- .4 Stagger vertical joints of sheathing.
- .5 Leave smooth and securely fastened ready to receive shingles on sloped roof.

3.5 WALL SHEATHING

- .1 Install wall sheathing in accordance with manufacturer's printed instructions.
- .2 Apply plywood sheathing to walls. Nail securely to studs, plates, blocking and framing.
- .3 Cut sheathing neatly at door, window framed openings.
- .4 Leave smooth and securely fastened ready to receive sheathing paper and finishes.

3.6 SURFACE-APPLIED WOOD PRESERVATIVE

- .1 Treat surfaces of material with wood preservative, before installation. Wherever possible, apply preservative after materials have been cut and fit to size.
- .2 Apply preservative by dipping, or by brush or spray to completely saturate and maintain wet film on surface for minimum 3 minute soak on lumber and one minute soak on plywood.
- .3 Re-Re-treat surfaces exposed by cutting, trimming or boring with liberal brush application of preservative before installation.
- .4 Treat all material as follows:
 - .1 Wood fascia backing, curbs, nailers, on roof deck.
 - .2 Wood in contact with exterior concrete walls.
 - .3 All exposed exterior wood framing.
 - .4 Wood in contact with grade (ie support for crawl space smoke separations).

END OF SECTION

Part 1 General**1.1 REFERENCES**

- .1 CSA International
 - .1 CAN/CSA O80 Series-08 (R2013), Wood Preservation.
 - .2 CSA O86 Consolidation-14, Engineering Design in Wood.
 - .3 CSA O141-05(R2014), Softwood Lumber.
 - .4 CSA S307-M1980(R2006)], Load Test Procedure for Wood Roof Trusses for Houses and Small Buildings.
 - .5 CSA S347-99(R2014), Method of Test for Evaluation of Truss Plates Used in Lumber Joints.
 - .6 CSA W47.1-09 (R2014), Certification of Companies for Fusion Welding of Steel.
 - .7 CAN/CSA-Z809-08 (R2013), Sustainable Forest Management.
- .2 Forest Stewardship Council (FSC)
 - .1 FSC-STD-01-001-[2004], FSC Principle and Criteria for Forest Stewardship.
- .3 National Lumber Grades Authority (NLGA)
 - .1 Standard Grading Rules for Canadian Lumber [2010].
- .4 National Research Council (NRC)/Institute for Research in Construction (IRC) - Canadian Construction Materials Centre (CCMC)
 - .1 CCMC-[on-line edition], Registry of Product Evaluations.
- .5 Truss Plate Institute of Canada (TPIC)
 - .1 TPIC - 2007, Truss Design Procedures and Specifications for Light Metal Plate Connected Wood Trusses (Limit States Design).

1.2 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Submit in accordance with Section 01 00 15.
- .2 Product Data:
 - .1 Submit manufacturer's instructions, printed product literature and data sheets for wood trusses 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 Alberta, Canada.
 - .2 Include on drawings:
 - .1 Each shop drawing submission showing connection details.
 - .2 Indicate special structural application and specification as according to local authorities having jurisdiction.

- .3 Indicate TPIC Truss Design Procedure and CSA O86 Engineering Design in Wood and specific CCMC Product Registry number of the truss plates
- .4 Indicate species, sizes, and stress grades of lumber used as truss members. Show pitch, span, camber, configuration and spacing of trusses. Indicate connector types, thicknesses, sizes, locations and design value. Show bearing details. Indicate design load for members.
- .5 Submit stress diagram or print-out of computer design indicating design load for truss members. Indicate allowable load and stress increase.
- .6 Provide certification that trusses meet requirements of CSA S307 and CSA S347.
- .7 Indicate arrangement of webs or other members to accommodate ducts and other specialties.
- .8 Show location of lateral bracing for compression members.
- .9 Test reports: submit certified test reports for prefabricated wood trusses from approved independent testing laboratories, indicating compliance with specifications for specified performance characteristics and physical properties.
- .10 Certificates: submit certificates signed by manufacturer certifying that materials comply with specified performance characteristics and physical properties.
- .11 Instructions: submit manufacturer's installation instructions.

1.3 QUALITY ASSURANCE

- .1 Qualifications:
 - .1 Fabricator for trusses to show evidence of quality control program such as provided by regional wood truss associations, or equivalent.
 - .2 Fabricator for welded steel connections to be certified in accordance with CSA W47.1.

1.4 DELIVERY, STORAGE AND HANDLING

- .1 Deliver, store and handle materials in accordance with Section 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 wood trusses from nicks, scratches, and blemishes.
 - .3 Replace defective or damaged materials with new.
 - .4 Provide bearing supports and bracings. Prevent bending, warping and overturning of trusses.

Part 2 Products**2.1 DESIGN REQUIREMENTS**

- .1 Design light metal plate connected wood trusses in accordance with TPIC truss design procedures for wood truss chords and webs in accordance with engineering properties in CSA O86.
- .2 Design light metal plate connected wood trusses in accordance with TPIC truss design procedures for truss joint designs to test engineering properties in accordance with CSA S347 and listed in CCMC Registry of Product Evaluations.
- .3 Design trusses, bracing in accordance with CSA O86.1 for building locality as ascertained by NBC, Climatic Information for Building Design in Canada.
- .4 Limit live load deflection to 1/360th of span where gypsum board ceilings are hung directly from trusses.
- .5 Limit live load deflections to 1/240th of span unless otherwise specified or indicated.

2.2 MATERIALS

- .1 Lumber: SPF species, #1/2 grade, softwood, with maximum moisture content of 19% at time of fabrication and to following standards:
 - .1 CSA O141.
 - .2 NLGA (National Lumber Grading Association), Standard Grading Rules for Canadian Lumber.
 - .3 CAN/CSA-Z809 or FSC or SFI certified.
- .2 Fastenings: to CSA O86.

2.3 FABRICATION

- .1 Fabricate wood trusses in accordance with reviewed shop drawings.
- .2 Provide for design camber and roof slopes when positioning truss members.
- .3 Connect members using metal connector plates.

2.4 SOURCE QUALITY CONTROL

- .1 Identify lumber by grade stamp of an agency certified by Canadian Lumber Standards Administration Board.
- .2 Certify by agency accredited by Standards Council of Canada that fire retardant treated wood in accordance with CAN/CSA O80 Series.

Part 3 Execution**3.1 EXAMINATION**

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

- .1 Visually inspect substrate in presence of Departmental Representative.
- .2 Inform Consultant of unacceptable conditions immediately upon discovery.
- .3 Proceed with installation only after unacceptable conditions have been remedied and after receipt of written approval to proceed from Departmental Representative.

3.2 MANUFACTURER'S INSTRUCTIONS

- .1 Compliance: comply with manufacturer's written recommendations or specifications, including product technical bulletins, handling, storage and installation instructions, and datasheet.

3.3 ERECTION

- .1 Erect wood trusses in accordance with reviewed shop drawings.
- .2 Handling, installation, erection, bracing and lifting in accordance with manufacturers instructions.
- .3 Make adequate provisions for handling and erection stresses.
- .4 Exercise care to prevent out-of-plane bending of trusses.
- .5 Install temporary horizontal and cross bracing to hold trusses plumb and in safe condition until permanent bracing and decking are installed.
- .6 Install permanent bracing in accordance with reviewed shop drawings, prior to application of loads to trusses.
- .7 Do not cut or remove any truss material without approval of Departmental Representative.
- .8 Remove chemical and other surface deposits on treated wood, in preparation for applied finishes.

3.4 FIELD QUALITY CONTROL

- .1 Manufacturer's Field Services:
 - .1 Have manufacturer of products supplied under this Section review work involved in handling, installation/application, protection and cleaning of its products, and submit written reports, in acceptable format, to verify compliance of work with Contract.
 - .2 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 Schedule site visits to review work at stages listed:
 - .1 After delivery and storage of products, and when preparatory work on which work of this Section depends is complete, but before installation begins.
 - .2 Twice during progress of work at 25% and 60% complete.
- .2 Upon completion of work, after cleaning is carried out.
- .3 Obtain reports within three days of review and submit immediately to Departmental Representative.

3.5 CLEANING

- .1 Progress Cleaning: clean in accordance with Section 01 00 15.
 - .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 00 15.

END OF SECTION

Part 1 General**1.1 INTENT**

- .1 The work of this section includes the supply, fabrication, and delivery to the job site factory finishing and site installation of shop manufactured architectural woodwork indicated on the drawings and as specified.
- .2 Architectural woodwork shall include all clear, kiln dried, dressed, or resawn material exposed to view in a finished building interior, including cabinet work, frames, paneling, trim, and other wood related products.
- .3 Cabinet hardware to be supplied by this section.

1.2 REFERENCES

- .1 Architectural Woodwork Manufacturers Association of Canada (AWMAC):
 - .1 “Architectural Woodwork Standards ”, First Edition 2009, published by the Architectural Woodwork Institute of the U.S. and jointly copyrighted with the Architectural Woodwork Manufacturer's Association of Canada (AWMAC). This document is herein referred to as the “AWMAC Manual”.
- .2 American National Standards Institute (ANSI):
 - .1 ANSI A208.21994, Medium Density Fibreboard for Interior Use
 - .2 ANSI/NEMA LD3.11995, Performance, Application, Fabrication, and Installation of High Pressure Decorative Laminates
- .3 American Society for Testing and Materials (ASTM):
 - .1 ASTM D24500 (R2002)e1, Standard Practice for Establishing Structural Grades and Related Allowable Properties for Visually Graded Lumber
 - .2 ASTM D103799, Standard Test Methods for Evaluating Properties of Wood Base Fibre and Particle Panel Materials
- .4 Canadian Standards Association (CSA):
 - .1 CAN3 A172M79 (R1996), High Pressure, Paper Base, Decorative Laminates.
 - .2 CSA O115M1982 (R2001), Hardwood and Decorative Plywood.
 - .3 CAN/CSA O141M91(R1999), Softwood Lumber.
 - .4 CSA O153M1980(R2003), Poplar Plywood.
- .5 Canadian General Standards Board (CGSB):
 - .1 CAN/CGSB11.3M87, Hardboard.
 - .2 CAN/CGSB19.13M87, Sealing Compound, One Component, Elastomeric, Chemical Curing.

- .6 Canadian Hardwood Lumber Association (CHLA):
 - .1 Official Grading Rules
- .7 Canadian Hardwood Plywood Association (CHPA):
 - .1 CHPA Official Grading Rules for Canadian Hardwood Plywood (1993).
 - .2 CHPA Official Grading Rules for Rotary Cut Birch, Oak and Maple Veneers (April 1999).
- .8 National Lumber Grades Authority (NLGA):
 - .1 Standard Grading Rules for Canadian Lumber

1.3 SUBMITTALS

- .1 Comply with requirements of Section 01 00 15.
- .2 Submit shop drawings indicating over all dimensions, cut-outs, fabrication details, installation requirements and rough-ins for items being supplied by.
- .3 Samples:
 - .1 Submit two (2) finished samples, 625 cm² (100 in²) of each finish to be applied at the factory, to the Departmental Representative for approval.
 - .2 Where existing materials are being matched, verify that specified materials match existing prior to submitting samples.
 - .3 Alternative cabinet hardware from that specified shall be submitted to the Departmental Representative for approval.
 - .4 Approved samples shall become the standard for the work.
- .4 Project Record Data:
 - .1 Submit to the Departmental Representative 2 copies of the project record sheet identifying the project title and address, Departmental Representative, Contractor, and Architectural Woodwork Subcontractor. Indicate also materials and finishes used for architectural woodwork and whether shop finished or site finished and by whom. Include type and source of all cabinet hardware and any specialty items used under architectural woodwork.

1.4 QUALITY ASSURANCE STANDARDS

- .1 "Architectural Woodwork Quality Standards ", First Edition – 2009, together with authorized additions and amendments, shall be used as a reference standard and shall form part of this project specification. Where differences occur between the drawing and specification requirements, and the Manual the more restrictive requirement shall prevail.
- .2 Where modifications to the AWMAC Quality Standards contained within the Manual are included in this project specification, then such modifications shall govern in case of conflict.
- .3 Any reference to Custom or Premium grade in this specification shall be as defined in the Manual.

- .4 Any item not given a specific quality grade shall be Premium grade as defined in the Manual.
- .5 A copy of the AWMAC Quality Standards Manual shall be made readily available for reference purposes on the job site.
- .6 All architectural woodwork to be used in the project shall meet the requirements of the AWMAC Quality Standards Manual.
- .7 References in this specification to part and item numbers mean those parts and items contained within the AWMAC Quality Standards Manual.
- .8 Materials and installation shall be in Metric measurement as specified.

1.5 PRODUCT HANDLING AND STORAGE

- .1 The Architectural Woodwork Manufacturer and the Contractor shall be jointly responsible to make certain that architectural woodwork and wood doors are not delivered until the building and storage areas are sufficiently dry so that the architectural woodwork and wood doors will not be damaged by excessive changes in moisture content.
- .2 Architectural woodwork delivery, storage, and handling shall be in accordance with Section 2 of the Manual.
- .3 Delivered materials which are damaged in any way or do not comply with these specifications will be rejected by the Departmental Representative and shall be removed from the job site and replaced with acceptable materials.

1.6 ENVIRONMENTAL REQUIREMENTS

- .1 Area, or room, in which cabinet and millwork to be installed must be maintained at a uniform temperature of 16°C minimum, and 25% to 55% humidity, 24 hours prior to, during and after installation.
- .2 Maintain a minimum 430 lx (40 f.c.) illumination on surfaces and areas where cabinet and millwork is being installed.

1.7 COORDINATION

- .1 Coordinate activities with Section 08 80 00 – Glazing to ensure that supply and installation of glass and plastic glazing materials are installed when work of this Section is ready to receive work of that section.
- .2 Coordinate activities with Section 09 65 16 to ensure that supply and installation of rubber materials are installed when work of this section is completed.
- .3 Coordinate activities with Divisions 20 and 26 for removal and installation of items affecting this work.
- .4 Coordinate activities of this Section with work of others to ensure that all components fit together properly.

Part 2 Products**2.1 MATERIALS**

- .1 Use clean stock only and comply with AWMAC Quality Standards for following grades.
- .2 Poplar plywood: to CSA O153, utility interior moisture resistant type.
- .3 Hardwood plywood: to CSA O115, of thickness indicated, and maximum size sheets application and as follows:
 - .1 AWMAC premium grade, for clear finish.
 - .2 Face Veneer: 'A' Veneer Grade:
 - .1 Minimum 150 mm flitch width.
 - .2 Continuous across face of panel, no end matching allowed.
 - .3 Birch, plain sliced, single sheet match and symmetry.
 - .4 Minimum veneer thickness, 0.50 mm ($\frac{1}{50}$ ").
 - .5 Vertical grain direction.
 - .3 Core Construction: Veneer or Medium Density Fibreboard as indicated. Provide exterior waterproof grade plywood veneer core for countertops to receive sinks and in "wet areas".
 - .4 Back Veneer: #1 Backing Grade.
 - .5 Panel Edge: Blind Edge, matching face veneers, hardwood 12 mm ($\frac{1}{2}$ " wide x thickness of panel, edge glued to side of panel where edge of panel is exposed.
 - .6 Grade stamp marked on the edge of each panel, indicating cut, species and grade, and manufacturer's name.
- .4 Lumber:
 - .1 Soft wood: to CAN/CSA0141, kiln dried to maximum moisture content of 12%, dressed 4 sides.
 - .2 Hardwood: to Canadian Hardwood Lumber Association, selected to meet AWMAC premium grade, plain sliced, maple, select for clear finish where exposed.
- .5 Fibreboard: Medium density fibreboard (MDF) to ASTM D1037, Premium Grade with the following characteristics:
 - .1 Density 800 kg/m³ to 750 kg/m³ (50 #/ft³ to 47#/ft³) depending on thickness, thickness as indicated.
 - .2 Formaldehyde emissions shall be 0.30 ppm or less per 0.424m²/m³ (0.13 ft²/ft³) of room volume.
- .6 High Pressure Plastic Laminate: meeting the requirements of CAN3A172 or National Electric Manufacturers Association (NEMA) Publication LD31991 for Class 1 Decorative Laminate; and as follows:
 - .1 Self edging work: GP grade, standard duty, composed of phenolic resin impregnated Kraft paper filler stock:
 - .1 Horizontal surfaces: 1.06 to 1.27 mm (0.042" to 0.050") thickness for all countertops and back splashes, window sills and horizontal surfaces;

- .2 Vertical surfaces: 1.06 to 1.27 mm (0.042" to 0.050") thickness, same as horizontal surfaces for all vertical surfaces, back splashes and panels, furniture finish.
- .2 Backing sheet: Liner grade, 1.06 to 1.27 mm (0.042" to 0.050") same thickness as face required to balance face material, sanded on one side; furniture finish, solid white colour.
- .7 Adhesives:
 - .1 Plastic laminate: polyvinyl acetate or aliphatic resin in accordance with manufacturers recommendation for curing under pressure for bonding to wood cores, water resistant type.
 - .2 Edge banding: Thermoplastic hot melt, synthetic resin suitable for applying thin veneer wood edge banding and film overlays.
 - .3 Cork adhesive: As recommended by Manufacturer.
- .8 Sealant: 1 part silicone to CAN/CGSB19.13, non-staining, mould and mildew resistant, GE 1700 or Dow Corning 697, white.

2.2 CABINET WORK

- .1 Cabinet work shall conform to Section 10 of the Manual as applicable.
- .2 Edge Banding shall be applied to all four edges in accordance with the Manual, high pressure plastic laminate to match face materials or solid wood to match face veneers as indicated.
- .3 Door and Drawer Bumpers: Self adhesive type approximately 6 mm (1/4") diameter clear silicone bumpers for all cabinet work doors and drawer faces, two per door and drawer, placed at door top and bottom and drawer top.

2.3 CABINET FABRICATION

- .1 General
 - .1 All cabinet doors and drawer fronts to be flush overlay system as detailed.
 - .2 Fabricate gables and edges meeting walls oversize to allow for scribing to fit on site.
 - .3 Assemble all Work with flush butt hairline corners and joints. Cutouts for all services to be done on site during installation. No hairline cracks will be allowed in the face area of cabinet work modules unless approved in writing by the Departmental Representative.
 - .4 Joints to be carefully fitted, coped or mitred and well glued-up. There shall be no end wood visible on finished surfaces.
 - .5 Set nail heads in finished surfaces. Countersink screws and bolts, except those detailed to be exposed, and fill holes with edge grain wood plugs to match colour and grain.
 - .6 Ensure adjacent part of continuous laminate work match in colour and pattern.

- .7 Veneer plastic laminate 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 maximum sheet size. Keep joints 610 mm (24") from sink cutouts. Make joints only where approved in writing by the Departmental Representative.
- .8 Use straight self-edging laminate strip for flatwork to cover exposed edge of core material. Chamfer exposed edges uniformly at approximately 20°. Do not mitre laminate edges.

.2 Construction

- .1 Minimum core thicknesses as follows:
 - .1 Drawer bottoms, Birch Veneer Plywood 12 mm (1/2");
 - .2 Drawer sides and backs, Birch Veneer Plywood 12 mm (1/2");
 - .3 Drawer fronts, MDF 19 mm (3/4");
 - .4 Doors, MDF 19 mm (3/4");
 - .5 Lower case backs against walls, Poplar Plywood 10 mm (3/8");
 - .6 Upper case backs against walls, Poplar Plywood 10 mm (3/8");
 - .7 Shelves, fixed and adjustable, Poplar Plywood 19 mm (3/4");
 - .8 Counter top cores, Poplar Plywood 19 mm (3/4") with 38 mm (1 1/2") edge, for wet areas ensure that all cutouts are sealed prior to installation of sinks, primer is not considered to be an appropriate sealer;
 - .9 Back splashes at all locations: Poplar Veneer Plywood 19 mm (3/4");
 - .10 All other work Poplar Veneer Plywood, 19 mm (3/4").
- .2 Glue, dowel, mortise, lock joint or dado all cabinet work and cabinet work. Do not use staples. Nailing and screws are acceptable. Do not surface nail or screw through countertops.
- .3 Blocking, framing, web frames to be solid lumber.
- .4 Provide solid wood edge strips in all doors and cases to receive hardware. Rebate and pressure glue to core.
- .5 Cut and adapt all Work to receive hardware.
 - .1 Drill and prepare end gables for insert type shelf standards on gables.
 - .2 Install cash scoop and drop safe collar assemblies flush with top of countertop finish.
 - .3 Install all finishing hardware and fittings in shop.
 - .4 Fittings which may be susceptible to damage during shipping and installation may be installed after millwork installed on site.

2.4 CONTRACTOR SUPPLIED CABINET HARDWARE

- .1 Provide the following cabinet hardware, in quantities required, complete with all screws, bolts, washers for complete installation.
 - .1 Fasteners:
 - .1 Draw Bolt Fasteners: Mitre butt joint fastener, adjustable and requiring no special tools for installation, galvanized.
 - .2 Non-exposed Fasteners: Fabricators choice consistent with quality level specified.
 - .3 Exposed Fasteners: Architectural appearance, material, finish and fastener tool type as selected by Consultant; coordinate sample submittals before ordering materials.

- .2 Pulls: back mount, 96 mm wire 'D' pulls, brushed nickel finish.
 - .3 Drawer Slides: Blum full extension "Blumotion" model 569H for 16mm thick drawers and 569F for 19mm thick drawers..
 - .4 Hinges: Concealed, eurostyle hinge with cover caps; fully adjustable for overlay, depth, height and closing force; opening angle of 110°; self-closing feature; nickel plated steel construction; overlay and half overlay mounting, size and profile to suit cabinet construction
 - .5 Shelf Standards: to ANSI-A156.9, B84071, steel construction, adjustable in 13 mm increments, zinc finish.
 - .6 Shelf Rests: to ANSI-A156.9, B84091, steel construction, zinc finish.
 - .7 Grommets for electrical cords: 38mm Ø black colour.
- .2 Bolts, nuts, washers, screws, cup washers for removal panels, etc., all hot dip heavy zinc coated.

2.5 FACTORY FINISHING – CABINET WORK

- .1 Cabinet work for High Pressure Laminate Finish:
- .1 AWMAC Quality Grade Premium.
 - .2 Construction: Cabinet work shall conform to Section 10 of the Manual.
 - .3 Exposed Parts: High pressure plastic laminate, Poplar Plywood or MDF core as indicated, colour as indicated on Drawings.
 - .4 SemiExposed Parts: High pressure plastic laminate, Plywood core as specified above.
 - .5 Concealed parts: High pressure plastic laminate backer to balance face materials.
 - .6 All edges of door and drawer panels shall be finished the same as face and back (6 sides finished).
- .2 Laminate Countertops and Back Splashes
- .1 Countertops shall be self edge type to AWMAC Quality Standards.
 - .2 Edge type shall conform to AWMAC requirements
 - .3 Backsplash shall conform to AWMAC requirements.
 - .4 Laminate: high pressure plastic laminate as indicated on Drawings.
 - .5 Custom counter shall be seamless.
- .3 Factory finish cabinet work as follows:
- .1 Finishes shall be applied in accordance with Section 5 of the Manual.
 - .1 Exposed parts requiring clear finish shall have AWMAC No. 11 catalyzed polyurethane, satin gloss, premium grade lacquer coating.
 - .2 SemiExposed parts requiring clear finish shall have AWMAC No. 11 finish to match exposed components, including all surfaces of reveals and returns, underside of items and inside. Semi exposed parts shall match exposed parts for finishing.
 - .3 Drawer box requiring clear finish shall have AWMAC No. 11 catalyzed polyurethane, satin gloss, premium grade lacquer coating.
 - .4 All exposed wood shall be fabricated using solid White Birch for clear finish. All drawer boxes shall be Baltic Birch for clear finish.

- .2 Plastic Laminate:
 - .1 All surfaces (both exposed and unexposed) of shelves, doors, drawer fronts, gables and case work shall be shop plastic laminate faced as indicated, and applied to core as specified above.
 - .2 Pressure apply plastic laminate to smooth sanded and cleaned core material with proper adhesives and methods, in accordance with the plastic laminate manufacturer's written instructions.
 - .3 Plastic laminate, 1.27 mm white backing sheet in all cases where facings applied. Plywood or lumber with plastic laminate on one face only will not be accepted.
 - .4 Finish all glazing recesses to match adjacent plastic laminate surfaces.

3 Execution

3.5 JOB CONDITIONS

- .3 Job Conditions for installation of architectural woodwork shall be as specified under Section 2 of the Manual.

3.6 INSPECTION

- .3 Contractor and Departmental Representative to visit site at 80% completion and note state of Work and finishes in the various areas in which cabinet and millwork to be installed.
- .4 Ensure surfaces are ready to receive Work. All surfaces of other Work to be finished and painted before being built over or covered in any way or millwork installed.
- .5 Ensure all areas in which cabinetwork is scheduled are finished and ready to accept Work; walls painted, ceilings finished, all overhead services completed, tested and approved.

3.7 PREPARATION

- .3 Obtain all measurements from the site.
- .4 Check access to ensure large pieces of Work can be easily and safely handled to their place of final installation.
- .5 Protect finished surfaces and materials of other trades from damage.
- .6 Ensure all services and roughing-in which affect or are connected to or through this Work are complete and acceptable.
- .7 Ensure cabinet work is back primed immediately after delivery to site.

3.8 INSTALLATION

- .3 Install all cabinet work in its proper location, plumb, level and true, as indicated on drawings.
- .4 Anchor to floor, walls or ceiling using fastening devices and hardware consistent with the building materials encountered for quality installation. Do not use wood plugs. Do not use plastic plugs for ceilings or walls. Provide wall strapping as required.

- .5 Anchor cabinet work and millwork securely to building structure. Shim level and set square in relation to adjoining surfaces. Scribe accurately to adjacent Work. Provide allowance for finish flooring installation to base by other trades.
- .6 Cabinet work: Install in accordance with Section 2 of the Manual.
 - .1 Fasten to framing using zinccoated bolts, countersunk and plugged with matching wood plugs.
 - .2 Set cabinetwork in place, on base, anchoring securely to building structure and to adjoining cabinetwork. Use approved connector type fasteners between items of cabinetwork to hold adjoining pieces tightly together.
 - .3 Scribe neatly and accurately to smooth snug fit with adjoining surfaces and materials to align work properly. Mitre corners accurately.
 - .4 Perform all cutting, fitting, repairing in woodwork as required by other trades where their Work is connected to or part of this Work.
 - .5 Cut out openings for mechanical and electrical fittings and fixtures. Coordinate and cooperate in the connection and installation of mechanical and electrical work.
 - .6 Apply a neat bead of sealant between all countertops and adjoining walls and cabinetwork. Seal all edges of cut-out core material before fixtures installed.
 - .7 Install any finishing hardware shipped loose.
- .5 Finish Hardware: Install finish hardware to doors in accordance with Section 10 of the Manual.

3.5 ADJUSTING/CLEANING

- .1 During and after installation adjust all hardware and operating parts as necessary to ensure smooth and proper operation.
- .2 Clean all cabinet, countertops, shelves and fixtures.
- .3 Repair any marks, scratches or marring.

END OF SECTION

Part 1. General**1.1 REFERENCES**

- .1 ASTM C20808 Cellulosic Fibre, Insulating Board.
- .2 ASTM C55207 Cellular Glass Thermal Insulation.
- .3 ASTM C57808 Rigid, Cellular Polystyrene Thermal Insulation.
- .4 ASTM C59108 Unfaced Preformed Rigid Cellular Polyisocyanurate Thermal Insulation.
- .5 ASTM C61204e1 Mineral Fibre Block and Board Thermal Insulation.
- .6 ASTM C112604 Faced or Unfaced Rigid Cellular Phenolic Thermal Insulation.
- .7 ASTM C128907 Faced Rigid Cellular Polyisocyanurate Thermal Insulation Board.
- .8 ASTM E8408a Test Method for Surface Burning Characteristics of Building Materials.
- .9 ASTM E96/E96M05 Test Methods for Water Vapor Transmission of Materials.
- .10 CAN/ULCS10207 Method of Test for Surface Burning Characteristics of Building Materials and Assemblies.
- .11 CAN/ULCS70105 Thermal Insulation, Polystyrene, Boards and Pipe Covering.
- .12 CAN/ULCS70297 Thermal Insulation, Mineral Fibre, for Buildings.
- .13 CAN/ULCS70301 Cellulose Fibre Insulation (CFI) for Buildings.
- .14 CAN/ULCS70403 Thermal Insulation, Polyurethane and Polyisocyanurate Boards, Faced.
- .15 CAN/ULCS70602 Wood Fibre Thermal Insulation for Buildings.

1.2 SEQUENCING

- .1 Sequence work to ensure air barrier materials are in place before beginning the Work of this section.

1.3 ENVIRONMENTAL REQUIREMENTS

- .1 Do not install insulation adhesives when temperature or weather conditions are detrimental to successful installation.

Part 2. Products**2.1 BELOW GRADE INSULATING MATERIALS**

- .1 Perimeter Wall Insulation: Polystyrene, extruded type, in accordance with CAN/ULC S701, Type 4, thermal resistance not less than RSI 0.87/25 mm; square edges, board size 610 mm x 2440 mm x thickness as indicted on Drawings; minimum compressive strength 170 kPa at 10% deformation in accordance with ASTM D1621, water absorption (% by volume) maximum 0.7% in conformation with ASTM D2842:
- .2 Load Bearing Insulation: Polystyrene, high density extruded type in accordance with CAN/ULC S701, Type 4, thermal resistance not less than RSI 0.87/25 mm; square edges, board size 610 mm x 2440 mm x thickness as indicated on Drawings; minimum compressive strength 275 kPa at 5% deformation in accordance with ASTM D1621, water absorption (% by volume) maximum 0.7% in conformation with ASTM D2842.

ACCESSORIES

- .3 Insulation Fasteners:
 - .1 Perimeter Insulation Fasteners: Concrete faced insulation manufacturer's standard concealed fasteners with groove mounting plate and fastening spline.
- .4 Insulation Adhesive:
 - .1 Trowelable Polystyrene Insulation Adhesive: Trowel consistency, synthetic rubber based insulation adhesive compatible with polystyrene insulation in accordance with CGSB 71GP24M; suitable for application in temperatures down to 12°C.
- .5 Perimeter Insulation Flashings: Coordinate supply of end closures and flashings for perimeter insulation system with Section 07 62 00.

Part 3. Execution**3.1 EXAMINATION**

- .1 Examine substrates and conditions for compliance with requirements for Sections in which substrates and related work are specified and other conditions affecting performance.
- .2 Verify that all surfaces which are to receive rigid insulation are clean, free of deleterious matter and are sufficiently level to allow the proper installation of insulation.
- .3 Verify that all flashings provided under other Sections are installed and that they divert moisture to exterior of insulated systems.

3.2 PREPARATION

- .1 Clean substrates of substances harmful to insulations; remove projections that interfere with insulation attachment.
- .2 Proceed with installation only after unsatisfactory conditions have been corrected.

3.3 INSTALLATION, GENERAL

- .1 Comply with insulation and accessory manufacturer's written instructions applicable to products and application indicated.
- .2 Install insulation that is undamaged, dry, and unsoiled and that has not been left exposed at any time to ice and snow.
- .3 Install insulation to maintain continuous thermal insulation, vapour barrier and air tightness for building spaces and elements, and as follows:
- .4 Saw cut and trim insulation neatly to fit spaces; fill voids with foamed-in-place insulation compatible with installed insulation, refer to Section 07 21 19.
- .5 Butt edges and ends tight.
- .6 Fit insulation tight against mechanical, electrical and other items protruding through the plane of insulation.
- .7 Use insulation free of broken or chipped edges.
- .8 Apply single layer of insulation to produce thickness indicated, unless multiple layers are otherwise specifically shown or required to make up total thickness.

- .9 Fit insulation firmly against substrate using mechanical fasteners spaced in accordance with manufacturers recommended spacing and pattern; in addition, adhere insulation to uneven substrate surfaces and provide additional fasteners to eliminate air spaces between insulation and substrate.
- .10 Mechanically fasten insulation boards 50 mm in from edges at 305 mm centres.
- .11 Leave insulation joints un-bonded over line of expansion and control joints; bond a continuous 150 mm wide 150 µm thick polyethylene strip over expansion and control joints using compatible adhesive before application of insulation.
- .12 Protect insulation from damage until it is covered; replace any broken, sunburned, crushed or dented insulation immediately prior to covering; coordinate with backfilling operations.

3.4 INSTALLATION, PERIMETER AND UNDER SLAB INSULATION

- .1 Perimeter Insulation: Adhere board insulation to vertical surfaces with adhesive applied in accordance with manufacturer's written instructions, and as follows:
 - .1. Exterior Application: Extend boards a minimum of 1220 mm below finish grade, as indicated on Drawings, installed on exterior face of perimeter foundation wall.
 - .2. Apply adhesive to the substrate by the "dab" method not less than 10 mm x 19 mm size at 150 mm centres; bed the insulation in the adhesive before the adhesive loses its tack or skins over.
 - .3. Protect below grade insulation on vertical surfaces from damage during backfilling by applying protection board; set in adhesive according to insulation manufacturer's written instructions.

3.5 INSTALLATION, BELOW GRADE INSULATION

- .1 Load Bearing Insulation: Install board insulation horizontally having a minimum compressive strength to locations indicated on Drawings.

3.6 PROTECTION

- .1 Protect installed board insulation from damage due to harmful weather exposures, physical abuse, and other causes.
- .2 Provide temporary coverings or enclosures where insulation is subject to abuse and cannot be concealed and protected by permanent construction immediately after installation.

END OF SECTION

Part 1. General**1.1 REFERENCES**

- .1 ASTM C66506 MineralFibre Blanket Thermal Insulation for Light Frame Construction and Manufactured Housing.
- .2 ASTM E84 10 Test Method for Surface Burning Characteristics of Building Materials.
- .3 CAN/ULCS10203 Method of Test for Surface Burning Characteristics of Building Materials and Assemblies.
- .4 CAN/ULCS70209 Thermal Insulation, Mineral Fibre, for Buildings.
- .5 NFPA 255 Test of Surface Burning Characteristics of Building Materials.
- .6 UL 723 Tests for Surface Burning Characteristics of Building Materials.

Part 2. Products**2.1 MATERIALS**

- .1 Batt Insulation: Un-faced, flexible, preformed GreenGuard™ or formaldehyde free fibrous insulation in accordance with CAN/ULC S702, Type 1; having a nominal RSI of 0.55/25 mm, thickness as required to meet design insulation values indicated on drawings or as required to fill insulated spaces where not indicated.
- .2 Fibrous Mineral Wool Wall Insulation: Un-faced, preformed mineral slag batt insulation in accordance with CAN/ULC S702, Type 1; having a nominal RSI of 0.67/25 mm; rated noncombustible in accordance with CAN/ULC S114 and having a flame spread rating of 5 or less in accordance with CAN/ULC S102; density 32 kg/m³; square edges, thickness as required to meet design insulation values indicated on drawings or as required to fill insulated spaces where not indicated.
- .3 Acoustic Insulation: CAN/ULC S702; preformed glass or mineral fibre, friction fit type, unfaced, in thicknesses to fill wall cavities.

Part 3. Execution**3.1 INSTALLATION**

- .1 Install insulation where indicated in accordance with ASTM A1320, and as follows:
 - .1. Utilize either fibrous or mineral wool insulation for exterior wall applications at the option of the Contractor and acoustic insulation for all interior wall applications, unless specifically noted otherwise on Drawings.
 - .2. Where required to maintain continuity of thermal insulation of the building envelope.
 - .3. Cut and trim insulation neatly to fit spaces; butt ends and edges tight; fit insulation tightly to framing members and around pipes, conduits, and projecting structural members within insulated spaces.
 - .4. Fill stud space of exterior framed walls with insulation full depth of stud only where no insulation/vapour retardant indicated on exterior face of stud walls.
 - .5. Do not compress insulation to fit into spaces.
 - .6. Fill stud space of temporary partitions with insulation.

- .7. Hold insulation in position with clips, wires or as recommended by manufacturer when insulation is installed in horizontal locations.
- .8. Place acoustic insulation in interior walls tight within spaces, around cut openings, behind and around electrical and mechanical items within or behind walls, and tight to items passing through walls.

3.2 PROTECTION

- .1 Protect installed insulation from damage arising from harmful weather exposures, physical abuse, and other causes.
- .2 Provide temporary coverings or enclosures where insulation is subject to abuse and cannot be concealed and protected by permanent construction immediately after installation.

END OF SECTION

Part 1 General**1.1 INTENT**

- .1 Foam-in-place insulation to exterior hollow metal doorframes and aluminum door and window frames.
- .2 Foam-in-place insulation around protrusions through the exterior wall envelope and juncture of different cladding materials.

1.2 REFERENCES

- .1 American Society for Testing and Materials (ASTM):
 - .1 ASTM C273-00e1, Standard test method for shear properties of sandwich core materials
 - .2 ASTM D1622-03, Standard test methods for apparent density of rigid cellular plastics
 - .3 ASTM D1621-04, Standard test methods for compressive properties of rigid cellular plastics
 - .4 ASTM D1623-03, Standard test methods for tensile and tensile adhesion properties of rigid cellular plastics
 - .5 ASTM D2842-01, Standard test methods for water absorption of rigid cellular plastics
 - .6 ASTM E96-00e1, Standard test method for water vapour transmission of materials

1.3 QUALITY ASSURANCE

- .1 Cooperate and coordinate with the requirements of other units of work specified in other sections.

1.4 PROJECT CONDITIONS

- .1 Apply foam-in-place insulation only when substrate and ambient temperatures are within the prescribed limits.
- .2 Ensure that temperature is maintained throughout the curing period.

Part 2 Products**2.1 MATERIALS**

- .1 Insulation: One component rigid urethane foam with the following physical properties:

Density (ASTM D1622):	30.3 kg/m ³
Compressive Strength (ASTM D1621):	57.5 kPa
Compressive Modulus (10% deflection):	848 kPa
Tensile Strength (ASTM D1623):	133.5 kPa
Flatwise Shear (ASTM C273):	58.5 kPa
Thermal Resistance:	1.41 RSI/25 mm thickness
Water Absorption (ASTM D2842):	3.0 kg/H2O/m ²
Water Vapour Transmission (ASTM E96):	2.327 perms

Part 3 Execution**3.1 SURFACE PREPARATION/EXISTING CONDITIONS**

- .1 Clean spaces that are to receive insulation, of dirt, dust, grease, loose material or other foreign matter that may inhibit adhesion.
- .2 Provide sufficient ventilation during and until insulation has cured, to ensure safe working conditions. Introduce fresh air and exhaust air continuously during the 24-hour period after application.
- .3 Protect adjacent surfaces from overspray and dusting.
- .4 Prior to application, slightly moisten surfaces to which foam-in-place insulation is being applied, to accelerate curing.
- .5 Temporarily brace frames as may be required to prevent possible bowing of frames due to over expansion of the foam-in-place insulation.

3.2 INSTALLATION STEEL DOOR FRAMES

- .1 Fill exterior hollow metal door frames 75% full with foam-in-place insulation prior to installation of frames. Fill the remainder of the frame after installation, through the gap between the frame and the wall construction.

3.3 INSTALLATION/AIR SEAL AROUND EXTERIOR WINDOW AND DOOR FRAMES

- .1 Install foam-in-place insulation around all exterior window frames to maintain continuity of the thermal barrier, after air barrier has been installed and sealed to window frames.
- .2 Ensure that foam completely fills spaces, without voids, and that voids, and that foam is continuous at corners.

3.4 INSTALLATION/AROUND PROTRUSIONS THROUGH AIR SEAL

- .1 Install foam-in-place insulation around all protrusions through the exterior building envelope to achieve and maintain continuity of air/vapour seal.

3.5 CLEAN UP

- .1 Cut back excess foam-in-place insulation once cured, flush with surrounding surfaces, or recess back for application of sealant as specified in Section 07 90 00.
- .2 Upon completion of foam-in-place insulation work, clean adjacent surfaces of overspray and dusting to the satisfaction of the Consultant.

END OF SECTION

Part 1. General**1.1. PRODUCT DELIVERY, STORAGE AND HANDLING**

- .1 Deliver sheet air and vapour retarder materials in factory wrapped rolls with labels indicating:
 - .1 Manufacturer or trade name.
 - .2 Compliance with CGSB standard and type or CMHC Acceptance Number.
 - .3 Material type, thickness, roll width and area.
- .2 Protect materials from direct exposure to sunlight and physical damage.

1.2. COORDINATION

- .1 Coordinate installation of sheet air and vapour retarders with work of other Sections to achieve an air and vapour retarder tight building envelope.

Part 2. Products**2.1. MATERIALS**

- .1 Sheet Vapour Retarder: to CAN/CGSB-51.34-M86, 6 mil. thick polyethylene film.
- .2 Staples: hot-dipped galvanized, type and size to suit application, minimum 6 mm leg
- .3 Sheet Air Retarder: asphalt saturated breather type sheathing paper to CAN2-51.32M, 11.34 kg, meeting the requirements of Federal Specification UU-B-790a, Grade D
- .4 Sheathing Joint Tape: specially formulated self adhesive permanent acrylic type with oriented polypropylene backing, 50mm wide, red colour.
- .5 Flexible Sealant: non-hardening, non-skinning permanently flexible, polyurethane sealant to CAN/CGSB 19-GP-13M.
- .6 Polyethylene Pans: 18 mil black polyethylene pans moulded to fit between framing members to accommodate recessed equipment and electrical outlet boxes.

Part 3. Execution**3.1. INSTALLATION OF VAPOUR RETARDER.**

- .1 Install continuous sheet vapour retarder at exterior insulated framing elements.
- .2 Place vapour retarder on warm side (inside) of thermal insulation as indicated on drawings.
- .3 Installed vapour retarder shall form a complete and continuous envelope at exterior building elements, properly sealed at all joints, fastenings and penetrations, effectively resisting moisture migration.
- .4 All penetrations through the vapour retarder, unless clearly detailed on drawings, must be approved by the Departmental Representative. Install polyethylene pans at all electrical penetrations.

- .5 To ensure continuity of vapour retarder at all locations, install strips of vapour retarder material of sufficient widths, at all intersecting walls, at tops of walls at joist bearings and all other locations where subsequent work would prevent installation of a continuous vapour retarder membrane.
- .6 Mechanically fasten vapour retarder joints over solid backing, lap minimum one full stud or joist space, and seal with flexible sealant between sheets. Ensure that no gaps exist in sealant bead. Seal joints with tape.
- .7 Seal perimeter of vapour retarder as follows:
 - .1 Apply continuous bead of sealant to substrate at perimeter of sheet vapour retarder.
 - .2 Lap sheet into sealant and press into sealant bead.
 - .3 Ensure that no gaps exist in sealant bead. Smooth out folds and ripples occurring in sheet over sealant.
 - .4 Seal joints with tape.
- .8 Seal around all penetrations through membrane with flexible sealant.
- .9 After completion, inspect entire installation and repair or replace damaged material. Do not conceal any areas until the Departmental Representative has inspected and accepted installation of vapour retarder.
- .10 Inspect vapour retarder for continuity. Repair punctures, rips and tears with sealing tape.
- .11 Where punctures and tears are extensive replace entire damaged section.
- .12 Seal penetrations through polyethylene pans and outlet box covers with acoustical sealant.

3.2. INSTALLATION OF AIR RETARDER.

- .1 Install air retarder to exterior face of wall sheathing.
- .2 Offset joints with those of sheathing minimum 300mm. Overlap joints of membrane minimum 300mm. Ensure no joints occur at corners.
- .3 Pull air retarder tight against wall sheathing and around perimeter of openings.
- .4 At window openings, lap air retarder over vapour retarder and seal with joint tape.
- .5 Staple air retarder to substrate and cover staples and all joints with joint tape.
- .6 Repair all rips, tears, punctures or holes in air retarder with joint tape.

3.3. SEALING AROUND EXTERIOR DOOR AND WINDOW OPENINGS

- .1 Fill gap between rough opening and aluminum window frames with batt insulation.
- .2 Apply foam rod and sealant in accordance with manufacturer's instructions.
- .3 Install foam sealant around door frames, electrical chases, exhaust systems, lintels, sheathing, sill plates, sole plates, top plates, wall penetrations, wood window frames and as shown on drawings.
- .4 Seal in and around main power supply conduit where it enters building.

- .5 Seal where electrical wires and plumbing stacks penetrate the top plates of partition walls intersecting insulated ceilings, or the first stud of an interior partition wall intersects an exterior perimeter insulated wall.

END OF SECTION

Part 1. General**1.1 SECTION INCLUDES**

- .1 Synthetic shingles.
- .2 Associated metal flashings and accessories.

1.2 REFERENCES

- .1 ASTM D 3161 - Standard Test Method for Wind-Resistance of Asphalt Shingles (Fan-Induced Method).
- .2 ASTM D226 Asphalt Saturated Organic Felt Used in Roofing and Waterproofing.
- .3 ASTM E 108 (UL 790) - Standard Test Methods for Fire Tests of Roof Covering.
- .4 ASTM G 21 - Standard Practice for Determining Resistance of Synthetic Polymeric Materials to Fungi.
- .5 UL 2218 - Impact Resistance of Prepared Roof Covering Materials.

1.3 SUBMITTALS

- .1 Comply with requirements of Section 01 00 15.
- .2 Product Data: Provide data indicating material characteristics, performance criteria, and limitations.
- .3 Shop Drawings: Indicate metal flashings, jointing methods and locations, fastening methods and locations, and installation details.
- .4 Installation Data: Manufacturer's special installation requirements and procedures.
- .5 Manufacturer's Certificate: Certify that Products meet or exceed specified requirements.

Part 2. Products**2.1 SHINGLES**

- .1 Harvest Shake recycled rubber shingle panels as manufactured by Euroshield.

2.2 SHEATHING MEMBRANE MATERIALS

- .1 Asphalt saturated breather type sheathing paper to CAN2-51.32M, 11.34 kg, meeting the requirements of Federal Specification UU-B-790a, Grade D.
- .2 Sheathing Joint Tape: specially formulated self adhesive permanent acrylic type with oriented polypropylene backing, 50mm wide, red colour, Y-8086 “#M Contractors Sheathing Tape”.

2.3 ACCESSORIES

- .1 Nails: stainless steel Type 316, length sufficient to lay flush with face of shingle and penetrate wood strapping to depth required in CSSB Wall Manual.
- .2 Flashing: as specified in Section 07 62 00.

Part 3. Execution

3.1 EXAMINATION

- .1 Verify that substrate surfaces are ready to receive work.

3.2 PREPARATION

- .1 Determine the number of courses, layout courses, aligning bottoms of shingles with windows and other openings and match exposure of final course at top with those below.

3.3 INSTALLATION OF SHEATHING MEMBRANE

- .1 Install sheathing membrane to exterior face of wall sheathing.
- .2 Offset joints with those of sheathing minimum 300mm. Overlap joints of membrane minimum 300mm. Ensure no joints occur at corners.
- .3 Pull sheathing membrane tight against wall sheathing and around perimeter of openings.
- .4 Repair all rips, tears, punctures or holes with joint tape.

3.5 INSTALLATION OF METAL FLASHING AND ACCESSORIES

- .1 Install flashings as shown on Drawings and to CSSB requirements.
- .2 Weather lap joints minimum 50 mm and seal weather tight with plastic cement.
- .3 Flash and seal work weather tight, projecting through or mounted on roofing with plastic cement.

3.6 INSTALLATION SHINGLES

- .1 Install shake shingles in accordance with manufacturer's instructions.
- .2 Install for natural shed of water.
- .3 Position cut ends over bearing surfaces. Sand cut edges smooth and clean.
- .4 Install corner strips, closures, trim.

3.7 ERECTION TOLERANCES

- .1 Maximum Variation from Level: 6 mm per meter.

END OF SECTION

PART 1 General**1.1 REFERENCES**

- .1 American Society for Testing and Materials (ASTM):
 - .1 ASTM A653/A653M07, Standard Specification for Steel Sheet, ZincCoated (Galvanized) or ZincIron AlloyCoated (Galvannealed) by the HotDip Process
 - .2 ASTM D14604, Standard Test Methods for Sampling and Testing BitumenSaturated Felts and Woven Fabrics for Roofing and Waterproofing
 - .3 ASTM D41298a(R2002)e1, Standard Test Methods for Vulcanized Rubber and Thermoplastic Rubbers and Thermoplastic ElastomersTension
- .2 Canadian Steel Structures and Building Institute (CSSBI):
 - .1 CSSBI Technical Bulletin No. 20 M91, Sheet Steel Cladding Architectural and Industrial Applications

1.2 SUBMITTALS

- .1 Comply with requirements of Section 01 00 15.
- .2 Submit a sample of soffit panel, in the selected colour on actual metal base.
- .3 Submit shop drawings showing assembly and installation details, method of sealing and flashing, building connection attachments, provision for thermal movement, fabrication details and static release loads and static release forces.

1.3 PERFORMANCE REQUIREMENTS

- .1 Design and construct soffit system so that completed installation is air, vapour and moisture resisting from interior and exterior.
- .2 Maximum deflection not to exceed $L/180$ under system own weight plus wind and suction loads acting normal to the plane in accordance with the Building Code Climatic Data, wind load 1:30 years.
- .3 Provide movement of components without causing buckling, failure of joint seals, undue stress on fasteners when subject to seasonal temperature range, from 40°C to 50°C, and preceding noted wind and suction loads.
- .4 Include expansion joints to accommodate movement in soffit system and between soffit system and building structure, where these movements are caused by deflection of building structure. Accommodate these movements, without permanent distortion, damage to infills, racking of joints, breakage of seals, or water penetration.
- .5 Provide for positive drainage to the exterior of all water entering or condensation occurring within the system.

1.4 DELIVERY, STORAGE AND HANDLING

- .1 Cover pre-finished components to protect surface finishes and insulation core from damage and deterioration.
- .2 Store components off the ground to prevent twisting, bending or de-lamination. Slope to shed moisture.

PART 2 Products**2.1 MATERIALS**

- .1 Metal Cladding: Pre-finished, preformed galvanized sheet steel, 0.48 mm (26 ga. (0.019")) metal core thickness. Profile 13 mm (½") deep x 406 mm (16") wide x maximum length, 3 rib 2/3 perforated and non-perforated soffit; solid fascia panels; colour as selected by Consultant from Stelco/Dofasco 8000 Series standard colour range.
- .2 Erection girts: As recommended by cladding manufacturer.
- .3 Flashing, Trim and Closures: Steel, core thickness and finish as for metal cladding as required for complete installation
- .4 Fastenings: Manufacturer's standard or custom to suit design loads and application. Finish all exposed fasteners to match soffit panels.
- .5 Sealant: In accordance with Section 07 90 00, type as recommended by manufacturer for specific end use, colour to match soffit panels.
- .6 Z Bars: 1.27 mm (18 ga. (0.050")) minimum thickness, galvanized steel with a zinc coating of not less than 275 g/m².

PART 3 Execution**3.1 PREPARATION**

- .1 Obtain all dimensions from job site.
- .2 Ensure all structural support is aligned and condition is acceptable.
- .3 Provide additional structural framing as may be required to conform with Performance Requirements.

3.2 INSTALLATION

- .1 Install support girts, as required, to structural support. Interlock and seal side and end joints.
- .2 Install flashings to divert all moisture and condensation to exterior.
- .3 Install fascia and soffit panels to structural support by hidden mechanical fasteners.
- .4 Install preformed corners and end enclosures, caulked and sealed to arrest direct weather penetration.
- .5 Ensure panels are aligned horizontally.

3.3 ADJUSTING AND CLEANING

- .1 Remove all excess materials, debris and equipment at completion.
- .2 Clean all panels free of all grime and dirt.

END OF SECTION

Part 1 General**1.1 Intent**

- .1 Sheet metal flashings used with membrane roofing are intended to protect the roof membrane from accelerated deteriorating effects of the elements, and, with few exceptions (e.g. penetration pockets, scuppers), are not intended to protect the building from direct migration of moisture.
- .2 Sheet metal flashings and trims required to complete wall, window and door assemblies and to provide closures to building envelope, and where indicated on drawings.

1.2 REFERENCES

- .1 Alberta Roofing Contractors Association Ltd. (ARCA) "Roofing Application Standards Manual", current edition.
- .2 American Society for Testing and Materials (ASTM):
 - .1 ASTM D458607 Asphalt Roof Cement, AsbestosFree.
 - .2 ASTM D22606 AsphaltSaturated Organic Felt Used in Roofing and Waterproofing.
- .3 SMACNA (Sheet Metal and Air Conditioning Contractors' National Association) Architectural Sheet Metal Manual.

1.3 QUALITY CONTROL

- .1 Construct and install roof metal flashings in accordance with ARCA Manual details and in accordance with the ARCA Manual. If requirements conflict, this specification takes precedence over the manual.

1.4 DELIVERY, STORAGE AND HANDLING

- .1 Stack preformed and pre-finished material in manner to prevent twisting bending and rubbing.
- .2 Provide protection for galvanized surfaces.
- .3 Prevent contact of dissimilar metals during storage and protect from acids, flux, and other corrosive materials and elements.
- .4 Protect pre-finished surfaces from scratches and from rust staining.

Part 2 Products**2.1 METAL FLASHING**

- .1 Metal flashing (pre-finished): Factory finish baked enamel paint to Dofasco/Stelco 8000 Series meeting standards specified in CSSBI Technical Bulletin 20M91 zinc-coated steel. Galvanized zinc coating minimum 275 g/m². Colour as indicated on drawings.

2.2 MISCELLANEOUS MATERIALS

- .1 Flashing Nails: 2.67 mm (0.105") hot dipped zinc coated, annular ringed
- .2 Flashing Screws: Hot-dipped zinc coated, self drilling
- .3 Bituminous Paint: To CAN/CGSB1.08M
- .4 Plastic Cement: To CAN/CGSB37.5M

2.3 FABRICATION

- .1 Make flashings of pre-finished metal for all cap flashings, for all flashings adjacent to roofing at roof edges and area dividers and where exposed to view from ground. Make flashings for other locations, of plain galvanized metal as follows:
 - .1 Use 0.45 mm (0.017") metal core thickness except where otherwise indicated
 - .2 Use 0.62 mm (0.023") metal core thickness wherever a flat length exceeding 305 mm (12") wide occurs
 - .3 Use 0.80 mm (0.031") metal core thickness for concealed fastening strips
- .2 All straight run joints shall be SLock in roof flashings.
- .3 Make joints to allow for thermal movement, space SLock joints at 1500 mm (5 feet) maximum centers.
- .4 Make flashings for building into masonry and concrete so that joints can be lapped 100 mm (4") or more.
- .5 Strengthen free edges of metal flashings by folding to form a 13 mm (½") hem.
- .6 Make flashings to curbs, walls and parapets a minimum of 200 mm (8") high, where possible.
- .7 Where curb mounted roof penetrations are not required, provide flashing sleeves and collars for all pipes and conduit extending through the roof. Sleeves shall be soldered to a piece of sheet metal extending at least 150 mm (6") onto the surrounding roof.
- .8 Make joints for corners and intersections with standing seams except where exposed of pre-finished metal when seams shall be flat locked.
- .9 All bends machine made; sharp, straight and true to line.
- .10 Back paint all metal flashings with bituminous paint prior to installation.

Part 3 Execution**3.1 INSPECTION**

- .1 Verify that roof jacks and goose necks, fabricated to requirements of other Sections of the specification, are of 0.80 mm (22 ga. (0.028")) galvanized sheet steel, with seams doubled, flattened and soldered. Report defects to the Departmental Representative.
- .2 Check mounting and counter-flashing of mechanical items and report any defect to the Departmental Representative.
- .3 Verify that solid wood blocking or sheathing provided to backup all flashings and that all nails, screws set and wood provides a smooth flat plane.
- .4 Verify that all reglets, provided under other Sections or built-in by other trades, properly and securely located, true and level in line.

3.2 METAL FLASHINGS

- .1 Apply metal roof flashings to ARCA recommended requirements as a minimum.
- .2 Do not install metal flashings over flexible roof flashing until the flexible roof flashing has been inspected and approved by the Roofing Inspector. This includes curbs for roof mounted items.
- .3 Fasten metal base flashing to walls or up-stands along top of flashing. Do not secure to cant strip. Form lapped corner joints. Extend rolled edge of base flashing approximately 25 mm (1") on to roof from toe of cant, and rest on top of roof surface.
- .4 Allow for thermal expansion and contraction in all exterior sheet metal work.
- .5 Do not use exposed fastening unless indicated, or concealed fastening is not possible. Locations and methods shall be approved by the Consultant.
- .6 All exposed and pre-finished flashings to provide a smooth flat surface free of indentations, bumps, oil canning, or twists, all edges, bends hard, sharp and true to line.

END OF SECTION

PART 1. General**1.1 INTENT**

- .1 Work of this section includes: pre-fabricated aluminum gutters, downspouts and accessories.

1.2 REFERENCE STANDARDS

- .1 American Architectural Manufacturers Association:
 - .1. AAMA 2605: Voluntary Specification, Performance Requirements and Test Procedures for Superior Performing Organic Coatings on Aluminum Extrusions and Panels.
- .2 ASTM International:
 - .1. ASTM B209: Standard Specification for Aluminum and Aluminum Alloy Sheet and Plate.
- .3 Sheet Metal and Air Conditioning Contractors' National Association (SMACNA) Inc. Architectural Sheet Metal Manual.

1.3 SUBMITTALS

- .1 Comply with requirements of Section 01 00 15.
- .2 Shop Drawings: Clearly indicate the following:
 - .1. Manufacturer of pre-finished coating application for gutters.
 - .2. Type and thickness of pre-finished aluminum components.
 - .3. Type and thicknesses of pre-finished colour coating system and special coating system.
 - .4. Typical profiles of formed metal systems.
 - .5. Typical details of jointing profiles.
 - .6. Manufacturer and type of sealants and gaskets.
 - .7. Typical sectional details showing locations of fasteners.

1.4 HANDLING AND PROTECTION

- .1 Stack preformed and pre-finished materials in a manner to prevent permanent deformation and marring of finished surfaces.
- .2 Prevent contact with dissimilar metals during storage and protect from acids and other corrosive materials and elements.
- .3 Deliver, handle and store all accessory materials to job site, in original packages and containers with manufacturer's seals and labels intact.
- .4 Store materials requiring protection from the weather in weatherproof shelters having floors.
- .5 Protect installed work and materials from damage.

- .6 In the event of materials being damaged by the elements, improper handling, or other causes, such materials will be rejected, and shall be replaced at no increase in Contract Price. Promptly remove rejected materials from site.

PART 2. Products

2.1 MATERIALS

- .1 Pre-finished Sheet Aluminum: to ASTM B209, manufacturer's standard alloy and temper for specified finish; shop finished with three coat PVDF (polyvinylidene fluoride) coating.
 - .1. Gutters: minimum 1.78mm (14 gauge) base metal thickness.
 - .2. Downspouts: 0.76mm (22 gauge) base metal thickness
 - .3. Colours: as indicated on drawings.
 - .4. Sizes and Profiles: [75mm x 100mm (3" x 4")] [150mm x 150mm (6" x 6")] ogee profile for gutters; downspouts sized to suit gutters.
- .2 Anchors and Supports: profiled to suite gutters and downspouts and as follows:
 - .1. Anchoring Devices: in accordance with SMACNA requirements.
 - .2. Gutter Supports, Brackets and Straps: sized in accordance with SMACNA Table 1B.
 - .3. Downspout Supports: to SMACNA Figure 1-35E.
 - .4. Finish: to match gutters and downspouts.
- .3 Strainers: 0.76mm (14 gauge) stainless steel wire baskets.
- .4 Fasteners: aluminum or stainless steel complete with EPDM washers.
- .5 Sealant: type and quality specified in Section 07 90 00. Sealants are acceptable in non-visible locations only.
- .6 Splashpads: Precast concrete splashpad from 24 Mpa concrete, 310 mm (12 1/4") wide x 75 mm (3") deep x 610 mm (24") long, to CAN/CSA A23.1.

2.2 FABRICATION

- .1 Fabricate gutters and downspouts to profiles detailed to maximum practical lengths. Joints in gutters must correspond with joints in eave edge fascias.
- .2 Fabricate all corners as one piece with joints mitred and welded watertight.
- .3 Fabricate gutters with ends closed off, with caps welded in place watertight.
- .4 Form spill-outs as detailed, welded in place watertight.
- .5 At expansion joints, gutters are to be end capped and separated by 25mm (1"). End caps are to be welded in place watertight.
- .6 Fabricate gutter sections with flush butt joints. All joints are to be backed with alignment splines which are to have a face width of 65 mm (2 1/2").
- .7 Alignment splines are to be full welded to one side of each gutter section so that when gutters are installed each and every joint will be backed with an alignment spline.

- .8 Lap Alignment splines 25 mm (1") over the gutter sections to which they are to be welded.
- .9 Fabricate shapes free of distortion, ripples, dents, and other visible non-repairable surface damage. Grind all welds smooth and flush with adjacent surfaces.

PART 3. Execution

3.1 INSTALLATION OF GUTTERS

- .1 Install eave edge gutters well secured in place and rigid, and with all sections in-line with each other. All joints must correspond with joints in metal fascias. All anchorage's must penetrate back up Z-bars and channels.
- .2 Maintain 10 mm (3/8") wide joints between gutter sections to allow for expansion and contraction. Seal lapped edges as work progresses. Clean all visible traces of sealant at lapped joints as work progresses.
- .3 Match building expansion joints with gutters..

3.2 INSTALLATION OF DOWNSPOUTS

- .1 Secure downspouts using 0.76-mm (0.029") (22 gauge) thick straps at 600 mm (24") on centre. Secure straps using corrosion resistant screws.

3.3 INSTALLATION OF BITUMINOUS COATING

- .1 Apply two (2) coats of asphalt bitumen on all inside surfaces of steel gutters. Allow the first coat to dry prior to installing the second coat.

3.4 SPLASH PADS

- .1 Install splash pads to locations indicated.

END OF SECTION

Part 1. General**1.1 SECTION INCLUDES**

- .1 This Section includes through penetration firestopping and smoke seal systems for penetrations through the following fire resistance rated assemblies, including both empty openings and openings containing penetrating items:
 - .1. Floors
 - .2. Walls and Partitions
- .2 This Section includes fire resistive joint systems for the following:
 - .1. Floor-to-floor joints
 - .2. floor-to-wall joints
 - .3. Joints between perimeter edge of fire resistance rated floor assemblies and exterior wall assemblies.
- .3 This specification section provides requirements for Rated Systems or systems requiring Engineered judgements:
 - .1. Use of materials that have not been tested in a system or that are not capable of obtaining an engineered judgement will not be acceptable for use on this project.
 - .2. Materials having only a ULC label will not be acceptable for use on this project, unless supporting documentation is provided indicating its use in a listed assembly.

1.2 REFERENCES

- .1 ASTM E84-10: Test Method for Surface Burning Characteristics of Building Materials.
- .2 ASTM E119-09: Method for Fire Tests of Building Construction and Materials.
- .3 ASTM E814-10: Test Method of Fire Tests of Through-Penetration Fire Stops.
- .4 ASTM E1966-07: Test Method for Fire-Resistive Joint Systems
- .5 CAN/ULC S101-07: Fire Endurance Tests of Building Construction and Materials.
- .6 CAN/ULC S102.2-07: - Method of Test for Surface Burning Characteristics of Building Materials and Assemblies.
- .7 CAN/ULC S115-05: Fire Tests of Firestop Systems.
- .8 NFPA 251, 2006 edition Fire Tests of Building Construction and Materials.
- .9 UL 263-03: Fire Tests of Building Construction and Materials (ASTM E119, NFPA 251).
- .10 UL 2079: Tests for Fire Resistance of Building Joint Systems
- .11 FCIA- MOP: Firestop Contractors International Association, Manual of Practice.

1.3 DEFINITIONS

- .1 Firestopping : A sealing or stuffing material or assembly placed in spaces between building materials to arrest the movement of smoke, heat, gases, or fire through wall or floor openings.

1.4 SYSTEM PERFORMANCE REQUIREMENTS

- .1 Penetrations: Provide and install firestopping systems that are produced to resist the spread of fire, and the passage of smoke and other gases according to requirements indicated, including but not limited to the following:
 - .1. Firestop all penetrations passing through fire resistance rated wall and floor assemblies and other locations as indicated on the drawings.
 - .2. Provide and install complete penetration firestopping systems that have been tested and approved by third party testing agency.
 - .3. F - Rated Through-Penetration Firestop Systems: Provide through-penetration firestop systems with F ratings indicated, as determined per ASTM E 814, but not less than one hour or the fire-resistance rating of the construction being penetrated.
 - .4. T - Rated Through-Penetration Firestop Systems: Provide firestop systems with T ratings, in addition to F ratings, as determined per ASTM E 814, where indicated by Code.
 - .5. L – Rated Through-Penetration Firestop Systems: Provide firestop systems with L ratings, in addition to F and T ratings, as determined per UL 1479, where indicated by Code.
 - .6. (Optional) W – Rated Through-Penetration Firestop Systems: Provide firestop systems with W Water Resistance ratings, in addition to F, T and L ratings, as determined per UL 1479, where indicated.
- .2 Perimeter Fire Containment Systems: Provide interior perimeter joint systems with fire-resistance ratings indicated, as determined per ASTM E 2307, but not less than the fire-resistance rating of the floor construction.
- .3 Fire-Resistive Joints: Provide joint systems with fire-resistance ratings indicated, as determined per UL 2079, but not less than the fire-resistance rating of the construction in which the joint occurs.
- .4 For firestopping exposed to view, traffic, moisture, and physical damage, provide appropriate firestop systems for these conditions.
- .5 Where there is no specific third party tested and classified firestop system available for a particular firestop configuration, the firestopping contractor shall obtain from the firestop manufacturer, an Engineering Judgment (EJ) or Equivalent Fire Resistance Rated Assembly (EFFRA) for submittal.

1.5 SUBMITTALS

- .1 Comply with requirements of Section 01 00 15.
- .2 System Design Listings: Submit system design listings, including illustrations from a qualified testing and inspection agency that is applicable for each firestop configuration.
- .3 Submit Manufacturers Product Data Sheets for each type of product selected. Certify that Firestop Material shall be asbestos free and complies with local regulations.
- .4 Certification by firestopping manufacturer that products supplied comply with local regulations controlling use of volatile organic compounds (VOC's) and are nontoxic to building occupants.
- .5 Submit system design listings, including illustrations from a qualified testing and inspection agency that is applicable to each firestop configuration

- .6 Where there is no specific third party tested and classified Firestop System available for particular firestop configuration, the firestopping contractor shall obtain from the firestop manufacturer an Engineering Judgment (EJ) or Equivalent Fire Resistance Rated Assembly (EFRRA) for submittal.
- .7 Submit contractor qualifications as noted in "Quality Assurance" article.
- .8 Installation Data: Manufacturer's special preparation and installation requirements.
- .9 Manufacturer's Certificate: Certify that products meet or exceed specified requirements.

1.6 QUALITY ASSURANCE

- .1 Design firestopping for this project under direct supervision of a Firestopping Design Consultant Professional experienced in design of this Work.
- .2 Manufacturer Qualifications: Company specializing in manufacturing the Products specified in this section with minimum three (3) years experience and FCIA Member in good standing.
- .3 Contractor Qualifications: Company specializing in performing the work of this section and as follows:
 - .1. FCIA Member in good standing.
 - .2. Licensed by the province or local authority where applicable.
 - .3. Completed not less than five (5) comparable scale projects.
- .4 Single Source Responsibility: Obtain firestop systems for each type of penetration and construction situation from a single primary firestop systems manufacturer.
- .5 Fire-Test-Response Characteristics: Provide firestopping System Design Listing by a testing and inspection agency in accordance with the appropriate ASTM Standard(s) per article 1.04. A qualified testing and inspection agency may be UL, FM Research, Intertek Testing Services, Omega Point Laboratories (OPL) or another agency performing testing and follow-up inspection services for firestop materials that is acceptable to the authority having jurisdiction.

1.7 MOCK – UP

- .1 Provide mock-up of applied firestopping assemblies.
- .2 Apply firestop material to a representative penetrated masonry, concrete, and stud wall substrate surface.
- .3 Obtain Departmental Representative's acceptance of mock-up before start of Work.
- .4 Retain and maintain accepted mock-ups during construction in undisturbed condition as a standard for judging completed work.
- .5 Locate where directed by Departmental Representative.
- .6 Approved mock-up may remain as part of the Work.

1.8 REGULATORY REQUIREMENTS

- .1 Conform to applicable code and ULC for fire resistance ratings and surface burning characteristics.
- .2 Provide certificate of compliance from authority having jurisdiction indicating approval of materials used.

1.9 ENVIRONMENTAL REQUIREMENTS

- .1 Do not apply materials when temperature of substrate material and ambient air is below <15 degrees C> <<60 degrees F>>.
- .2 Maintain this minimum temperature before, during, and for 3 days after installation of materials.

Part 2. Products**2.1 MANUFACTURERS – FIRESTOPPING, GENERAL**

- .1 Systems listed by approved testing agencies, as identified in part 1 above, may be used, providing they conform to the construction type, penetrant type, annular space requirements and fire rating involved in each separate instance.
- .2 Manufacturer of firestop products shall have been successfully producing and supplying these products for a period of not less than 3 years, and be able to show evidence of at least 10 projects where similar products have been installed and accepted.

Part 3. Execution**3.1 EXAMINATION**

- .1 Verify openings are ready to receive the work of this section.

3.2 PREPARATION

- .1 Clean substrate surfaces of dirt, dust, grease, oil, loose material, or other matter which may affect bond of firestopping material.
- .2 Remove incompatible materials which may affect bond.
- .3 Install backing or damming materials to arrest liquid material leakage.

3.3 INSTALLING PENETRATION FIRESTOPS

- .1 General: Comply with the "System Performance Requirements" article in Part 1 and the through-penetration firestop manufacturer's installation instructions and drawings pertaining to products and applications indicated.
 - .1. Coordinate with other trades to assure that all pipes, conduit, cable, and other items, which penetrate fire rated construction, have been permanently installed prior to installation of firestop assemblies.
 - .2. Schedule the work to assure that partitions and all other construction that conceals penetrations are not erected prior to the installation of firestop and smoke seals.
- .2 Install forming/damming materials and other accessories in accordance with manufacturers written instructions.
- .3 Install fill materials for through-penetration firestop systems by proven techniques to produce the following results:
 - .1. Completely fill voids and cavities formed by openings, forming materials, accessories, and penetrating items.
 - .2. Install materials so they contact and adhere to substrates formed by openings and penetrating items.

- .3. For fill materials that will remain exposed after completing Work, finish to produce smooth, uniform surfaces.

3.4 INSTALLING FIRESTOP JOINT SYSTEMS

- .1 General: Comply with the "System Performance Requirements" article in Part 1 and with the firestop manufacturer's installation instructions and drawings pertaining to products and applications indicated.
 - .1. Install joint fillers to provide support of firestop materials during application and at the position required to produce the cross-sectional shapes and depths of installed firestop material relative to joint widths that allow optimum sealant movement capability and develop fire-resistance rating required.
- .2 Install systems by proven techniques that result in firestop materials:
 - .1. directly contacting and fully wetting joint substrates.
 - .2. completely filling recesses provided for each joint configuration,
 - .3. providing uniform, cross-sectional shapes and depths relative to joint width that optimize movement capability.
- .3 Tool non-sag firestop materials immediately after their application and prior to the time skinning or begins. Form smooth, uniform beads of configuration indicated or required to:
 - .1. produce fire-resistance rating
 - .2. to eliminate air pockets
 - .3. to ensure contact and adhesion with sides of joint.

3.5 INSTALLING PERIMETER FIRE BARRIER SYSTEMS

- .1 General: Comply with "System Performance Requirements" article in Part 1 and with the firestop manufacture's installation and drawings pertaining to products and applications indicated.
- .2 Install metal framing, curtain wall insulation, mechanical attachments, safing materials and firestop materials as applicable within the system design.

3.6 CLEANING

- .1 Protect adjacent surfaces from damage by material installation.
- .2 Clean off excess fill materials and sealants adjacent to openings and joints as work progresses. Use methods and cleaning materials approved by manufacturers of firestopping products and or assemblies in which openings and joints occur.

3.7 PROTECTION OF FINISHED WORK

- .1 Protect firestopping during and after curing period from contact with contaminating substances. If damage caused by others, Departmental Representative and general contractor to instruct firestop contractor to make appropriate repairs and charge to appropriate trades.

END OF SECTION

Part 1 General**1.1 SUMMARY**

- .1 This Section includes joint sealants for the following applications, including those specified by reference to this Section:
 - .1 Exterior joints for vertical surfaces and horizontal non-traffic surfaces:
 - .2 Construction joints in cast-in-place concrete.
 - .3 Joints between different materials listed above.
 - .4 Perimeter joints between materials listed above and frames of doors, windows and louvers.
 - .5 Control and expansion joints in ceilings and other overhead surfaces.
 - .6 Other joints as indicated.
- .2 Exterior joints for horizontal traffic surfaces:
 - .1 Isolation and contraction joints in cast-in-place concrete slabs.
 - .2 Other joints as indicated.
- .3 Interior joints in the following vertical surfaces and horizontal non-traffic surfaces:
 - .1 Control and expansion joints on exposed interior surfaces of exterior walls.
 - .2 Perimeter joints of exterior openings where indicated.
 - .3 Tile control and expansion joints.
 - .4 Vertical joints on exposed surfaces of concrete walls.
 - .5 Perimeter joints between interior wall surfaces and frames of interior doors, windows and elevator entrances.
 - .6 Joints between plumbing fixtures and adjoining walls, floors, and counters.
 - .7 Other joints as indicated.
- .4 Interior joints in the following horizontal traffic surfaces:
 - .1 Isolation joints in cast-in-place concrete slabs.
 - .2 Control and expansion joints in tile flooring.
 - .3 Other joints as indicated.

1.2 REFERENCE STANDARDS

- .1 ASTM C834-00e1, Standard Specification for Latex Sealants
- .2 ASTM C919-02, Standard Practice for Use of Sealants in Acoustical Applications
- .3 ASTM C920-02, Standard Specification for Elastomeric Joint Sealants
- .4 ASTM C1184-00ae1, Standard Specification for Structural Silicone Sealants
- .5 ASTM C1193-00, Standard Guide for Use of Joint Sealants
- .6 ASTM C1247-98 (2004), Standard Test Method for Durability of Sealants Exposed to Continuous Immersion in Liquids
- .7 ASTM C1311-02, Standard Specification for Solvent Release Sealants
- .8 ASTM C1330-02, Standard Specification for Cylindrical Sealant Backing for Use with Cold Liquid Applied Sealants

- .9 ASTM C1481-00, Standard Guide for Use of Joint Sealants with Exterior Insulation and Finish Systems (EIFS)
- .10 ASTM D2240-04, Standard Test Method for Rubber Property-Durometer Hardness
- .11 CGSB 19-GP-5M, Sealing Compound, One-Component, Acrylic Base, Solvent Curing
- .12 CGSB 19-GP-14M, Sealing Compound, One Component, Butyl-Polyisobutylene Polymer Base, Solvent Curing
- .13 CAN/CGSB 19.17-M90, One Component, Acrylic Emulsion Base Sealing Compound
- .14 CAN/CGSB 19.13-M87, Sealing Compound, One Component, Elastomeric, Chemical Curing
- .15 CAN/CGSB 19.24-M90, Sealing Compound, Multi-Component , Chemical Curing
- .16 Sealant, Waterproofing and Restoration Institute (SWRI): SWRI Validated Product List

1.3 ADMINISTRATIVE REQUIREMENTS

- .1 Pre-Construction Meetings: Arrange a pre-construction meeting in accordance with Section 01 31 19 – Project Meetings with installer, manufacturer’s representative, Contractor and Departmental Representative present, to discuss materials being used on project, compatibility with adjacent materials, and methods of installation.

1.4 SUBMITTALS

- .1 Provide required information in accordance with Section 01 00 15.
- .2 Provide the following submittals before starting any work of this Section:
- .3 Product Data: Submit product data for each joint sealant product indicated.
- .4 Samples for Initial Selection: Submit manufacturer's colour charts consisting of strips of cured sealants showing the full range of colours available for each product exposed to view for Departmental Representative’s for initial selection.
- .5 Provide the following submittals when requested by the Departmental Representative:
 - .1 Certificates: Submit product certificates for each type of joint sealant and accessory, signed by product manufacturer certifying that materials used are appropriate for applications that they were used and certificate for each elastomeric sealant specified indicating validation by SWRI's Sealant Validation Program.

1.5 QUALITY ASSURANCE

- .1 Qualifications: Provide proof of qualifications when requested by Departmental Representative:
- .2 Manufacturer: Obtain each type of joint sealant through one source from a single manufacturer.
- .3 Installer: Installer shall be experienced with the use and application of materials specified in this Section, have a minimum of five (5) years experience with projects of a similar nature, and be approved or licensed for installation of elastomeric sealants by manufacturer if required for warranty conditions.

1.6 PROJECT CONDITIONS

- .1 Proceed with installation of joint sealants only when the following conditions are met:

- .1 Ambient and substrate temperature conditions are within limits permitted by joint sealant manufacturer.
- .2 Joint substrates are dry.
- .3 Joint widths are within tolerances of those permitted by joint sealant manufacturer for applications indicated.
- .4 Substrates are free from contaminants capable of interfering with adhesion.

1.7 WARRANTY

- .1 Manufacturer's shall provide a warranty stating that they agree to provide joint sealants to repair or replace those that do not comply with performance and other requirements specified in this Section for a period of five (5) years from Substantial Performance for the Project.
- .2 It is understood that the specified warranties exclude deterioration or failure of joint sealants arising from the following conditions:
- .3 Movement of the structure resulting in stresses on the sealant exceeding sealant manufacturer's written specifications for sealant elongation and compression caused by structural settlement or errors attributable to design or construction.
- .4 Disintegration of joint substrates from natural causes exceeding design specifications.
- .5 Mechanical damage caused by individuals, tools, or other outside agents.
- .6 Changes in sealant appearance caused by accumulation of dirt or other atmospheric contaminants.

1.8 WASTE MANAGEMENT AND DISPOSAL

- .1 Place materials defined as hazardous or toxic waste in designated containers.
- .2 Ensure emptied containers are sealed and stored safely for disposal away from children.
- .3 Dispose of surplus chemical and finishing materials in accordance with federal, provincial and municipal regulations.
- .4 Separate corrugated cardboard in accordance with the Waste Management Plan and place in designated areas for recycling.
- .5 Fold up metal banding, flatten, and place in designated area for recycling.
- .6 Use trigger operated spray nozzles for water hoses.
- .7 Return solvent and oil soaked rags for contaminant recovery and laundering or for proper disposal.
- .8 Use the least toxic sealants, adhesives, sealers and finishes necessary to comply with the requirements of this section.
- .9 Close and seal tightly all partly used sealant containers and store protected in well ventilated fire-safe area at moderate temperature.
- .10 Place used hazardous sealant tubes and other containers in areas designated for hazardous materials.

Part 2 Products**2.1 MATERIALS**

- .1 Provide joint sealants, backings, and other related materials that are compatible with one another and with joint substrates under conditions of service and application, as demonstrated by sealant manufacturer, based on testing and site experience.
- .2 Colours of exposed joint sealants will be selected by the Departmental Representative from manufacturer's complete range to match adjacent finish materials.
- .3 Elastomeric Joint Sealants: Provide sealants in accordance with ASTM C920 classifications for type, grade, class, and uses related to exposure and joint substrates and as follows:
 - .1 Provide products that have been tested in accordance with ASTM C1247 where elastomeric sealants are required for water immersion Class 1 or 2 as referenced in ASTM C920.
- .4 Latex Joint Sealants: Provide sealants in accordance with ASTM C834, temperature Grade to suit related exposure and joint substrates, paintable, non-sag and non-staining for general application, and acoustic seals in exposed locations.
- .5 Acoustical Sealant for Concealed Joints: Provide sealants in accordance with CAN/CGSB-19.21-M, non-drying, non-hardening, non-skinning, non-staining, gun grade, synthetic-rubber sealant recommended for sealing interior concealed joints to reduce airborne sound transmission. Coordinate with Section 09 21 16.
- .6 Performance Requirements:
 - .1 Provide elastomeric joint sealants for exterior applications that establish and maintain watertight and airtight continuous joint seals without staining or deteriorating joint substrates.
 - .2 Provide joint sealants for interior applications that establish and maintain airtight and water resistant continuous joint seals without staining or deteriorating joint substrates.

2.2 LIQUID SEALANTS

- .1 Type S-1; acrylic sealant: One part acrylic latex, Shore A Hardness 20, conforming to CAN/CGSB-19.17-M and ASTM C834:
- .2 Type S-2; silicone sealant: Mould and mildew resistant, Shore A Hardness 15-25, conforming to ASTM C920, Type S, Grade NS, Class 25, use NT, G, and A:
- .3 Type S-3; silicone sealant: Exterior Weatherproofing Sealant, One-part, low modulus, neutral cure, Shore A Hardness 15-25, conforming to CAN/CGSB-19.13-M, Classification C-1-40-B-N and C-1-25-B-N, and ASTM C 920, Type S, Grade NS, Class 25, use NT, M, G, A and O:
- .4 Type S-5; interior acoustical sealant: Non-skinning, non-hardening, single component synthetic rubber sealant, conforming to CAN/CGSB-19.21-M:
- .5 Type S-6; air-seal sealant: One part, silicone, shore A hardness 15 – 25, conforming to CGSB 19-GP-13M, classification C-1-40-B-N and C-1-25-B-N and ASTM C920, Type S, Grade NS, Class 25. Use NT, M, G, A and O:
- .6 Type S-7; two part multi-component sealant: Chemical curing, non-sag, exterior wall sealant, Shore A Hardness 20-35, conforming to CAN/CGSB-19.24-M, Type 2, Class B, and ASTM C920, Type S, Grade NS, Class 25, use NT, M, and A:

- .7 Type S-8; horizontal joint sealant: Two component, self levelling, conforming to CAN/CGSB-19.24M, Type 1, Class A, and ASTM C920, Type M, Grade P, Class 5, use T, M, and O:
- .8 Type S-9; fuel resistant sealant: Two component, polyurethane elastomeric, chemical cured, conforming to ASTM C 920, Type M, Grade P, Class 25:
- .9 Type S-10; polyurethane sealant: One component, non-sag, for general construction, Shore A Hardness 15+, conforming to CAN/CGSB-19.13-M, Type 2, Classification MCG-2-25-A-N and ASTM C920, Type S, Grade NS, Class 25, Use NT, M, and A:
- .10 Type S-11; saw-cut sealant: Multi-component, self-levelling, conforming to ASTM D2240:
- .11 Type S-12; control joint sealant: Two-component, solvent free, flexible epoxy urethane, load bearing, conforming to ASTM D2240, Shore A Hardness 65-75.

2.3 PREFORMED SEALANTS

- .1 Preformed Silicone Sealant System: Manufacturer's standard system consisting of pre-cured low modulus silicone extrusion, in sizes to fit joint widths indicated, combined with a neutral curing silicone sealant for bonding extrusions to substrates:

2.4 SEALANT BACKING

- .1 Provide sealant backings of material and type that are non-staining, compatible with joint substrates, sealants, primers, and other joint fillers, and are approved for applications indicated by sealant manufacturer based on site experience and laboratory testing.
- .2 Rod Type Sealant Backings:
 - .1 ASTM C1330, Type C (closed cell material with a surface skin), Type O (open cell material) or Type B (bi-cellular material with a surface skin).
 - .2 Use any of the preceding types, as approved in writing by joint sealant manufacturer for joint application indicated.
 - .3 Size and density to control sealant depth and otherwise contribute to producing optimum sealant performance.
 - .4 Non-adhering to sealant, to maintain two sided adhesion across joint.
 - .5 Bond Breaker Tape: Self adhesive polyethylene tape or other plastic tape recommended by sealant manufacturer for preventing sealant from adhering to rigid, inflexible joint filler materials or joint surfaces at back of joint where three sided adhesion will result in sealant failure.

2.5 ACCESSORIES

- .1 Primer: Material recommended by joint sealant manufacturer where required for adhesion of sealant to joint substrates indicated, as determined from pre-construction joint sealant substrate tests and site tests.
- .2 Cleaners for Nonporous Surfaces: Chemical cleaners acceptable to manufacturers of sealants and sealant backing materials, free of oily residues or other substances capable of staining or harming joint substrates and adjacent nonporous surfaces in any way, and formulated to promote optimum adhesion of sealants to joint substrates.
- .3 Masking Tape: Non-staining, non-absorbent material compatible with joint sealants and surfaces adjacent to joints.

Part 3 Execution**3.1 EXAMINATION**

- .1 Examine joints indicated to receive joint sealants for compliance with requirements for joint configuration, installation tolerances, and other conditions affecting joint sealant performance.
- .2 Proceed with installation after unsatisfactory conditions have been corrected.
- .3 Verify adhesion to each substrate separately for joints with dissimilar substrates; extend cut along one side, verifying adhesion to opposite side; repeat procedure for opposite side.

3.2 PREPARATION

- .1 Clean out joints immediately before installing joint sealants to comply with joint sealant manufacturer's written instructions and the following requirements:
 - .1 Remove all foreign material from joint substrates that could interfere with adhesion of joint sealant, including dust, paints (except for permanent, protective coatings tested and approved for sealant adhesion and compatibility by sealant manufacturer), old joint sealants, oil, grease, waterproofing, water repellents, water, surface dirt, and frost.
 - .2 Clean porous joint substrate surfaces by brushing, grinding, blast cleaning, mechanical abrading, or a combination of these methods to produce a clean, sound substrate capable of developing optimum bond with joint sealants.
 - .3 Remove loose particles remaining after cleaning operations above by vacuuming or blowing out joints with oil free compressed air.
 - .4 Remove laitance and form release agents from concrete.
 - .5 Clean nonporous surfaces with chemical cleaners or other means that do not stain, harm substrates, or leave residues capable of interfering with adhesion of joint sealants.
 - .6 Porous joint substrates include the following:
 - .1 Concrete.
 - .2 Masonry.
 - .3 Unglazed surfaces of ceramic tile.
 - .7 Nonporous joint substrates include the following:
 - .1 Metal.
 - .2 Glass.
 - .3 Porcelain enamel.
 - .4 Glazed surfaces of ceramic tile.
 - .8 Prime joint substrates as recommended in writing by joint sealant manufacturer, based on pre-construction joint sealant substrate tests or prior experience:
 - .1 Apply primer to comply with joint sealant manufacturer's written instructions.
 - .2 Confine primers to areas of joint sealant bond; do not allow spillage or migration onto adjoining surfaces.

- .2 Use masking tape where required to prevent contact of sealant with adjoining surfaces that otherwise would be permanently stained or damaged by such contact or by cleaning methods required to remove sealant smears; remove tape immediately after tooling without disturbing joint seal.

3.3 INSTALLATION OF JOINT SEALANTS

- .1 Comply with joint sealant manufacturer's written installation instructions for products and applications indicated, unless more stringent requirements apply.
- .2 Comply with recommendations in ASTM C1193 for use of joint sealants as applicable to materials, applications, and conditions indicated.
- .3 Acoustical Sealant Application Standard: Comply with recommendations in ASTM C919 for use of joint sealants in acoustical applications as applicable to materials, applications, and conditions indicated.
- .4 Install sealant backings of type indicated to support sealants during application and at position required to produce cross sectional shapes and depths of installed sealants relative to joint widths that allow optimum sealant movement capability.
 - .1 Do not leave gaps between ends of sealant backings.
 - .2 Do not stretch, twist, puncture, or tear sealant backings.
 - .3 Remove absorbent sealant backings that have become wet before sealant application and replace them with dry materials.
- .5 Install bond breaker tape behind sealants where sealant backings are not used between sealants and backs of moving joints.
- .6 Install sealants at the same time backings are installed, and as follows:
 - .1 Place sealants so they directly contact and fully wet joint substrates.
 - .2 Completely fill recesses in each joint configuration.
 - .3 Produce uniform, cross sectional shapes and depths relative to joint widths that allow optimum sealant movement capability.
- .7 Sealants: Immediately after sealant application and before skinning or curing begins, tool non-sag sealants to form smooth, uniform beads, to eliminate air pockets; and to ensure contact and adhesion of sealant with sides of joint, and as follows:
 - .1 Remove excess sealant from surfaces adjacent to joints.
 - .2 Use tooling agents and profiles that are approved in writing by sealant manufacturer and that do not discolour sealants or adjacent surfaces in accordance with the figures listed in ASTM C1193 as follows:
 - .1. Provide concave joints in accordance with Figure 5A.
 - .2. Provide flush joint in accordance with Figure 5B.
 - .3. Provide recessed joint configuration in accordance with Figure 5C.
 - .4. Use masking tape to protect surfaces adjacent to recessed tooled joints.
- .8 Install preformed tapes in accordance with manufacturer's written instructions.
- .9 Install preformed silicone sealant system as follows:
 - .1 Apply masking tape to each side of joint, outside of area covered by sealant system.
 - .2 Apply silicone sealant to each side of joint to produce a bead of size complying with preformed silicone sealant system manufacturer's written instructions and covering a bonding area of not less than 10 mm (3/8").

- .3 Hold edge of sealant bead 6 mm (1/4") inside masking tape.
- .4 Press silicone extrusion into sealant to wet extrusion and substrate within 10 minutes of sealant application.
- .5 Use a roller to apply consistent pressure and ensure uniform contact between sealant and both extrusion and substrate.
- .6 Complete installation of sealant system in horizontal joints before installing in vertical joints.
- .7 Lap vertical joints over horizontal joints.
- .8 Cut silicone extrusion with a razor knife at ends of joints.

3.4 CLEANING

- .1 Clean off excess sealant or sealant smears adjacent to joints as the Work progresses by methods and with cleaning materials approved in writing by manufacturers of joint sealants and of products in which joints occur.

3.5 PROTECTION

- .1 Protect joint sealants during and after curing period from contact with contaminating substances and from damage resulting from construction operations or other causes so sealants are without deterioration or damage at time of Substantial Performance.
- .2 Cut out and remove damaged or deteriorated joint sealants immediately so installations with repaired areas are indistinguishable from original work if, despite protection measures, damage or deterioration occurs.

3.6 JOINT SEALANT SCHEDULE

- .1 Where no specified type of sealant is shown or specified choose one of the sealants specified in this Section applicable to that intended application, and consistent with manufacturer's recommendations.
- .2 Use acrylic sealant Type S-1 only on the interior and only in situations where little or no movement can occur.
- .3 Use mould and mildew resistant silicone sealant Type S-2 for non-moving joints in washrooms and kitchens; do not use on floors.
- .4 Use silicone general construction sealant Type S-3 or polyurethane sealant Type S-7 and S-10 for all joints, interior and exterior, where no other specific sealant type specified; do not use on horizontal traffic joints or where immersed in water.
- .5 Use acoustical sealant Type S-5 for interior applications only where they will be fully concealed and only where no constant or consistent air pressure difference will exist across the joint.
- .6 Use air seal sealant Type S-6 for exterior walls only where constant or consistent air pressure difference will exist across the joint.
- .7 Use multi-component sealant Type S-7 for exterior vertical joints where large movement is anticipated; not for continuous water immersion.
- .8 Use multi-component sealant Type S-8 for horizontal joint sealant of plaza, floors and decks, exterior areas only, subject to pedestrian and vehicular traffic.
- .9 Use two component polysulphide fuel resistant sealant Type S-9 in pavement around diesel generators, and wherever fuel oils may be present.

- .10 Use multi-component sealant type S-11 for saw-cuts in slabs on grade and horizontal joint sealant of plaza, floors and decks, interior areas only.
- .11 Use multi-component sealant type S-7 for edge joint sealant at slab edges at walls, columns, interior shaft walls and grade beams.
- .12 Use multi-component sealant type S-7, primed penetration element surfaces other than concrete, for mechanical and electrical service penetrations in concrete foundation walls and cored holes in existing concrete.
- .13 Use two-component flexible epoxy sealant type S-12 for joint sealant where floor finished "concrete with hardener" is specified elsewhere in the Project Manual.
- .14 In addition, seal the following joints:
 - .1 Seal perimeters of hollow metal door frames on both sides, and at junction between door frame and resilient or solid flooring materials.
 - .2 Seal perimeters of aluminum door frames on both sides.
 - .3 Seal elevator door frames where they abut concrete or masonry prior to application of finish.
 - .4 Seal control joints in gypsum board, and junctures between interior partitions with exterior walls.
 - .5 Seal window and door frames around the inside perimeter, so that an airtight seal is obtained, as indicated on drawings.
 - .6 Seal control, expansion joints in floors and walls and around service and fixture penetrations.

END OF SECTION

Part 1 General**1.1 REFERENCES**

- .1 American Society for Testing and Materials (ASTM):
 - .1 ASTM A591/A591M-98 Standard Specification for Steel Sheet, Electrolytic Zinc-Coated, for Light Coating Weight (Mass) Applications
 - .2 ASTM A653/A653M-04a Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc Iron Alloy coated (Galvannealed) by the Hot-Dip Process, Lock-Forming Quality
 - .3 ASTM A924/A924M-04 Standard Specification for General Requirements for Sheet Steel, Metallic-Coated by the Hot-Dip Process
- .2 Canadian General Standards Board (CGSB):
 - .1 CAN/CGSB 1.181-99, Ready-Mixed Organic Zinc-Rich Coating
 - .2 CGSB 41-GP-19Ma-84, Rigid Vinyl Extrusions for Windows and Doors
- .3 Canadian Standards Association (CSA):
 - .1 CAN/CSA G40.20/G40.21-04 General Requirements for Rolled or Welded Structural Quality Steel/Structural Quality Steels
 - .2 CSA W59-03 Welded Steel Construction (Metal Arc Welding)
- .4 Underwriters' Laboratories of Canada (ULC):
 - .1 CAN4-S104-1980 (R1985) Fire Tests of Door Assemblies
 - .2 CAN4-S105-1985(R1992) Fire Door Frames Meeting the Performance Required by CAN4-S104
- .5 Canadian Steel Door and Frame Manufacturers' Association, (CSDFMA):
 - .1 CSDFMA Specifications for Commercial Steel Doors and Frames, 1995
 - .2 CSDFMA Recommended Selection and Usage Guide for Commercial Steel Doors, 1995
- .6 National Fire Protection Association (NFPA):
 - .1 NFPA 80-1999 Fire Doors and Windows
 - .2 NFPA 252-2003 Standard Methods of Fire Tests of Door Assemblies
- .7 ITS/Warnock Hersey Professional Services Ltd. (WHI):
 - .1 Fire Rating Services, Building Materials and Equipment, Listings (ITS/WH)

1.2 SUBMITTALS

- .1 Comply with requirements of Section 01 00 15.
- .2 Shop Drawings: Clearly indicate general construction of each type of door, configurations, material, material thickness, jointing methods, mortises, reinforcements, anchors, finish and special features.
- .3 Reference door types to Door Schedule. Indicate door numbers where applicable.

1.3 QUALITY ASSURANCE

- .1 Manufacture fire door and frame components and assemblies to ULC or ITS-Warnock Hersey requirements.
- .2 Doors shall bear testing agency label indicating fire endurance rating for standard doors.
- .3 Hollow Metal Trades Association - Canadian Manufacturing Standards for Metal Doors and Frames.

Part 2 Products**2.1 MATERIALS**

- .1 Steel Sheet
 - .1 Exterior Doors and Frames: Metallic coated steel sheets in accordance with ASTM A924/M924; coated to meet requirements of ASTM A653/A654M, Commercial Steel (CS), Type B, ZF120 (A40) galvanized; stretcher levelled standard of flatness where used for face sheets
 - .2 Interior Doors and Frames: Electrolytic zinc coated steel sheets in accordance with ASTM A591/A591M, Commercial Steel (CS), Class B coating; mill phosphatized; suitable for unexposed applications; stretcher levelled standard of flatness
- .2 Door Cores
 - .1 Honeycomb: Structural small cell (25 mm (1") maximum) kraft paper honeycomb; minimum weight 36.3 kg (80#)/ream; minimum density 16.5 kg/m³ (1.03 ft³); sanded to the required thickness
 - .2 Polystyrene: Rigid extruded, closed cell insulation, fire retardant treated meeting the requirements of ULC S701, Type 4, minimum thermal resistance RSI 0.87 (R 5.0)/25 mm (1") thickness
- .3 Adhesives
 - .1 Core Adhesive: Heat resistant, single component, polyurethane reactive (water) hot melt, thermoset adhesive
 - .2 Interlocking Edge Seam Adhesive: Resin reinforced polychloroprene (RRPC), fire resistant, high viscosity, and sealant/adhesive

- .4 Primer
 - .1 Rust inhibitive primer meeting CAN/CGSB 1.132, shop prime coat doors and frames before delivery; grey or red coloured primer; clear primer not acceptable; provide primer for field touch-up
- .5 Accessories
 - .1 Glazing Stops:
 - .1 Glass Mouldings: Formed steel having 0.90 mm (0.036") metal core thickness, screw fixed
 - .2 Accurately fit and butt at corners glazing trim and stops; located on secure side of door, or interior of room window frame
 - .2 Floor Anchors, Channel Spreaders, 1.6 mm (0.060") tee anchors, 1.20 mm (0.048") Wall Stud Anchors, and as follows:
 - .1 Hot-dipped zinc coated for exterior locations
 - .2 Wipe coat galvanized for interior locations
 - .3 Corrugated, galvanized tee anchors for masonry bond
 - .4 Drill stud anchors for wire tie to studs
 - .5 Lag bolts, shields and bushing for existing or concrete openings
 - .6 Provide anchors appropriate to installation conditions
 - .3 Sealant: As specified in Section 07 90 00 Sealants
 - .4 Exterior Top Caps: Rigid polyvinylchloride (PVC) extrusion in accordance with CAN/CGSB 41-GP-19Ma
 - .5 Door Silencers (Bumpers): Black neoprene; three silencers on strike jambs of single door frames; two silencers on heads of double-door frames; stick on bumpers are not acceptable

2.2 DOOR FABRICATION

- .1 Fabricate steel doors rigid, neat in appearance, and free from defects including warp and buckle; 45 mm (1 3/4") thickness of types and sizes indicated in Section 08000 – Door, Frame and Hardware Schedule, and as follows:
 - .1 Door faces of all steel doors shall be fabricated without visible seams, free of scale, pitting, coil brakes, buckles and waves.
 - .2 Form edges true and straight with minimum radius suitable for thickness of steel used.

- .3 Bevel lock and hinge edges 3 mm ($\frac{1}{8}$ ") in 50 mm (2"); confirm requirement with builder's hardware or door swing that could dictate a different bevel.
- .4 Top and bottom of doors shall be provided with inverted, recessed, 1.6 mm (0.060") steel end channels, welded to each face sheet at 150 mm (6") O/C.
- .5 Equip exterior doors with factory installed flush PVC top caps.
- .6 Provide fire labelled doors for those openings requiring fire protection ratings, as indicated in Door Schedule.
- .7 Fabricate doors with the following clearances:
 - .1 Clearance between door and frame and between meeting edges of doors swinging in pairs shall not exceed 3 mm ($\frac{1}{8}$ ")
 - .2 Clearance between the bottom of door and floor shall not exceed 19 mm ($\frac{3}{4}$ ") where there is no sill
 - .3 Clearance between bottom of door and a raised non-combustible sill shall not exceed 10 mm ($\frac{3}{8}$ ")
 - .4 Clearance between bottom of door and nominal surface of combustible floor coverings shall not exceed 12 mm ($\frac{1}{2}$ ")
- .2 Exterior Doors: Flush, lock seam construction, insulated doors fabricated in accordance with CAN/CGSB 82.5, and as follows:
 - .1 Face sheets: Minimum 1.6 mm (0.060") base steel sheet thickness
 - .2 Stiffened, insulated and sound deadened with polystyrene core laminated under pressure to each face sheet
 - .3 Longitudinal edges mechanically interlocked, adhesive assisted with edge seams tack welded, filled and sanded flush with no visible seam
- .3 Interior Doors: Flush, lock seam construction, hollow metal doors fabricated in accordance with CSDFMA Manufacturing Specifications for Doors and Frames, and as follows:
 - .1 Face sheets: Minimum 1.6 mm (0.060") base steel sheet thickness
 - .2 Stiffened and sound deadened with honeycomb core laminated under pressure to each face sheet
 - .3 Longitudinal edges mechanically interlocked, adhesive assisted with edge seams tack welded, filled and sanded flush with no visible seam
- .4 Fire Rated Doors: Flush, lock seam construction, hollow metal doors fabricated in accordance with CAN4 S104 and NFPA 80, and as follows:
 - .1 Face sheets: Minimum 1.6 mm (0.060") base steel sheet thickness

- .2 Stiffened and sound deadened with honeycomb core laminated under pressure to each face sheet
- .3 Longitudinal edges mechanically interlocked, adhesive assisted with edge seams tack welded, filled and sanded flush with no visible seam
- .4 Equip pairs of fire labelled doors with minimum 2.7 mm (0.105") steel surface mounted flat bar astragal, shipped loose for application on site
- .5 Labelled by Underwriters Laboratories of Canada, ITS/Warnock Hersey, or other testing laboratory approved by the authority having jurisdiction

2.3 FRAME FABRICATION

- .1 Fabricate door frames with mitred corners of frames and weld continuously along inside of frame profile, or lap and weld concealed corner plates, making exposed faces flush, mitres tight, filled, and finished smooth, and as follows:
 - .1 Knock-down ("KD") frames are not acceptable and will be rejected.
 - .2 Jambs, heads, mullions, sills and centre rails shall be straight and uniform throughout their lengths
 - .3 Factory assembled frame product shall be square, free of defects, warps or buckles.
 - .4 Accurately cope joints at mullions, transom bars, sills or centre rails, butted and tightly fitted, with faces securely welded, matching corner joint faces.
 - .5 Fabricate frames in sections for field splicing where required due to site access, or when shipping limitations dictate smaller assemblies, and as follows:
 - .1 Provide 1.60 mm (0.060") splice plates for field spliced jambs, heads and sills, securely welded into one section, extending 100 mm (4") minimum each side of splice joint.
 - .2 Provide 1.60 mm (0.060") splice plates for field splices at closed sections (mullions or centre rails) securely welded to the abutting member; extend 100 mm (4") minimum into closed sections when assembled.
 - .3 Field splice joints shall be welded, filled and ground to present a smooth uniform surface after assembly is complete.
 - .6 Provide two (2) temporary steel jamb spreaders welded to the base of the jambs or mullions to maintain proper alignment during shipping and handling; remove spreaders before anchoring frame to floor.
 - .7 Prepare door opening for single stud door silencers, three (3) for single door openings, two (2) for double door openings; shipped loose for installation after finish painting.
 - .8 Provide fire labelled frames for those openings requiring fire protection ratings, as indicated Door Schedule.

- .2 Frames
 - .1 Interior Frames: 1.60 mm (0.060") minimum for single doors; 1.90 mm (0.075") for frames with opening width in excess of 1220 mm (48"), with 50 mm (2") face standard frame profile, throat and frame width to suit wall construction
 - .2 Exterior Frames: 1.90 mm (0.075") minimum, with 50 mm (2") face standard frame profile, throat and frame width to suit wall construction
- .3 Screens, Borrowed Lights and Miscellaneous Frames
 - .1 Same as specified for pressed steel door frames.
 - .2 Fabricate oversize frames with flush hairline field joints with hidden mechanical fasteners.
 - .3 Weld floor extension support legs to frames that do not sit on floor in stud wall assemblies.
 - .4 Include standard pressed steel glazing stops, minimum height 16 mm (5/8") full length for opening, butt edge corners, counter sunk oval head screw fastening; stops installed on interior side of screens.

2.4 HARDWARE PREPARATION

- .1 Prepare doors in coordination with hardware schedule in Section 08 71 00 and templates provided by the hardware supplier, and as follows:
 - .1 Fully Templated Mortised Hardware: Factory blank, reinforce, drill and tap doors
 - .2 Non-Fully Templated Mortised Hardware: Factory blank and reinforce only
 - .3 Surface Mounted Hardware: Factory reinforce only
 - .4 Templated Holes 13 mm (1/2") and Larger: Factory prepared, except mounting and through bolt holes shall be site prepared at the time of application
 - .5 Templated Holes Less Than 13 mm (1/2") Ø: Factory prepared only when required for the function of the device (for knobs, levers, cylinders, thumb or turn pieces) or when holes overlap function holes
 - .6 Site drill and tap for surface mounted hardware or mortised hardware that is not fully templated at the time of hardware application
- .2 Hardware Reinforcement for Doors and Frames: carbon steel, welded in place, prime painted, to the following minimum thicknesses:
 - .1 Hinge, pivot and panic bar reinforcements 3.5 mm (0.138")
 - .2 Lock face, flush bolts, concealed bolts 1.6 mm (0.060")
 - .3 Strike reinforcements 1.6 mm (0.060")

- | | | |
|----|---|---------------------------|
| .4 | Concealed or surface closer reinforcements | 2.7 mm (0.105") |
| .5 | Electronic hardware reinforcements | 1.6 mm (0.060") |
| .6 | Door jamb reinforcement,
structural steel shape | 100 mm (4") x 38 mm (1½") |
| .7 | Door surface hardware reinforcements | 1.6 mm (0.060") |
| .8 | Frame surface hardware reinforcements | 2.7 mm (0.105") |
| .9 | Guard boxes to protect mortised cut-outs from mortar
or spray applied insulation, fully welded | 0.80 mm (0.031") |
- .3 Electronic Door Hardware Preparation
- .1 Provide templated hardware enclosures and junction boxes; inter-connected with CSA approved 13 mm (½") Ø conduit and connectors.
- .2 Coordinate with hardware specified in Section 08 71 00 and Division 26 for locations of conduit connections in doors and door frames.

2.5 FINISHING

- .1 Shop apply zinc-rich primer, repair damaged zinc coatings arising from fabrication; cure primer fully before shipping to site.
- .2 Remove weld slag and splatter from exposed surfaces.
- .3 Fill and sand smooth all tool marks, abrasions and surface blemishes to present smooth uniform surfaces.
- .4 Field apply, factory supplied touch-up primer on exposed surfaces where zinc coating has been damaged during installation.

Part 3 Execution

3.1 FRAME INSTALLATION

- .1 Install steel doors, frames, and accessories in accordance with Shop Drawings, CSDFMA Installation Guide, manufacturer's data, and as specified.
- .2 Set frames accurately in position, plumbed, aligned, and braced securely until permanent anchors are set; limit of acceptable frame distortion 2 mm (1/12") out of plumb measured on face of frame, maximum twist corner to corner of 3 mm (1/8"); align horizontal lines in final assembly.
- .3 Remove temporary braces and spreaders after completion of adjacent work, leaving surfaces smooth and undamaged after wall construction is completed.

- .4 Place frames before construction of enclosing walls and ceilings, and as follows:
 - .1 Masonry construction: Provide a minimum of three wall anchors per jamb; install adjacent to hinge location on hinge jamb and at corresponding heights on strike jamb.
 - .2 Metal Stud Partitions: Provide a minimum of three wall anchors per jamb; install adjacent to hinge location on hinge jamb and at corresponding heights on strike jamb; attach wall anchors to studs with screws.
 - .3 Install an additional anchor at hinge and strike jambs for openings 2286 mm (90") or more in height.
- .5 Install glazing materials and studded door silencers.
- .6 Field assemble large screens to provide true and even alignment with flush butt hairline jointing, all fasteners concealed.
- .7 Do not site-weld unless approved by Consultant in writing for the specific screen.
- .8 Provide formed steel drip section full width of frame opening for exterior doors.
- .9 Fill exterior frames with foamed-in-place insulation before installation of sealants and back-up materials, coordinate with Section 07 21 19.
- .10 Install fire rated frames in accordance with NFPA 80.

3.2 DOOR INSTALLATION

- .1 Fit hollow-metal doors accurately in frames within clearances required for proper operation; shim as necessary for proper operation..
- .2 Install hardware in accordance with manufacturers' templates and instructions.
- .3 Adjust operable parts for correct clearances and function.
- .4 Install fire rated doors within clearances specified in NFPA 80.

3.3 ADJUSTING AND CLEAN UP

- .1 Immediately after installation, sand smooth any rusted or damaged areas of prime coat and apply touch up of air-drying primer compatible with factory applied primer, and as follows:
 - .1 Clean exposed surfaces with soap and water to remove foreign matter before site touch-up.
 - .2 Finish exposed field welds to present a smooth uniform surface and touch-up with rust inhibitive primer
 - .3 Touch-up exposed surfaces that have been scratched or otherwise marred during shipment, installation or handling with rust inhibitive primer.

- .2 Keep steel surfaces free of grout, tar or other bonding materials or sealers; clean grout or other bonding material from surfaces immediately following installation.

END OF SECTION

Part 1. General

1.1. REFERENCE STANDARDS

- .1 CSA W59-M1982: Welded Steel Construction (Metal Arc Welding).

1.2. SUBMITTALS

- .1 Comply with requirements of Section 01 00 15.
- .2 Shop Drawings: clearly indicate sizes, description of components, materials, finishes, fabrication details and attachment methods.

Part 2. Products

2.1 COMPONENTS

- .1 Frames and Anchors :1.5mm thick steel.
- .2 Hatches : 1.8mm single thickness steel; reinforced with formed steel channels; recessed to allow flush floor finish installation; 1 hour rated.
- .3 Hardware:
Hinges: 175 degree steel hinges with spiral lift spring.
Lock: Removable wrench lift handle.

2.2 FINISHES

- .1 Base Metal Protection: Galvanized, hot dipped finish.

Part 3. Execution

3.1. INSTALLATION

- .1 Install floor access hatches in accordance with manufacturer's instructions.
- .2 Install floor access hatches to location indicated on drawings.
- .3 Ensure installation allows for flush installation of floor finish over hatch.
- .4 Clean and adjust completed assembly to ensure correct function.

END OF SECTION

Part 1 General**1.1 SUMMARY**

- .1 This Section includes conventionally glazed aluminum windows consisting of, but not limited to, the following:
 - .1 Fixed and sliding, clear, low emissivity (Low E) sealed glass units
 - .2 Dry glazed from exterior with screw on pressure plates, keyed-in neoprene gasket and thermal break
 - .3 Internal weep drainage and compartmentalization in accordance with established design principles for rain screen and pressure equalization in curtain wall systems
- .2 Drawings contain details that suggest directions for solving some of the major design requirements; these details can be developed further by the Contractor provided that the final installation adheres to aesthetic criteria established by the drawings and specified dimensions with all elements in planes as drawn, maintaining their relationships with all other building elements.

1.2 REFERENCES

- .1 Aluminum Association (AA):
 - .1 Aluminum Design Manual, 2000
 - .2 Welding Aluminum: Theory and Practice, 2002
 - .3 Properties of Aluminum Alloys: Tensile, Creep, and Fatigue Data at High and Low Temperatures, 1999
- .2 American Architectural Manufacturer's Association (AAMA):
 - .1 AAMA 50194, Methods of Test for Exterior Walls (incl. 501.1 and 501.2)
 - .2 AAMA 61198, Voluntary Specification for Architectural Anodized Aluminum
 - .3 AAMA 150398, Voluntary Test Method for Thermal Transmittance and Condensation Resistance of Windows, Doors and Glazed Wall Sections
 - .4 AAMA AFPA91, Anodic Finishes/Painted Aluminum
 - .5 AAMA CWRS196, The Rain Screen Principle and Pressure Equalized Wall Design
 - .6 AAMA RPC00, Rain Penetration Control: Applying Current Knowledge
- .3 American Society for Testing and Materials (ASTM):
 - .1 ASTM A653/A653M04a, Standard Specification for Steel Sheet, Zinc Coated (Galvanized) or Zinc Iron Alloy Coated (Galvannealed) by the Hot Dip Process
 - .2 ASTM A16799 (2004), Stainless and Heat Resisting Chromium Nickel Steel Plate, Sheet and Strip
 - .3 ASTM B209/209M04, Standard Specification for Aluminum and Aluminum Alloy Sheet and Plate
 - .4 ASTM B221/B221M02, Standard Specification for Aluminum and Aluminum Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes
 - .5 ASTM B42902, Standard Specification for Aluminum Alloy Extruded Structural Pipe and Tube
 - .6 ASTM C92002 Standard Specification for Elastomeric Joint Sealants

- .4 Canadian Standards Association (CSA):
 - .1 CAN/CSA G40.20/G40.2104, General Requirements for Rolled or Welded Structural Quality Steel/Structural Quality Steels
- .5 The Society for Protective Coatings (SSPC)/National Association of Corrosion Engineers (NACE International):
 - .1 Surface Preparation Guidelines:
 - .1 SSPCSP COM Surface Preparation Commentary for Steel and Concrete Substrates
 - .2 SSPCPS Guide 12.00, Guide to ZincRich Coating Systems

1.3 SUBMITTALS

- .1 Comply with requirements of Section 01 00 15.
- .2 Submit shop drawings signed and sealed by the Manufacturer's Engineer clearly detailing profiles, construction, assembly, finishes, installation for all conditions, also flashing, caulking, sealing, provision for thermal movement and glazing, attachment to building structure and method of adjustment.

1.4 QUALITY ASSURANCE

- .1 Window fabricator shall have a minimum of 5 years successful experience in the fabrication and erection of metal windows of similar sizes, shapes and finishes to the units required for this project and shall have ample facilities to produce, furnish and supply the units as required for installation without delay to the Work.
- .2 Retain a professional engineer registered in Alberta experienced in structural design in glass and aluminum window units, connections to door units and connections to building, to ensure the adequacy of the structural aspects of the design, manufacture, and installation of complete assembly. This Engineer is called the "Manufacturer's Engineer" elsewhere in this Section.

1.5 DELIVERY, STORAGE AND HANDLING

- .1 Deliver, handle and store units in accordance with manufacturer's directions.
- .2 Store units at site on raised wood pallets protected from the elements and corrosive materials. Do not remove from crates or other protective covering until ready for installation.
- .3 Store all glass units vertically on end with solid bearing full thickness of insulating units.
- .4 Store prefabricated frame assemblies blocked off the ground to prevent warping, twisting, undo strain on assembly or physical abuse and damage.

1.6 SITE CONDITIONS

- .1 Protect aluminum finishes and glazing during erection against disfiguration, contamination or damage by abuse of harmful materials. Install protective cover where exposure to damage is critical.

- .2 After glass is installed, mark each light with large cross or other symbol to make glass obvious and noticeable to other trades. Use substance which will not stain, mark or "Shadow" glass either by itself or by reaction with sunlight, moisture or the environment. Do not use masking tape.
- .3 Coordinate installation of windows with Work specified in other Sections to ensure proper placement and installation of vapour barrier, insulation and flashing in order that air/vapour/thermal barrier of building is intact and moisture will be diverted to the exterior.

1.7 WARRANTY

- .1 Provide manufacturers written guarantee, signed and issued in the name of Owner, to replace the following items for defective material and workmanship for the time stated from date of Substantial Performance:
 - .1 Framing, panels and glazing: failure of performance requirements specified in Contract Documents; 2 years
 - .2 Sealed glass units: misting, dusting and seal failure; 2 years
 - .3 Sealants, caulking: failure to maintain seal; 2 years
 - .4 Aluminum brake shapes: oil canning and delaminations; 2 years

Part 2 Products

2.1 ACCEPTABLE PRODUCTS

- .1 Fixed Windows: refer to drawings for required profiles and sizes.
- .2 Operable Windows: refer to drawings for required profiles and sizes.

2.2 MATERIALS

- .1 Sheet aluminum: Alloy 1100, F temper, 1.5 mm ($\frac{3}{16}$ ") or 3 mm ($\frac{1}{8}$ ") minimum thickness.
- .2 Glass: as indicated on drawings, sealed glass units as specified under Section 08800 Glazing
- .3 Fasteners: To ASTM A167, stainless steel, type 304 selected to prevent galvanic action with the components fastened, of suitable size to sustain imposed loads
- .4 Gaskets: Neoprene or EPDM with dimensional tolerances and durometer hardness and of suitable size and shape to meet the requirements of the specifications and their specific application. Gaskets shall be virgin material as manufactured by Tremco Ltd., Tremco Ltd. Gaskets shall conform to Tremco Information Bulletins:

For EPDM TDB4601
For Neoprene TDB2701
- .5 Supporting angles, plates, bars, rods, and other steel accessories: Mild steel CAN3G40.20/G40.21, shop painted with zinc chromate primer, thickness as required to sustain imposed loads and in no case less than 5 mm ($\frac{3}{16}$ ") thick
- .6 Sealant: Including primer, joint filler, as specified in Section 07 90 00
- .7 Dielectric separator: Bituminous paint CAN/CGSB1.108

- .8 Thermal separator: Polyvinyl chloride, 50 Shore A durometer hardness +5
- .9 Glazing Tape: Refer to Section 08 80 00 Glazing
- .10 Metal air seal/vapour barrier (by window supplier) to be bonded to window frame and extend behind mounting frame. Seal all corners to maintain air sea/vapour retarder. Install flexible flashing with continuous metal retaining strip to lap to interior wall assembly.
- .11 Exterior Window Frame: To profiles indicated and as required to meet performance requirements, nominal thickness 2.5 mm (0.098"), suitable alloy and proper temper for extruding and adequate structural characteristics; and suitable for finishing as specified.
- .12 Insect Screens:
 - .1 Insect screening mesh: count 18 x 16.
 - .2 Fasteners: tamper proof.
 - .3 Screen frames: aluminum to match window frames.
 - .4 Mount screen frames for interior replacement.

2.3 FABRICATION

- .1 Fit and assemble all Work in the shop insofar as practical.
- .2 Carefully fit and match all Work for continuity of line and design, using rigidly secured joints with hairline contact, unless otherwise shown.
- .3 Reinforce members and joints with steel plates, bars, rods or angles for rigidity and strength as needed to fulfill performance requirements. Use concealed stainless steel fasteners for jointing which cannot be welded.
- .4 Separate unlike metals or alloys with a heavy coating of bituminous paint, separator gaskets or slip gaskets as required to prevent galvanic action.
- .5 Provide weep holes in the glazing recess and an air seal at the interior glass line.

2.4 FINISHES

- .1 Exposed surfaces: Kynar or Hylar high performance fluoropolymer coating to AAMA 2605, minimum coating thickness 1.2mils; minimum 70% resin content by weight in paint system; white colour.
- .2 Paint ungalvanized steel clips, supports and reinforcing steel with steel primer or bituminous paint.
- .3 Non exposed surfaces may be left natural.

Part 3 Execution

3.1 INSPECTION

- .1 Inspect Work and conditions affecting the Work of this Section. Proceed only after deficiencies have been corrected.
- .2 Ensure that all flashings built-in or provided by others integrate with system to divert moisture to exterior.

- .3 Ensure that all anchor blocks or inserts required to receive system are correctly located and installed.
- .4 Ensure that all anchors and setting or installing components provided by this Section for installation are properly located and installed.
- .5 Ensure that building air and vapour retarding membranes can be sealed to window units to maintain system integrity. Co-ordinate with materials installation specified in 07 27 19 Air/Vapour Retarder.

3.2 PREPARATION

- .1 Obtain all dimensions from the job site.
- .2 Provide data, dimensions and components, anchors and assemblies to be installed by others in proper time for installation.

3.3 ERECTION

- .1 Erect Work in strict accordance with manufacturer's written instructions.
- .2 Conceal all anchors and fitments. Exposed heads of fasteners not permitted. All joints in exposed work to be flush hairline butt joints.
- .3 Use anchors that will permit sufficient adjustment for accurate alignment. Make allowance for deflection of building structure.
- .4 Build in and provide any supplementary reinforcing and bracing required by assembly loads and deflections.
- .5 Secure Work adequately to structure in a manner not restricting thermal and wind movement.
- .6 Correctly locate and install flashings, deflectors and weep holes to ensure proper drainage of moisture to exterior.
- .7 Maintain alignment with adjacent Work.
- .8 Isolate aluminum surfaces from adjacent dissimilar materials and metals with coatings of bituminous paint.
- .9 Fill shim spaces at perimeter of assembly to maintain continuity of thermal barrier with foam-in-place insulation and seal with materials specified in Section 07900 – Sealants.

3.4 GLAZING

- .1 Ensure all stops, gaskets, splines, seals etc., are perfectly aligned and ready to receive glazing and insulated panels as specified herein.
- .2 Install glazing to approved details and instruction, using material specified in accordance with manufacturer's instructions.
- .3 Glazing stops, snap covers shall be of a continuous length from corner to corner, and be fitted at corners.

- .4 All preformed tapes or gaskets shall be of a continuous length corner to corner and shall be cut over length to prevent stretching. Joints, splices and corners shall be mitred and sealed.
- .5 Clean all contact surfaces of glazing with solvent and wipe dry. Ensure all glazing channels are clean, true to line, and free of dirt or debris and that weep and drainage vents are open.
- .6 Rest glazing on setting blocks at 1/4 points.
- .7 Install shims at sides to align glass units.
- .8 Apply a full heel bead of non-drying non-skinning sealant to the interior perimeter of each glass unit to provide positive air/vapour seal to warm light of glass.

3.5 SEALANT

- .1 Caulk and seal full perimeter of windows to building air/vapour retarder to provide and maintain the designed air/vapour/thermal barrier integrity and weather tightness.
- .2 Install sealants and backup materials in strict accordance with manufacturer's written instruction.

3.6 CLEAN UP

- .1 At completion and continuously as Work proceeds, remove all surplus materials, debris and scrap.
- .2 At completion of Work, remove all protective surface covering film and wrappings. Clean all glass, panels and frames using mild soap or other cleaning agent approved by manufacturer.
- .3 Remove all excess glazing or joint sealing materials from exposed surfaces. Clean and polish glass.

END OF SECTION

Part 1 General**1.1 SECTION INCLUDES**

- .1 Hardware for metal doors, including templates required to make proper provisions in other work to receive the Finish Hardware.
- .2 Thresholds.
- .3 Weatherstripping, seals, and door gaskets.

1.2 REFERENCES

- .1 AWMAC (Architectural Woodwork Manufacturers Association of Canada) - Quality Standards.
- .2 BHMA (Builders Hardware Manufacturers Association) - A156 series.
- .3 CSDMA (Canadian Steel Door Manufacturers Association).
- .4 DHI (Door and Hardware Institute Canada) - AHC and EHC certification programs.
- .5 DHI (Door Hardware Institute) - A115 series.
- .6 DHI (Door Hardware Institute) - WDHS.3 - Hardware Locations for Wood Flush Doors.

1.3 SUBMITTALS

- .1 Comply with requirements of Section 01 00 15.
- .2 Shop Drawings:
 - .1 Indicate locations and mounting heights of each type of hardware, schedules, catalogue cuts, electrical characteristics and connection requirements.
 - .2 Submit manufacturer's parts lists, and templates.
- .3 Samples:
 - .1 Submit one (1) sample of hinge, latch-set, lockset, closer, illustrating style, colour, and finish.
 - .2 Samples, where accepted, will be incorporated into the Work.
- .4 Installation Data: Manufacturer's special installation requirements.

1.4 CLOSEOUT SUBMITTALS

- .1 Operation and Maintenance Data: Include data on operating hardware, lubrication requirements, and inspection procedures related to preventative maintenance.
- .2 Warranty Documentation: Submit manufacturer warranty and ensure forms have been completed in Owner's name and registered with manufacturer.
- .3 Record Documentation:
 - .1 Record actual locations of installed cylinders and their master key code.
 - .2 Keys: Deliver with identifying tags to Owner by security shipment direct from hardware supplier.

1.5 QUALITY ASSURANCE

- .1 Finish Hardware: to A.N.S.I. standard dimensions.
- .2 Perform Work in accordance with the following requirements:
 - .1 BHMA A156 series.
 - .2 CSDMA.
- .3 Manufacturer Qualifications: Company specializing in manufacturing the Products specified in this section with minimum three (3) years experience.
- .4 Installer Qualifications: Company specializing in performing the work of this section with minimum three (3) years approved by the manufacturer.
- .5 Hardware Supplier Personnel: Employ an Architectural Hardware Consultant (AHC) to assist in the work of this section.
- .6 Hardware Supplier Personnel: Employ an Electrified Hardware Hardware Consultant (EHC) to assist in the electronics and controls work of this section.

1.6 DELIVERY, STORAGE, AND PROTECTION

- .1 Package hardware items individually; label and identify each package with door opening code to match hardware schedule.

Part 2 Products**2.1 PRODUCT REQUIREMENTS**

- .1 These products are listed in the BHMA Certified Product Directory, Product Qualification; Products listed in this Schedule have been selected to achieve a minimum standard based upon Quality, Design, Finish, Performance and localized support.
- .2 Supply all like products from one manufacturer.

2.2 LOCKS AND LATCHES

- .1 Bored Locks And Latches: to ANSI/BHMA A156.2-1996 designed for function, grade and keyed as stated in hardware schedule
- .2 Provide all lock sets installed in wood doors or frames with wrought boxes.

2.3 DOOR HANGING DEVICES

- .1 Butts And Hinges, and Pivots: to ANSI/BHMA A156.1-2000 as specified in Hardware Schedule.

2.4 ARCHITECTURAL DOOR TRIM

- .1 to ANSI/BHMA A156.6-2001, as specified in Hardware Schedule.
- .2 Door Protection Plates: kick plate construction stainless steel beveled 4 edge:
- .3 Push/Pull Plates: stainless steel construction beveled 4 edges, as specified in Hardware Schedule.

2.5 AUXILIARY HARDWARE

- .1 to ANSI/BHMA A156.16-2002, as specified in Hardware Schedule.

2.6 WEATHERSTRIPPING AND DOOR SEALS

- .1 Head and Jamb Seal:
 - .1 Extruded aluminum frame and neprene as specified in Hardware Schedule.
 - .2 Adhesive backed as specified in Hardware Schedule.
- .2 Door Bottom Seal:
 - .1 Extruded aluminum frame and closed cell neoprene, nylon brush as specified in Hardware Schedule.

2.7 MISCELLANEOUS HARDWARE

- .1 Thresholds: to ANSI/BHMA A156.21-2001, as specified in Hardware Schedule.

2.8 KEYING

- .1 Door Locks: Incorporate new door locks into Owner's existing keying system.

2.9 MATERIALS AND FASTENERS

- .1 Furnish hardware with all necessary fasteners, mounting brackets, and special tools required for the proper installation as recommended by the manufacturer.
- .2 Provide machine screws and lead anchors for floor stops toggle bolts for wall stops. Provide sex bolts or through bolts where required on rated mineral core doors. Provide wall stops in lieu of floor stops wherever possible. Where wall stops are not suitable provide floor stops.
- .3 All flatware shall be .050" Type 304 satin stainless steel with radius corners, and fastened with self tapping sheet metal screws or wood screws. Generally protective plates on single doors shall be 50mm less than door width on push side and 25mm less than door width on pull side. Plates on pairs of doors shall be 25mm less than door width on both sides. Refer to door schedule for flatware requirements.
- .4 Provide 114 x 101mm hinges for doors up to 950mm and 127 x 101mm hinges for doors over 950mm wide. Provide 3 hinges per leaf for doors up to 2200mm in height and one additional hinge for each additional 600mm in door height. Exterior out swinging doors shall have non removable pins.
- .5 Thresholds shall be constructed of high quality aluminum oxide with silicon carbon grains integrally cast into the fluted surface and fastened with stainless steel machine screws and lead anchors.

2.10 FINISHES

- .1 Finishes shall be as listed herein except where noted otherwise.

Butts and Hinges:	marine grade stainless steel
Exit devices:	630 Satin Stainless Steel.
Door Closers and Accessories:	689
Architectural door trim:	marine grade stainless steel

Part 3 Execution**3.1 EXAMINATION**

- .1 Verify that doors and frames are ready to receive work and dimensions are as indicated on shop drawings.

3.2 INSTALLATION

- .1 Install hardware to manufacturer instructions.
- .2 Use templates provided by hardware item manufacturer.
- .3 Where hardware items are required to be installed onto or into surfaces that are to be later painted or finished, install hardware completely to ensure proper fit, remove and store until finishing is complete, and then re-install.
- .4 Drill and countersink units which are pre-prepared for anchorage of fasteners. Space fasteners and anchors to manufacturer's recommendations. Use only fasteners supplied by hardware manufacturers.
- .5 Where hardware items are required to be installed onto or into surfaces that are to be later painted or finished, install hardware completely to ensure proper fit, remove and store until finishing is complete, and then re-install.
- .6 Protect doors and frames from damage due to installation of hardware.
- .7 Finish Hardware to be installed as per manufacturers instructions in accordance with D.H.I. document "Recommended Locations for Builders Hardware for Standard Steel Doors and Frames" which list all mounting heights and locations.

3.3 ADJUSTING AND PROTECTION OF INSTALLED HARDWARE

- .1 Adjust hardware for smooth operation.
- .2 Do not permit adjacent work to damage hardware or finish.

3.4 HARDWARE SCHEDULE

- .1 Refer to Drawings for specific door hardware requirements.

END OF SECTION

Part 1 General**1.1 REFERENCES**

- .1 Canadian General Standards Board (CGSB):
 - .1 CAN/CGSB12.1M90, Tempered or Laminated Safety Glass.
 - .2 CAN/CGSB12.3M91, Flat, Clear Float Glass.
 - .3 CAN/CGSB12.897, Insulating Glass Units.
 - .4 CAN/CGSB12.11M90, Wired Safety Glass.
 - .5 CAN/CGSB19.2M87, Glazing Compound, Non-hardening, Modified Oil Type.

1.3 QUALITY ASSURANCE

- .1 Manufacturer's technical recommendations:
 - .1 Perform glazing work in accordance with written recommendations from the glass manufacturer or glass fabricator.
 - .2 Certify glass compatibility with glazing materials (i.e. insulating glass sealants, structural sealants and silicones, gaskets, setting blocks, etc.)
 - .3 Designs to be analyzed for thermal stress.
 - .4 Provide shop inspection for glass.
- .2 Window fabricator shall be a member in good standing of the Northern Alberta Glass Trades Association and adhere to the rules and regulations for workmanship, training and personnel as set forth by the association.

1.4 PERFORMANCE REQUIREMENTS

- .1 Provide continuity of building enclosure vapour and air barrier using glass and glazing materials utilizing inner light of multiple light sealed units for continuity of air and vapour seal.
- .2 Size glass to withstand wind loads, dead loads and positive and negative live loads acting normal to plane of glass to a design pressure of 75 kPa as measured in accordance with ANSI/ASTM E330.
- .3 Limit glass deflection to 1/200 with full recovery glazing materials.

1.5 SUBMITTALS

- .1 Comply with requirements of Division 01 00 15.
- .2 Samples: Submit 300mm x 300mm sized samples of each type of glass, clearly labeled with manufacturer's name and glass type. Reference glass types to those scheduled and specified herein.
- .3 Stress Analysis: Prepare a stress analysis on all tinted heat/absorbing glass and light and heat reflecting glass. Submit prior to ordering glass.

1.6 DELIVERY, STORAGE AND HANDLING

- .1 Deliver and store packaged materials in their original containers with manufacturer's labels and seals intact.
- .2 Store vertically, blocked off the floor in a weatherproof enclosure.

- .3 Install glass as soon as possible after delivery to site.
- .4 Handle glass carefully to its place of installation. Prevent damage to glass, adjacent materials and surfaces.

1.7 SITE CONDITIONS

- .1 Coordinate the Work of this Section with the installation of frames to ensure a continuous, uninterrupted sequence, and to prevent the undue exposure of unprotected frames to the weather.
- .2 Do not install any glazing until all nearby welding is completed.
- .3 As each light of glass installed, mark it in a manner to make it visible and obvious to all persons. Do not use materials which may permanently mar, discolour or disfigure the glass.

1.8 ENVIRONMENTAL REQUIREMENTS

- .1 Install glazing when ambient temperature is 4°C minimum. Maintain ventilated environment for 24 hours after application.
- .2 Maintain minimum ambient temperature before, during and 24 hours after installation of glazing compounds.

1.9 WARRANTY

- .1 Provide manufacturers guarantee for the following types of glass listed, against defects in materials and workmanship for the period indicated, commencing from the date of Substantial Performance of Work.
- .2 Sealed glass units against misting, dusting, seal failure, thermal shock breakers: or other impairments: 5 Years.

Part 2 Products

2.3 GLASS

- .1 Clear Tempered Glass: to CAN/CGSB12.1 and as follows:
 - .1 Type: 2 Tempered.
 - .2 Class: B Float Glass.
 - .3 Category: II 540 J impact resistance.
- .2 Low Emissivity (Low E) Glass: to CAN/CGSB12.10, thickness as indicated, clear, sputtered titanium providing an emissivity rating 0.03 or less for 2nd glass surface installation.
 - .1 Acceptable materials: Solarban 60
- .3 Wired Glass: to CAN/CGSB12.11, as follows:
 - .1 Type 1 Polished both sides (transparent.
 - .2 Wire mesh styles 3 Square.

2.4 INSULATING GLASS

- .1 Insulating Glass Units: Provide sealed insulating glass units in accordance with CAN/CGSB12.8 in configurations indicated, and as specified herein.
 - .1 Double Glazing:
 - .1 Manufacture sealed insulating glass units double glazed without edge channels or tape, that is, with bare glass edges.
 - .2 Use two stage seal method of manufacture, as follows:
 - .1 Primary Seal: polyisobutylene sealing compound between glass and metal spacer/separator.
 - .2 Secondary Seal: polyurethane, silicone or polysulphide base sealant, filling gap between the two lites of glass at the edge up to the spacer/separator and primary seal.
 - .3 Spacer/separator to provide continuous vapour barrier between interior of sealed unit and secondary seal.
 - .4 Sealants for Insulating Glass Units shall be silicone based and compatible with Structural Silicone and as follows:
 - .1 Silicone Base Sealants: to CAN/CGSB19.13M87, one component, elastomeric, chemical curing.
 - .2 Rheological Properties: Class 2 nonsag.
 - .3 Substrate Class: G Glass.
 - .4 Glazing Suitability: Class A resists ultraviolet through glass.
 - .5 Temperature Class: L low temperature
 - .6 Movement Class: 40.
 - .7 Colour: Black.
 - .5 Thickness: 5mm Heat Strengthened or Tempered Glass with Low 'E' coating on #2 surface + 5mm Air Space + inner pane of 5mm Clear Glass; fill voids with argon gas.

2.5 ACCESSORY MATERIALS

- .1 Sealants: Silicone, one component clear, with primers, sealers, cleaners all as specified in Section 07 92 00.
- .2 Glazing Tape: 100 percent polybutene vehicle. Extruded in ribbon form with paper separator. Tape shall have an integral shim strip where required.
- .3 Setting Blocks: Neoprene, shore A" hardness 7090; shims shore A" hardness 4050.
- .4 Glazing Compound: For glazing to metal, to CAN/CGSB19.2.

2.6 FABRICATION GENERAL

- .1 Cut all glass to field measurement with proper clearances. Cut to produce clean, straight edges with no chips, cracks or flaws, round over and polish all edges of security glass.
- .2 Make any cutouts, openings to approved drawings. Grind and polish exposed edges smooth roundoff corners.

Part 3 Execution

3.3 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.

3.4 PREPARATION

- .1 Ensure all glazing rebates smooth and true, free of projections nails, screws, fastenings properly set to prevent contact with glass.
- .2 Ensure all stops, splines, glazing accessories provided by others accurately cut to length and proper size and type for specific glazing.
- .3 Clean contact surfaces with solvent and wipe dry.
- .4 Seal porous glazing channels or recesses with substrate compatible primer or sealer.
- .5 Prime surfaces scheduled to receive sealant.

3.5 INSTALLATION

- .1 Install in accordance with the manufacturer's written instructions and the contract documents, plumb, true, level and rigid.
- .2 Do not glaze when ambient or surface temperatures are less than 4°C. Glazing rebates, stops and glass shall be dry, free from ice, frost slick, grease, oil, dust, rust, or other matter detrimental to adhesion of tape, glazing compounds and sealant.
- .3 Installation of glass shall be by workmen skilled in this trade in strict accordance with manufacturer's directions, to produce a first class installation.
- .4 Centre and support glass on setting blocks at quarter points, as required shim sides.
- .5 Glass shall be free from contact with the frames and stops.
- .6 Label each light to show manufacturer's name or trade mark, quality and thickness.
- .7 Use sealant at exterior doors, sealing water and weather tight.

3.6 GLASS SCHEDULE

- .1 Refer to Drawings for types and sizes of glass required.

END OF SECTION

Part 1. General**1.1 SECTION INCLUDES**

- .1 Portland cement plaster system.
- .2 Metal furring and lathing.
- .3 Smooth surface finish.

1.2 REFERENCES

- .1 ASTM C91-05 Masonry Cement.
- .2 ASTM C150-07 Portland Cement.
- .3 ASTM C207-06 Hydrated Lime for Masonry Purposes.
- .4 ASTM C847-06 Metal Lath.
- .5 ASTM C897 Aggregate for JobMixed Portland CementBased Plasters.
- .6 ASTM C926 Application of Portland Cement Based Plaster.
- .7 ASTM C1002-07 Steel SelfPiercing Tapping Screws for the Application of Gypsum Panel Products or Metal Plaster Bases to Wood Studs or Steel Studs
- .8 ASTM C1063-06 Installation of Lathing and Furring to Receive Interior and Exterior Portland CementBased Plaster
- .9 CSA A3000-03 Cementitious Materials Compendium.
- .10 PCA (Portland Cement Association) Portland Cement Plaster (Stucco) Manual.

1.3 SUBMITTALS

- .1 Comply with requirements of Section 01 00 15.
- .2 Product Data: Provide data on plaster materials, characteristics and limitations of products specified.
- .3 Samples: Submit duplicate 300mm x 300mm size panels illustrating finish colour and texture.
- .4 Installation Data: Manufacturer's special installation requirements.

1.4 QUALITY ASSURANCE

- .1 Perform Work in accordance with ASTM C926 and PCA Portland Cement Plaster (Stucco) Manual.
- .2 Manufacturer Qualifications: Company specializing in manufacturing the Products specified in this section with minimum three (3) years documented experience.
- .3 Installer Qualifications: Company specializing in performing the work of this section with minimum three (3) years documented experience and approved by the manufacturer.

1.5 ENVIRONMENTAL REQUIREMENTS

- .1 Do not apply plaster when substrate or ambient air temperature is less than 10 degrees C nor more than 27 degrees C.

- .2 Maintain minimum ambient temperature of 10 degrees C during installation of plaster and until cured.

Part 2. Products

2.1 PLASTER BASE MATERIALS

- .1 Portland Cement: to CAN/CSAA5 white colour.
- .2 Lime: ASTM C207, Type S.
- .3 Aggregate: In accordance with PCA Plaster (Stucco) Manual.
- .4 Water: Clean, fresh, potable and free of mineral or organic matter which can affect plaster.
- .5 Plaster Mix Reinforcement: Purpose made glass fibres, chopped to 13 mm nominal length, alkali resistant .
- .6 Metal Lath: to ASTM C847; flat diamond self furring mesh of weight to suit application; galvanized.
- .7 Wire Mesh Reinforcement: 38 x 38 mm galvanized steel, 0.6mm wire, woven mesh, self-furring type.
- .8 Casing and Corner Bead: Formed zinc coated sheet steel or PVC, depth governed by plaster thickness, maximum possible lengths, expanded metal flanges, with bullnosed edges.
- .9 Control and Expansion Joint Accessories: Formed zinc coated sheet steel or PVC accordion profile, 50mm width.
- .10 Anchorage: Tie wire, nails, and other metal supports, of type and size to suit application; to rigidly secure materials in place, galvanized.
- .11 Fasteners: ASTM C1002, self drilling, self tapping screws.

2.2 CEMENT PLASTER MIXES

- .1 Mix and proportion cement plaster [in accordance with in accordance with PCA Portland Cement Plaster (Stucco) Manual and to manufacturer's written instructions.
- .2 Base Coat and Brown Coat: One part cement, minimum and maximum 4 parts aggregate, and minimum 15 percent and maximum 25 percent hydrated lime, and glass fibres at a rate of 0.7 kg per sack of cement.
- .3 Finish Coat: Premix in accordance with manufacturer's written instructions.
- .4 Mix only as much plaster as can be used prior to initial set.
- .5 Add colour pigments to finish coat in accordance with manufacturer's written instructions.
- .6 Mix materials dry, to uniform colour and consistency, before adding water.
- .7 Protect mixtures from freezing, frost, contamination, and excessive evaporation.
- .8 Do not re-temper mixes after initial set has occurred.

Part 3. Execution**3.1 EXAMINATION**

- .1 Masonry: Verify joints are cut flush and surface is ready to receive work of this section. Verify no bituminous or water repellent coatings exist on masonry surface.
- .2 Concrete: Verify surfaces are flat, honeycomb are filled flush, and surfaces are ready to receive work of this section. Verify no bituminous, water repellent, or form release agents exist on concrete surface that are detrimental to plaster bond.
- .3 Metal Lath and Accessories: Verify lath is flat, secured to substrate, and joint and surface perimeter accessories are in place.
- .4 Mechanical and Electrical: Verify services within walls have been tested and approved.

3.2 PREPARATION

- .1 Dampen masonry surfaces to reduce excessive suction.
- .2 Clean concrete surfaces of foreign matter. Clean surfaces using acid solutions, solvents, or detergents. Wash surfaces with clean water.
- .3 Roughen smooth concrete surfaces and apply bonding agent in accordance with manufacturer's written instructions.

3.3 INSTALLATION LATHING MATERIALS

- .1 Install lathing and furring to ASTM C1063.
- .2 Apply self furring reinforcement with self furring ribs perpendicular to supports.
- .3 Lap ends minimum 25mm. Secure end laps with tie wire where they occur between supports.
- .4 Lap sides of diamond mesh lath minimum 38mm. Nest outside ribs of rib lath together.
- .5 Attach metal lath to supports using nails or screws in accordance with manufacturer's recommendations.

3.4 INSTALLATION ACCESSORIES

- .1 Continuously reinforce internal angles with corner mesh, return metal lath 75mm from corner to form the angle reinforcement; fasten at perimeter edges only.
- .2 Place corner bead at external wall corners; fasten at outer edges of lath only.
- .3 Place strip mesh diagonally at corners of lathed openings. Secure rigidly in place.
- .4 Place 100mm wide strips of metal lath centred over junctions of dissimilar backing materials. Secure rigidly in place.
- .5 Place casing beads at terminations of plaster finish. Butt and align ends. Secure rigidly in place.
- .6 Install door [and glazed] frames plumb and level in opening. Secure rigidly in place.

3.5 CONTROL AND EXPANSION JOINTS

- .1 Locate control and expansion joints 6 meters maximum.

- .2 After initial set, scribe contraction joints in exterior work every 1 meter in each direction by cutting through 2/3 of the cement plaster depth, neatly, in straight lines.

3.6 ERECTION TOLERANCES

- .1 Maximum Variation from True Flatness: 3mm in 3 meters.

END OF SECTION

PART 1 General**1.1 SUMMARY**

- .1 This Section includes the following:
 - .1 Interior gypsum board for walls, ceilings and bulkheads

1.2 REFERENCES

- .1 American Society for Testing and Materials (ASTM):
 - .1 ASTM A653/A653M04a Steel Sheet, ZincCoated (Galvanized) or ZincIron AlloyCoated (Galvannealed) by the HotDip Process, General Requirements
 - .2 ASTM C1103d Standard Terminology Relating to Gypsum and Related Building Materials and Systems
 - .3 ASTM C47504 Joint Compound and Joint Tape for Finishing Gypsum Board
 - .4 ASTM C104799 (2004) Standard Specification for Accessories for Gypsum Wallboard and Gypsum Veneer Base
 - .5 ASTM C1396/C1396M04 Standard Specification for Gypsum Board
- .2 Canadian General Standards Board (CGSB):
 - .1 CAN/CGSB19.21M87 Sealing and Bedding Compound for Acoustic Purposes
- .3 Northwest Wall and Ceiling Bureau (NWCBS):
 - .1 Specification Standards Manual
- .4 Underwriters Laboratories of Canada (ULC):
 - .1 CAN/ULC S10104 Fire Endurance Tests of Building Construction and Materials
 - .2 CAN/ULCS10203 Surface Burning Characteristics of Building Materials and Assemblies
 - .3 CAN/ULC S1141980 (R1997) Test for Determination of NonCombustibility in Building Materials
 - .4 CAN/ULC S70297 Mineral Fibre Thermal Building Insulation
 - .5 List of Equipment and Materials

1.3 DEFINITIONS

- .1 **Levels of Finish:** Standard levels of finish defined by NWCBS Manual apply to products of this Section as follows, and are used in Section 09 99 10 Room Finish Schedule to designate required finish levels for indicated areas:
 - .1 **L0 – Level 0:** No tape or joint compound in joints.
 - .2 **L1 – Level 1:** Embed tape at joints in ceiling plenum areas, concealed areas, unless a higher level of finish is required for fire resistance rated assemblies and sound rated assemblies.
 - .3 **L2 – Level 2:** Embed tape and apply separate first coat of joint compound to tape, fasteners, and trim flanges where panels are substrate for tile.
 - .4 **L4 – Level 4:** Embed tape and apply separate first, fill, and finish coats of joint compound to tape, fasteners, and trim flanges at panel surfaces that will be exposed to view.
- .2 Refer to ASTM C11 for definitions of terms for gypsum board assemblies not defined in this Section or in other referenced standards.

1.4 QUALITY ASSURANCE

- .1 Install gypsum board in accordance with the Northwest Wall and Ceiling Bureau (NWCBC), except as specified otherwise herein.
- .2 Conform to product manufacturer's written instruction and ULC Design Requirements to provide STC and fire ratings indicated.

1.5 SITE SUPERVISION

- .1 Site supervision for work of this section shall be full time. Supervisor shall be directly employed by the installer and shall have the authority to receive, represent and make decisions on behalf of the Trade Contractor.

1.6 DELIVERY, STORAGE AND HANDLING

- .1 Comply with requirements of Section 01 65 00.
- .2 Deliver materials in undamaged, original factory wrappings with labels and seals intact, and stored on job site in a dry, weatherproof, heated area.
- .3 Store metal furring and accessories flat and protected from moisture and damage.
- .4 Store boards flat, in piles, without overhanging boards, protected from moisture and physical damage.
- .5 Waste Management and Disposal: separate waste materials for re-use and recycling in accordance with Section 01 35 41.

1.7 ENVIRONMENTAL CONDITIONS

- .1 Maintain room, surface and material between 15°C and 21°C for a period of at least 72 hours before and during application, and continuously after.

1.8 SUPERIMPOSED LOADS

- .1 Determine the superimposed loads which will be applied to suspended ceiling systems and ensure that adequate hangers are installed to safely support the additional loads in conjunction with the normal loads of the system.

PART 2 Products**2.1 GYPSUM BOARD MATERIALS**

- .1 Gypsum Board: meeting the requirements of ASTM C1396/C1396M and as follows:
 - .1. Panel Size: Provide in maximum lengths and widths available that will minimize joints in each area and correspond with support system as indicated on drawings.
 - .2. Regular Gypsum Board:
 - .1. Thickness: As indicated.
 - .2. Long Edges: Tapered.
 - .3. Location: Vertical surfaces, unless otherwise indicated.

- .3. Fire Resistant Type (Type C or X):
 - .1. Thickness: As indicated, 16 mm minimum.
 - .2. Long Edges: Tapered.
 - .3. Location: Where required for fire resistance rated assembly.
- .4. Sag Resistant Gypsum Board: ceiling board manufactured to have more sag resistance than regular type gypsum board:
 - .1. Thickness: As indicated.
 - .2. Long Edges: Tapered.
 - .3. Location: Ceiling surfaces.
- .5. Mould Resistant Gypsum Board, for use on ceilings and wall in washroom, wet work stations, and janitor areas: To ASTM C1396, and mould resistance to ASTM D3273.
 - .1. Thickness: As indicated, 13 mm minimum.
 - .2. Long Edges: Tapered.
 - .3. Location: Vertical surfaces, unless otherwise indicated.
- .6. Glass Mat Water Resistant Gypsum Backer Board (Interior Applications Only): Manufactured in accordance with ASTM C1178 to produce greater resistance to water penetration and to provide improved surface bonding characteristics for ceramic tile than standard gypsum board:
 - .1. Thickness: As indicated, minimum 13 mm x manufacturers maximum length and widths.
 - .2. Location: Substrate for ceramic tile.
- .2. Joint Tape: To ASTM C475, perforated paper with tapered edges as recommended by gypsum board manufacturer, or glass fibre mesh tape
- .3. Joint Compound: To ASTM C475, bedding and finishing types recommended by gypsum board manufacturer; casein, vinyl or latex base.
- .4. Corner and Casing Beads, Edge Trim: To ASTM 1047, Minimum 0.455 mm metal core thickness (0.017") (26 gauge) galvanized sheet steel with Z275 zinc finish to ASTM A525M86, type with perforated flanges, of type to be finished with joint compound
- .5. Control/Expansion Joints: To ASTM C1047, 3 m (10 foot) lengths, roll formed zinc with a tape protected 6 mm (1/4") opening, 11 mm (7/16") deep
- .6. Adhesive: Type as recommended by gypsum board manufacturers
- .7. Acoustic Insulation: To ULC S702, mineral fibre sound control batts, steel stud friction fit insulation (un faced), thickness 76 mm (3"), density 40 kg/m³ minimum STC 50 for wall assembly. Acceptable material: Roxul AFB, substitutions shall submit product data to the Consultant prior to close of bid with all supporting information
- .8. Sealant (acoustic purposes only): To CAN/CGSB19.21, non-skinning, non-hardening as specified in Section 07 90 00
- .9. Sealant (fire rated for rated walls): ULC labelled, as specified in Section 07 90 00
- .10. Insulating Strip: Rubberized, moisture resistant 3 mm thick closed cell neoprene strip 90 mm wide with self sticking permanent adhesive on one face lengths as required

PART 3 Execution**3.1 INSPECTION AND PREPARATION**

- .1 Inspect areas and surfaces and ensure all required metal backing for equipment is in place before commencing gypsum board application.
- .2 Verify stud framing securely and rigidly erected, all services, lines, outlets and insulation.
- .3 Prepare existing walls with wall metal backing ready for installation of new or relocated cabinet as indicated on drawings. Coordinate with Section 06 40 00 Architectural Wood work for backing requirements.
- .4 Inspect all pressed steel frames and correct out-of-plumb frames for true alignment.

3.2 RESTORATION AND REPAIRS

- .1 Skim coat all existing affected gypsum board walls and columns to make ready for new finishes. Repair all dents and gouges to provide smooth and even appearance. Cut and repair any gypsum board that has broken front and backer face.
- .2 Repair existing drywall surfaces where existing abutting partitions have been removed. Review conditions on site during bid period.

3.3 CONTROL JOINTS

- .1 Erect control joints at maximum 7.5 metre (25 feet) centres to divide large ceiling and wall areas into panels, over junction of structural members and non structural members where gypsum board is continuous, over control joints in masonry walls, at junction of ceilings and partitions with furred exterior wall.
- .2 Control joints shall be laid out to coincide as far as possible with metal door, window or screen frames, but not necessarily to occur at every individual frame. Obtain Architect's approval for location, prior to installation.

3.4 ACCESSORIES

- .1 Secure corner beads rigidly at all external angles of walls and ceilings.
- .2 Install casing beads where gypsum board terminates against surface having no trim concealing the junction or where junction is not taped.
- .3 Install casing beads where gypsum board butts to windows, frames or where interior partitions butt to exterior walls.
- .4 Install insulating strips continuously at edges of gypsum board and casing beads abutting metal window exterior door frames and ceilings to provide thermal break and air seal.

3.5 GYPSUM BOARD APPLICATION

- .1 Erect gypsum board and tape joints to NWCB except where specified otherwise herein.
- .2 Kerf cut gypsum board at curved walls follows by plaster fill system to present smooth even curve showing no faceting and blending smoothly into adjacent straight wall sections.
- .3 Install fire rated and labelled gypsum board at all locations indicated on Drawings, utilizing type "C" or "X" as indicated by ULC rating for assembly and as required by authority having jurisdiction. Continue fire and smoke rated wall construction behind and around fire hose cabinet recesses and other recessed items larger than a double gang switch box to maintain wall fire rating.

- .4 Stop gypsum board 25 mm (1") from underside of roof deck. Attach gypsum board to vertical studs, not to ceiling track, to allow for deflection.
- .5 Tile Backing Panels:
 - .1 Construct shower and bath surround partitions of glass mat reinforced water resistant gypsum backing board only, in strict accordance with manufacturer's current recommended installation procedures.
 - .2 Shim surfaces to produce a uniform plane across panel surfaces where tile backing panels abut other types of panels in the same plane.

3.6 SEALANT SOUND RATINGS

- .1 Caulk sound rated partitions strictly in accordance with gypsum board manufacturer's instructions for the specific sound rating requirements. Locate sealant to ensure it is covered at completion of partition when finishes applied. Seal top and bottom tracks, and seal studs where they abut adjacent wall construction to ensure that no sound flanking occurs.
- .2 Seal around mechanical and electrical work and other work in walls to ensure proper sound ratings. Provide gaskets where partitions abut a finished surface or material as per details and where partitions meet exterior wall furring.
- .3 Build in all door, borrowed light frames and equipment to best practice to provide a neat, cleanly finished system.
- .4 In fire rated partitions install fire stopping sealant before installing acoustic sealant.

3.7 INSULATION ACOUSTIC

- .1 Install insulation within metal stud space to top of wall construction as indicated for sound or fire rating. Insulation to extend full height of partitions. Fill behind electrical outlet boxes, fire hose cabinets, washroom accessories and other openings with at least 150 mm (6") lap around perimeter of opening, packed tight in layers (to approximately 50% of nominal thickness).
- .2 Coordinate with Electrical and Mechanical Subcontractors to ensure that no back-to-back openings are formed, whether or not so indicated on drawings. All electrical and mechanical openings shall be separated by one stud space and lined all around with gypsum board and sealed with acoustic sealant.
- .3 Installation to comply with manufacturer's current written recommendations.

3.8 SEALANT FIRE RATINGS

- .1 Coordinate requirements for fire sealants with General Contractor.
- .2 Caulking and sealing of fire and smoke rated partitions and separations specified under Section 07 84 00 Fire stopping and Smoke Seals.

3.9 CEILINGS AND SOFFITS

- .1 Apply no-sag gypsum board to ceiling suspension system with end joints occurring over supports. Allow 1.5 mm (1/16") to 3 mm (1/8") space between butting ends.
- .2 Cut board to fit within 6 mm (1/4") of fixtures and other surfaces.
- .3 Screw attach to furring channels at spacing recommended by gypsum board manufacturer but in no case less than 150 mm (6") on centre.

- .4 Coordinate cutouts, trim and opening details and location with mechanical and electrical subcontractors.
- .5 Finish gypsum board to heights and profiles indicated. Trim all corners and edges with proper corner and casing beads.
- .6 Install moisture resistant gypsum board ceiling in washrooms and housekeeping rooms.
- .7 Build bulkheads for drop ceilings as detailed. Carry gypsum board a minimum 50 mm (2") above finished acoustic board ceiling. Provide furring behind for attachment of acoustic board perimeter track.
- .8 Maintain surface flatness and level of ceiling within 3 mm (1/8") in 3 metres (10 feet).

3.10 FINISHING

- .1 Finish gypsum wallboard in accordance with the Northwest Wall and Ceiling Bureau (NWCBC), Section 9.6 Part 3, Item 12.2, Levels of Finish No. 4.

3.11 ACCESS DOORS

- .1 Install flush mounted access doors in locations as indicated on drawings in accordance with manufacturers instructions. Ensure that installation occurs prior to taping and finishing of gypsum board surfaces.
- .2 Install all access doors provided by other trades. Exact locations of these doors will be verified on site.

3.12 CLEAN UP

- .1 All gypsum board debris and dust shall be cleaned up and disposed of daily.
- .2 Cleaning shall consist of brushing down wall and ceiling and sweeping floors daily.
- .3 As areas are completed, thoroughly vacuum ceilings, walls and floors of all dust.

END OF SECTION

Part 1 General**1.1 REFERENCES**

- .1 American Society for Testing and Materials (ASTM):
 - .1 ASTM F14103, Terminology Relating to Resilient Floor Covering
 - .2 ASTM F71003, Standard Practice for Preparing Concrete Floors to Receive Resilient Flooring
 - .3 ASTM F1066-04 - Vinyl Composition Floor Tile
 - .4 ASTM F130304 (R2009) Standard Specification for Sheet Vinyl Floor Covering with Backing
 - .5 ASTM F2034-03e1 Sheet Linoleum Floor Covering
 - .6 ASTM F151603, Standard Practice for Sealing Seams of Resilient Flooring Products by the Heat Weld Method (when Recommended)
 - .7 ASTM F186102, Standard Specification for Resilient Wall Base
 - .8 ASTM F2169-02 (2008) - Resilient Stair Treads

1.2 SUBMITTALS

- .1 Product Data:
 - .1 Submit manufacturer's printed product literature, specifications and data sheets.
 - .2 Submit manufacturer's printed recommendations for installation of product.
- .2 Samples:
 - .1 Submit duplicate 300 mm square sample pieces of sheet material, 300 mm long base, nosing, feature strips, treads, edge strips, cap strips, cove support strips required for this project.

1.3 ENVIRONMENTAL CONDITIONS

- .1 Permanent heating system shall be used to heat installation areas and acclimatize materials prior to installation.
- .2 Maintain air temperature to between 18 and 24°C (64 and 75°F) and design relative humidity at flooring installation area for 3 days prior to, during, and for 48 hours after installation.
- .3 Maintain floor substrate temperature at minimum 15°C (59°F) during installation of resilient flooring materials

1.4 DELIVERY, HANDLING AND STORAGE

- .1 Keep delivered material dry and free from stains.
- .2 Store flooring materials in area of flooring installation for three (3) days prior to installation. Store roll goods vertically. Protect edges from damage

Part 2 Products**2.1 SHEET FLOORING**

- .1 Sheet Flooring: as follows:
 - .1 Sheet Flooring: to ASTM F130304 (R2009) and F2034-03e1
 - .2 Slip Resistant Sheet Flooring: to ASTM F1303-04 (2009).
 - .3 Wearing Surface: smooth
 - .4 Seams: heat welded
 - .5 Fire Test Data:
 - .1 ASTM E 648 Critical Radian Flux 0.45 watts/sq. cm. or more, Class I
 - .2 ASTM E 662 Smoke – 450 or less.
 - .3 CAN/ULCS102.2:
 - .1 Flame Spread 25 or less.
 - .2 Smoke developed 50 or less.

2.2 RESILIENT BASE (RBC)

- .1 Resilient Wall Base: Smooth, buffed exposed face and ribbed or grooved bonding surface supplied in maximum practical length, conforming to ASTM F1861-08 and as follows:
 - .1 Type: TS – Thermoset Vulcanized Rubber
 - .2 Group: 1 – Homogeneous
 - .3 Style: B – Cove
 - .4 Height: 100 mm (4")
 - .5 Thickness: 3 mm (1/8")
 - .6 Manufacturers standard maximum length.

2.3 ACCESSORY COMPONENTS

- .1 Edge Strips: aluminum extruded, smooth, polished, anodized with lip to extend under floor finish, shoulder flush with top of adjacent floor finish.
- .2 Resilient Transition and Edge Strips: Extruded vinyl shapes meeting or exceeding ADA Recommendations for change of level transitions for transition between floors finishes having different levels; acceptable materials as follows:
 - .1 The following list is included to indicate the most commonly used transition and edge strip accessories; additional materials may be required where transition heights differ from the products listed and shall be included as a part of the Contract.
 - .2 Transition Strip: TS1 – Carpet to Resilient Flooring Transition: Johnsonite CTAXXA Transitional Moulding between flooring materials having dissimilar thicknesses; colour: selected from manufacturer's standard range.
 - .3 Transition Strip: TS2 – Ceramic Tile to Resilient Flooring Transition: Johnsonite CTAXXK Transitional Moulding between flooring materials having dissimilar thicknesses; colour: selected from manufacturer's standard range.
 - .4 Transition Strip: TS3 – Carpet to Concrete Slab Transition: Johnsonite EGXXH Transitional Moulding between materials having a thickness to materials having no thickness; colour: selected from manufacturer's standard range.

- .5 Transition Strip: TS4 – Resilient Flooring to Concrete Slab Transition: Johnsonite SSRXXB Transitional Moulding between materials having a thickness to materials having no thickness; colour: selected from manufacturer's standard range.
- .6 Transition Strip: TS5 – Resilient Flooring to Resilient Flooring Transition: Johnsonite CTAXXN Transitional Moulding between materials having the same thickness; colour: selected from manufacturer's standard range.

2.4 ACCESSORY MATERIALS

- .1 Subfloor Filler/Leveler: premixed latex modified cementitious material, suitable for mixing with water to produce a workable, self leveling, compound. Minimum compressive strength 20 MPa at 28 days, containing no gypsum products.
- .2 Primers: as recommended by adhesive manufacturer.
- .3 Adhesives: solvent free, as recommended by flooring manufacturer and adhesive manufacturer for each flooring material and type and location of substrate.
- .4 Sealer and Wax: as recommended by flooring manufacturer for flooring type and location.

2.5 COLOURS AND PATTERNS

- .1 Colours and patterns will be chosen by the Departmental Representative from manufacturer's standard range.

Part 3 Execution

3.1 CONDITION OF SUBSTRATES

- .1 Ensure floor surfaces are dry, clean, free from dust, solvent, loose paint, wax, oil, grease, asphalt, sealing compounds and other extraneous materials.
- .2 Ensure moisture content of substrates does not exceed maximum recommended by flooring manufacturer, and that concrete substrates exhibit normal alkalinity and no carbonization or dusting.
- .3 Prepare concrete subfloors in accordance with ASTM F710 Preparing Concrete Floors and Other Monolithic Floors to Receive Resilient Flooring.

3.2 SUBSTRATE PREPARATION: GENERALLY

- .1 Where recommendations of flooring manufacturer indicate possible incompatibility of substrate, or portions of substrate, with new adhesive, apply skim coat of portland cement and water mix to minimum 1 mm (1/24") thickness.
- .2 Remove subfloor ridges and bumps. Fill low spots, cracks, joints, holes and other defects with subfloor filler.
- .3 Trowel and float subfloor filler to leave smooth, flat, hard surface. Prohibit traffic until filler is cured.
- .4 Remove all coatings and curing compounds using mechanical methods recommended by flooring manufacturer. Do not use solvents. Clean filled substrate prior to application of

adhesive.

3.3 INSTALLATION: RESILIENT FLOORING

- .1 Apply adhesive as recommended by manufacturer. Ensure adhesion over entire area of installation.
- .2 Set flooring in place, press with minimum 45 kg (99#) roller to ensure full adhesion.
- .3 Terminate resilient flooring at centreline of door in door openings where adjacent floor finish is dissimilar.
- .4 Scribe flooring to produce tight joints to walls, columns, cabinets, floor outlets and other appurtenances.
- .5 Heat weld seams in accordance with manufacturer's instructions.
- .6 Provide 150mm high coved base in washroom areas.

3.4 INSTALLATION: RESILIENT BASE

- .1 Fit joints tight and vertical. Joints along one plane shall be at minimum 7 m (23 ft) spacing, at inconspicuous locations.
- .2 Mitre internal corners, wrap external corners.
- .3 Install base on solid backing. Adhere tightly to wall and floor surfaces.
- .4 Scribe and fit to door frames and other obstructions.
- .5 Install straight and level to variation of plus or minus 3 mm (1/8") over 3050 mm (10'-0") straight edge. Do not stretch base during installation.
- .6 Shave back of base where necessary to produce snug fit to substrate.

3.5 INSTALLATION OF ACCESSORIES

- .1 Install metal edge strips at unprotected and exposed edges where flooring terminates.

3.6 CLEANING AND PROTECTING

- .1 Perform the following operations immediately after installing flooring:
 - .1 Remove adhesive and other surface blemishes using cleaner recommended by flooring manufacturer.
 - .2 Sweep or vacuum floor thoroughly.
 - .3 Do not wash flooring until after time period recommended by flooring manufacturer.
 - .4 Damp mop floor to remove marks and soil.
- .2 Protect flooring against mars, marks, indentations, and other damage arising from construction operations and placement of equipment and fixtures during the remainder of construction period using protection methods recommended in writing by flooring manufacturer, and as follows:

- .1 Apply manufacturer's recommended protective floor finish or sealer, as appropriate to the specified materials.
- .2 Use only commercially available product acceptable to flooring manufacturer, and provide list of products used as a part of maintenance instructions.
- .3 Coordinate selection of floor polish with Owner's maintenance service.
- .3 Cover flooring with undyed, untreated building paper until inspection for Substantial Performance.
- .4 Do not move heavy and sharp objects directly over flooring. Place plywood or hardboard panels over flooring and under objects while they are being moved. Slide or roll objects over panels without moving panels.
- .5 Provide final cleaning not more than 4 days before dates scheduled for inspections intended to establish date of Substantial Performance, and as follows:
 - .1 Clean flooring in accordance with manufacturer's written recommendations.
 - .2 Clean and strip protective floor finish applied after completing installation only if required to restore polish finish and if recommended by flooring manufacturer.
 - .3 Reapply polish to floor surfaces to restore protective floor finish in accordance with flooring manufacturer's written recommendations.
 - .4 Coordinate with Owner's maintenance program.

END OF SECTION

PART 1. General

1.1. SECTION INCLUDES

- .1 All labour, materials, tools and other equipment, services and supervision required to complete all interior and exterior repainting work as indicated on drawings.
- .2 Work under this Contract shall also include, but not necessarily be limited to:
- .3 Moisture testing of substrates.
- .4 Surface preparation of substrates as required for acceptance of paint, including cleaning, small crack repair, patching, caulking, and making good surfaces and areas to the limits defined under MPI Repaint Manual Preparation requirements.
- .5 Specific pre-treatments noted herein or specified in the MPI Repainting Manual.
- .6 Sealing / priming surfaces for repainting in accordance with MPI Repainting Manual requirements.
- .7 Repainting of existing surfaces and finishes when adjacent to new painting and coating work where applicable including surface preparation, prime and finish coats.
- .8 Provision of safe and adequate ventilation as required over and above temporary ventilation supplied by others, where toxic and/or volatile/flammable materials are being used.

1.2. QUALITY ASSURANCE

- .1 Conform to the standards contained in the Master Painters Institute Repainting Specification Manual, latest edition (hereafter referred to as MPI Repainting Manual), as issued by the local Painting Association having jurisdiction for all painting products including preparation and application of materials.
- .2 All paint manufacturers and products used shall be as listed under the "Paint Product Recommendation" section of the MPI Repainting Manual.

1.3. REGULATORY REQUIREMENTS

- .1 Conform to work place safety regulations for storage, mixing, application and disposal of all paint related materials to requirements of those authorities having jurisdiction.
- .2 Conform to safety precautions in accordance with the latest requirements to Industrial Health and Safety Regulations, latest edition, of authorities having jurisdiction.

1.4. SUBMITTALS

- .1 Comply with requirements of Section 01 00 15.
- .1 Submit list of all painting materials to the Departmental Representative for review prior to ordering materials.
- .2 Submit two sets of Material Safety Data Sheets (MSDS) prior to commencement of work for review and for posting at job site as required.
- .3 Submit certification reports for ecologo paint products used.
- .4 When requested or required by repainting of occupied areas, submit work schedule for various stages of work for review and approval.
- .5 At project completion provide an itemized list complete with manufacturer, paint type and color coding for all colors used for later use in maintenance.
- .6 At project completion provide properly packaged maintenance materials as noted herein and obtain a signed receipt.

1.5 DELIVERY, STORAGE AND HANDLING

- .1 Deliver all painting materials in sealed, original labeled containers bearing manufacturer's name, brand name, type of paint or coating and color designation, standard compliance, materials content as well as mixing and/or reducing and application requirements. Only approved paint products as listed in the MPI Repainting Manual shall be delivered to the site
- .2 Store all paint materials in original labeled containers in a secure (lockable), dry, heated and well ventilated single designated area meeting the minimum requirements of both paint manufacturer and authorities having jurisdiction and at a minimum ambient temperature of 7 degrees C (45 degrees F). Only material used on this project to be stored on site.
- .3 Where toxic and/or volatile/explosive/flammable materials are being used, provide adequate fireproof storage lockers and take all necessary precautions and post adequate warnings (e.g. no smoking) as required. Take adequate measures to prevent the release of volatile organic compounds (VOC) into the atmosphere
- .4 Take all necessary precautionary and safety measures to prevent fire hazards and spontaneous combustion and to protect the environment from hazard spills. Materials that constitute a fire hazard (paints, solvents, drop clothes, etc.) shall be stored in suitable closed and rated containers and removed from the site on a daily basis
- .5 Comply with requirements of authorities having jurisdiction, in regard to the use, handling, storage and disposal of hazardous materials/

1.6 PROJECT/SITE REQUIREMENTS

- .1 Perform no repainting work when the ambient air and substrate temperatures are below 10 degrees C (50 degrees F) for both interior and exterior work
- .2 Perform no repainting work when the relative humidity is above 85% or when the dew point is less than 3 degrees C (5 degrees F) variance between the air/surface temperature.
- .3 Perform no repainting work when the maximum moisture content of the substrate exceeds:
 - .1 12 % for concrete and masonry (clay and concrete brick/block).
 - .2 15% for wood.
 - .3 12 % for plaster and gypsum board.
- .4 Conduct all moisture tests using a properly calibrated electronic Moisture Meter, except test concrete floors for moisture using a simple "cover patch test".
- .5 Test concrete, masonry and plaster surfaces for alkalinity as required.
- .6 Perform no repainting work unless a minimum lighting level of 323 Lux (30 foot candles) is provided on surfaces to be repainted. Provide temporary lighting as required to ensure minimum lighting levels are met.
- .7 Perform no repainting work unless adequate continuous ventilation and sufficient heating facilities are in place to maintain ambient air and substrate temperatures above 10 degrees C (50 degrees F) for 24 hours before, during and after paint application. Provide supplemental ventilating and heating equipment if ventilation and heating from existing system is inadequate to meet minimum requirements.
- .8 Apply paint only to dry, clean, and adequately prepared surfaces in areas where dust is no longer generated by construction activities such that airborne particles will not affect the quality of finished surfaces.

1.7 SCHEDULING

- .1 Schedule repainting operations to prevent disruption of occupants in and about the building. Obtain written authorization from Consultant/Owner for changes in work schedule
- .2 Painting in occupied facilities to be carried out during hours in accordance with Owner's operating requirements. Schedule work such that painted surfaces will have dried before occupants are affected

1.8 MAINTENANCE MATERIALS

- .1 At project completion provide 4 litres (1 gallon) of each type and color of paint from same production run (batch mix) used in unopened cans, properly labeled and identified for Owner's later use in maintenance. Store where directed.

Part 2 Products**2.1 MATERIALS**

- .1 All materials (primers, paints, coatings, varnishes, stains, lacquers, fillers, thinners, solvents, etc.) shall be in accordance with the MPI Repainting Manual "Approved Product" listing and shall be from a single manufacturer for each system used.
- .2 Other paint materials such as linseed oil, shellac, turpentine, etc. shall be the highest quality product of an approved manufacturer listed in the MPI Repainting Manual and shall be compatible with other coating materials as required.
- .3 All materials and paints shall be lead and mercury free and shall have low VOC content where possible.
- .4 Paint products shall meet the requirements of the Environmental Choice Program, Department of the Environment. Water based paints to be certified to ECP-07-89, solvent based; to ECP-12-89.
- .5 All paint materials shall have good flowing and brushing properties and shall dry or cure free of blemishes or sags.

2.2 EQUIPMENT

- .1 Painting equipment: to suit project requirements for types of products and application.
- .2 Spray painting equipment - of ample capacity, suited to the type and consistency of paint or coating being applied and kept clean and in good working order at all times.

2.3 MIXING AND TINTING

- .1 Unless otherwise specified, paints shall be ready-mixed. Re-mix prior to application to ensure color & gloss uniformity.
- .2 Paste, powder or catalyzed paint mixes shall be mixed in strict accordance with manufacturer's written instructions.
- .3 Perform all color tinting operations prior to delivery of paint to site.
- .4 Where thinner is used, addition shall not exceed paint manufacturer's recommendations.

2.4 GLOSS/SHEEN

- .1 Paint gloss shall be defined as the sheen rating of applied paint, in accordance with the following values:
 - .1 flat or matte 0 to 5 units at 60 degrees and a maximum of 10 units at 85 degrees.
 - .2 low sheen - 0 to 10 units at 60 degrees and 10 to 30 units at 85 degrees.
 - .3 eggshell or low luster 10 to 25 units at 60 degrees and 10 to 30 units at 85 degrees.
 - .4 satin 20 to 35 units at 60 degrees and a minimum of 30 units at 85 degrees.
 - .5 semigloss 35 to 70 units at 60 degrees.
 - .6 gloss 70 units and greater.
- .2 Finish (i.e. gloss level) of all painted surfaces shall be as specified herein or as noted on Finish Schedule.

2.5 FINISHES

- .1 Colors shall be as selected by the Departmental Representative from a manufacturer's full range of colors.
- .2 Color selection will be based on (five (5) base colors and (three) accent colors (with a maximum of (one (1) deep or bright color). No more than (eight (8) colors will be selected for the entire project and no more than (three (3) colors will be selected in each area.

PART 3 Execution**3.1 CONDITION OF SURFACES**

- .1 Prior to commencement of work of this section, thoroughly examine (and test as required) all conditions and surfaces scheduled to be repainted and report in writing to the Contractor and Consultant any conditions or surfaces that will adversely affect work of this section.
- .2 No repainting work shall commence until all such adverse conditions and defects have been corrected and surfaces and conditions are acceptable to the Painting Subcontractor and Inspection Agency.
- .3 Commencement of work shall not be held to imply acceptance of surfaces except as qualified herein.
- .4 The Painting Subcontractor shall not be responsible for the condition of the substrate or for correcting defects and deficiencies in the substrate which may adversely affect repainting work except minimal work normally performed by the Painting Subcontractor. It shall always however be the responsibility of the Painting Subcontractor to see that surfaces are properly prepared before any paint or coating is applied.

3.2 PREPARATION OF SURFACES

- .1 Prepare all surfaces in accordance with MPI Repainting Manual requirements.
- .2 Protect all adjacent surfaces and areas from repainting operations and damage by drop cloths, shields, masking, templates, or other suitable protective means and make good any damage caused by failure to provide such protection.
- .3 Remove and securely store all miscellaneous hardware and surface fittings and fastenings (e.g. electrical plates, mechanical louvres, door rating labels, door and window hardware (e.g. hinges, knobs, locks, trim, frame stops), washroom accessories, light fixture trim, etc. from wall and ceiling surfaces, doors and frames, prior to repainting and replace upon completion. Carefully clean and replace all such items upon completion of repainting work in each area. Do not use solvent or reactive cleaning agents on items that will mar or remove finishes (e.g. lacquer finishes). Doors shall be removed before repainting to paint bottom and top edges and then re-hung.
- .4 Substrate defects shall be made good and sanded by others ready for painting particularly after first coat of paint. Repainting of defective shall indicate acceptance of substrate and any costs of making good defects shall be borne by the painter including repainting of entire defective surface again.

3.3 APPLICATION

- .1 Do not paint unless substrates are acceptable and/or until all environmental conditions (heating, ventilation, lighting and completion of other sub-trade work, if applicable) are acceptable for applications of products.
- .2 Apply paint material in a workmanlike manner using skilled and trade qualified applicators as noted under Quality Assurance.
- .3 Minimum painting standards shall be in accordance with MPI Repainting Manual Premium Grade finish requirements.
- .4 Repaint all surfaces requiring paint or stain finish to minimum MPI Repainting Manual finish requirements with application methods in accordance with best trade practices for type and application of materials used.
- .5 Apply paint and coatings within an appropriate time frame after cleaning when environmental conditions encourage flash-rusting, rusting, contamination or the manufacturer's paint specifications require earlier applications.
- .6 Painting coats specified are intended to cover surfaces satisfactorily when applied at proper consistency and in accordance with manufacturer's recommendations.
- .7 Tint each coat of paint progressively lighter to enable confirmation of number of coats.
- .8 Apply a minimum of four coats of paint where deep or bright colors are used to achieve satisfactory results.

- .9 Sand and dust between each coat to provide an anchor for next coat and to remove defects visible from a distance up to 1000 mm (39").
- .10 Do not apply finishes on surfaces that are not sufficiently dry. Unless manufacturer's directions state otherwise, each coat shall be sufficiently dry and hard before a following coat is applied.
- .11 Prime coat of stain or varnish finishes may be reduced in accordance with manufacturer's directions.

3.4 PROTECTION

- .1 Protect all newly painted exterior surfaces from rain and snow, condensation, contamination, dust, salt spray and freezing temperatures until paint coatings are completely dry. Curing periods shall exceed the manufacturer's recommended minimum time requirements.
- .2 Erect barriers or screens and post signs to warn of or limit or direct traffic away or around work area as required.

3.5 CLEAN-UP

- .1 Remove all paint where spilled, splashed, splattered or sprayed as work progresses using means and materials that are not detrimental to affected surfaces.
- .2 Keep work area free from an unnecessary accumulation of tools, equipment, surplus materials and debris.
- .3 Remove combustible rubbish materials and empty paint cans each day and safely dispose of same in accordance with requirements of authorities having jurisdiction.
- .4 Clean equipment and dispose of wash water / solvents as well as all other cleaning and protective materials (e.g. rags, drop cloths, masking papers, etc.), paints, thinners, paint removers/strippers in accordance with the safety requirements of authorities having jurisdiction.

END OF SECTION

Part 1 General**1.1 SECTION INCLUDES**

- .1 Provide labour, materials, tools and other equipment, services and supervision required to complete all interior and exterior (including above roof) painting and decorating work as indicated on Finish Schedules and to the full extent of the drawings and specifications.
- .2 Surface preparation to receive painting and finishing is not included under this section of work, except for priming and back-priming and specific pre-treatments noted herein or specified in the Master Painters Institute (MPI) Painting Specification Manual.

1.2 REFERENCES

- .1 AWWA (American Water Works Association) - C218 - Standard for Coating the Exterior of Aboveground Steel Water Pipelines & Fittings.
- .2 AWWA (American Water Works Association) - D102 - Coating Steel Water Storage Tanks.
- .3 NACE (National Association of Corrosion Engineers) - Industrial Maintenance Painting.
- .4 MPI (Master Painters Institute) - Specifications Manual.
- .5 SSPC (The Society for Protective Coatings) (formerly SSPC - Steel Structures Painting Council) - Steel Structures Painting Manual.

1.3 SUBMITTALS

- .1 Comply with requirements of Section 01 00 15.
- .2 Samples: Submit complete duplicate set of 100mm square manufacturer's colour chips.
- .3 Installation Data: Manufacturer's special installation requirements indicating special surface preparation procedures, substrate conditions requiring special attention.
 - .1 Provide percentage of recycled content for each Product used.
 - .2 Provide number of litres used for each product.

1.4 SYSTEM DESCRIPTION

- .1 Paint exposed surfaces in new construction affected by new work whether or not colors are designated in "schedules," except where a surface or material is specifically indicated not to be painted or is to remain natural.
 - .1 Where an item or surface is not specifically mentioned, paint the same as similar adjacent materials or surfaces.
 - .2 If color or finish is not designated, Departmental Representative will select from standard colors or finishes available.
 - .3 Painting includes field painting exposed bare and covered pipes and ducts (including color coding), hangers, exposed steel and iron work, and primed metal surfaces of mechanical and electrical equipment.
 - .2 Painting is not required on prefinished items, finished metal surfaces, concealed surfaces, operating parts, and labels.
 - .3 Prefinished items not to be painted include the following factory-finished components:
-

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- .1 Shower enclosures.
 - .2 Acoustic materials.
 - .3 Architectural woodwork and casework.
 - .4 Finished mechanical and electrical equipment. Rooftop mechanical equipment to be painted uniform colour.
 - .5 Light fixtures.
 - .6 Switchgear.
 - .7 Distribution cabinets.
 - .8 Cladding materials.
 - .4 Concealed surfaces not to be painted include wall or ceiling surfaces in the following generally inaccessible areas:
 - .1 Foundation spaces.
 - .2 Furred areas.
 - .3 Utility tunnels.
 - .4 Pipe spaces.
 - .5 Duct shafts.
 - .6 Elevator shafts.
 - .5 Finished metal surfaces not to be painted include:
 - .1 Anodized aluminium.
 - .2 Copper and copper alloys.
 - .3 Stainless steel.
 - .4 Chromium plate.
 - .6 Operating parts not to be painted include moving parts of operating equipment such as the following:
 - .1 Valve and damper operators.
 - .2 Linkages.
 - .3 Sensing devices.
 - .4 Motor and fan shafts.
 - .5 Door and window handles.
 - .7 Labels: Do not paint over CSA, Underwriter's Laboratories, Factory Mutual or other code-required labels or equipment name, identification, performance rating, or nomenclature plates.
 - .8 Coordination of Work: Review other sections in which primers are provided to ensure compatibility of the total systems for various substrates. On request, furnish information on characteristics of finish materials to ensure use of compatible primers.

1.5 MAINTENANCE MATERIAL SUBMITTALS

- .1 Extra Stock Materials:
 - .1 Provide <four (4) L> <<one (1) gallons>> of each colour, type, and surface texture to Departmental Representative.
 - .2 Label each container with colour, type, texture, room locations, in addition to the manufacturer's label.
-

1.6 QUALITY ASSURANCE

- .1 Conform to MPI - Specification Manual.
- .2 Manufacturer Qualifications: Company specializing in manufacturing the Products specified in this section with minimum three (3) years experience.
- .3 Installer Qualifications: Company specializing in performing the work of this section with minimum three (3) years documented experience.
- .4 Single Source Responsibility: Obtain materials from a single manufacturer for the complete system.
- .5 Pre-Installation Meetings: Conduct meetings at Project site.
- .6 Only qualified journeymen who have a "Tradesman Qualification Certificate of Proficiency" shall be engaged in painting and decorating work. Apprentices may be employed provided they work under the direct supervision of a qualified journeyman in accordance with trade regulations.
- .7 Surfaces shall receive Premium grade finish systems, 3 coats, except where MPI Manual indicates no Premium system in which case a 2 coat Custom system is acceptable.

1.7 PROJECT CONDITIONS

- .1 Painting and decorating work shall be inspected by a Paint Inspection Agency (inspector) acceptable to the specifying authority and the local MPDA Accredited Quality Assurance Association. Notify the Paint Inspection Agency a minimum of one week prior to commencement of work and provide a copy of the project painting specification, plans and elevation drawings (including pertinent details) as well as a Finish Schedule.
- .2 Surfaces requiring painting shall be inspected by the Paint Inspection Agency who shall notify the Departmental Representative and Contractor in writing of defects or problems, prior to commencing painting work, or after the prime coat shows defects in the substrate.
- .3 Do not apply paint finishes in areas where dust is being generated.
- .4 Conform to MPI and manufacturer's requirements.

1.8 REGULATORY REQUIREMENTS

- .1 Conform to applicable code for flame and smoke rating requirements for finishes.

1.9 DELIVERY, STORAGE, AND PROTECTION

- .1 Deliver products to site in sealed and labeled containers; inspect to verify acceptability.
 - .2 Container label to include manufacturer's name, type of paint, brand name, lot number, brand code, coverage, surface preparation, drying time, cleanup requirements, colour designation, and written instructions for mixing and reducing.
 - .3 Store paint materials at minimum ambient temperature of <7 degrees C> <<45 degrees F>> and a maximum of <32 degrees C> <<90 degrees F>>, in ventilated area, and as required by manufacturer's written instructions.
-

1.10 COORDINATION

- .1 Coordinate the work of this section closely with the work of Section 05 50 00 Metal Fabrications and 07 92 00 Joint Sealants to ensure compatibility of primers and finish systems.

1.11 ENVIRONMENTAL REQUIREMENTS

- .1 Do not apply materials when surface and ambient temperatures are outside the temperature ranges required by the paint product manufacturer.
- .2 Do not apply exterior coatings during rain or snow, or when relative humidity is outside the humidity ranges required by the paint product manufacturer.
- .3 Minimum Application Temperatures for Latex Paints: <7 degrees C> << 45 degrees F>> for interiors; <10 degrees C> << 50 degrees F>> for exterior; unless required otherwise by manufacturer's written instructions.
- .4 Minimum Application Temperature for Varnish and Clear Finishes: <18 degrees C> << 65 degrees F >>for interior or exterior, unless required otherwise by manufacturer's written instructions.
- .5 Provide lighting level of <860 lx> <<80 ft candles>> measured mid-height at substrate surface.

Part 2 Products**2.1 MATERIALS - GENERAL**

- .1 Provide paints and coatings that comply with Green Seal Standards GS-03, and GS-11.
 - .2 Provide paints and coatings that comply with the South Coast Air Quality Management District (SCAQMD) rule #1113 limits on volatile organic compounds.
 - .3 Paints and coatings, used on the interior of the building (defined as inside of the weatherproofing system and applied on-site) shall comply with the following criteria:
 - .1 Architectural paints, coatings and primers applied to interior walls and ceiling: do not exceed VOC content limits established in green seal standard GS-11, paints, first edition, May 20, 1993.
 - .1 Flats: 50 g/L.
 - .2 Non-Flats: 150 g/L.
 - .2 Anti-corrosive and anti-rust paints applied to interior ferrous metal substrates: Do not exceed the VOC content limit of 250 g/L established in green seal standard GC-03, anti-corrosive paints, second edition, January 7, 1997.
 - .3 Clear wood finishes, floor coatings, stains and shellacs applied to interior elements: Do not exceed the VOC content limits established in South Coast Air Quality Management District (SCAQMD) Rule 1113, Architectural coatings, rules in effect on January 1, 2004.
 - .1 Clear Wood Finishes: Varnish 350 g/L; lacquer 550 g/L.
 - .2 Floor Coating: 100 g/L.
 - .3 Sealers: Waterproofing sealers 250 g/L; sanding sealers 275 g/L; all other sealers 200 g/L.
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- .4 Shellacs: Clear 730 g/L; Pigmented 550 g/L.
- .5 Stains: 250 g/L. Surface preparation and field application of paints and coatings.

2.2 MATERIALS

- .1 All the materials must meet the Green Approved Products List of the Master Painters Institute.
- .2 Coatings: Ready mixed, except field catalyzed coatings. Process pigments to a soft paste consistency, capable of being readily and uniformly dispersed to a homogeneous coating; good flow and brushing properties; capable of drying or curing free of streaks or sags.
- .3 Accessory Materials: Linseed oil, shellac, turpentine, paint thinners and other materials not specifically indicated but required to achieve the finishes specified, of commercial quality.
- .4 Patching Materials: Latex filler.
- .5 Fastener Head Cover Materials: Latex filler.

2.3 GLOSS LEVELS

- .1 Specified gloss levels are based on the MPI standard, which is as follows:
 - .1 Level G1 – Matte or Flat: gloss rating of 0 to 5 units at 60 degrees and sheen rating of a maximum of 10 units at 85 degrees.
 - .2 Level G2 - Velvet: gloss rating of 0 to 10 units at 60 degrees and a sheen rating of 10 to 35 units at 85 degrees.
 - .3 Level G3 - Eggshell: gloss rating of 10 to 25 units at 60 degrees and a sheen rating of 10 to 35 units at 85 degrees.
 - .4 Level G4 - Satin: gloss rating of 20 to 35 units at 60 degrees and a sheen rating of 35 units minimum at 85 degrees.
 - .5 Level G5 - Semi-gloss: gloss rating of 35 to 70 units at 60 degrees.
 - .6 Level G6 - Gloss: gloss rating of 70 to 85 units at 60 degrees.
 - .7 Level G7 – High-gloss: gloss rating of more than 85 units at 60 degrees.

2.4 Finishes

- .1 Refer to schedules at end of section for surface finishes.

Part 3 Execution

3.1 EXAMINATION

- .1 Verify existing conditions before starting work.
 - .2 Verify that surfaces and substrate conditions are ready to receive work as instructed by the product manufacturer.
 - .3 Examine surfaces scheduled to be finished prior to commencement of work. Report any condition that may potentially affect proper application.
 - .4 Test shop applied primer for compatibility with subsequent cover materials.
-

- .5 Measure moisture content of surfaces using an electronic moisture meter. Do not apply finishes unless moisture content of surfaces are below the following maximums:
 - .1 Plaster and Gypsum Wallboard: 12 percent.
 - .2 Masonry, Concrete, and Concrete Unit Masonry: 12 percent.
 - .3 Interior Wood: 15 percent, measured in accordance with ASTM D2016.
 - .4 Concrete Floors: 8 percent.

3.2 PREPARATION

- .1 Remove electrical plates, hardware, light fixture trim, escutcheons, and fittings prior to preparing surfaces or finishing.
- .2 Correct defects and clean surfaces which affect work of this section.
- .3 Seal with shellac and seal marks which may bleed through surface finishes.
- .4 Impervious Surfaces: Remove mildew by scrubbing with solution of tri-sodium phosphate and bleach. Rinse with clean water and allow surface to dry.
- .5 Insulated Coverings: Remove dirt, grease, and oil from canvas and cotton.
- .6 Concrete Floors: Remove contamination, acid etch, and rinse floors with clear water. Verify required acid-alkali balance is achieved. Allow to dry.
- .7 Gypsum Board Surfaces: Fill minor defects with filler compound. Spot prime defects after repair.
- .8 Galvanized Surfaces: Remove surface contamination and oils and wash with solvent. Apply coat of etching primer.
- .9 Concrete and Unit Masonry Surfaces Scheduled to Receive Paint Finish: Remove dirt, loose mortar, scale, salt or alkali powder, and other foreign matter. Remove oil and grease with a solution of tri-sodium phosphate; rinse well and allow to dry. Remove stains caused by weathering of corroding metals with a solution of sodium metasilicate after thoroughly wetting with water. Allow to dry.
- .10 Uncoated Steel and Iron Surfaces: Remove grease, mill scale, weld splatter, dirt, and rust. Where heavy coatings of scale are evident, remove by power tool wire brushing or sandblasting; clean by washing with solvent. Apply a treatment of phosphoric acid solution, ensuring weld joints, bolts, and nuts are similarly cleaned. Spot prime paint after repairs.
- .11 Shop Primed Steel Surfaces: Sand and scrape to remove loose primer and rust. Feather edges to make touch-up patches inconspicuous. Clean surfaces with solvent. Prime bare steel surfaces. [Prime metal items including shop primed items.]
- .12 Interior Wood Items Scheduled to Receive Transparent Finish: Wipe off dust and grit prior to sealing, seal knots, pitch streaks, and sappy sections with sealer. Fill nail holes and cracks after sealer has dried; sand lightly between coats.
- .13 Wood and Metal Doors Scheduled for Painting: Seal top and bottom edges with primer.

3.3 APPLICATION

- .1 Apply products to manufacturer instructions.
 - .2 Do not apply finishes to surfaces that are not dry.
 - .3 Apply each coat to uniform finish.
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- .4 Apply each coat of paint slightly darker than preceding coat unless otherwise approved.
- .5 Sand wood and metal lightly between coats to achieve required finish.
- .6 Vacuum clean surfaces free of loose particles. Use tack cloth just prior to applying next coat.
- .7 Allow applied coat to dry before next coat is applied.
- .8 Where clear finishes are required, tint fillers to match wood. Work fillers into the grain before set. Wipe excess from surface.
- .9 Prime concealed surfaces of interior woodwork with primer paint.
- .10 Prime concealed surfaces of interior woodwork scheduled to receive stain or varnish finish with gloss varnish reduced 25 percent with mineral spirits.

3.4 FINISHING MECHANICAL AND ELECTRICAL EQUIPMENT

- .1 Refer to Mechanical and Electrical Specifications for schedule of colour coding and identification banding of equipment, duct work, piping, and conduit.
- .2 Paint shop primed equipment.
- .3 Remove unfinished louvres, grilles, covers, and access panels on mechanical and electrical components and paint separately. Paint to match adjacent surface.
- .4 Prime and paint insulated and exposed pipes, conduit, boxes, insulated and exposed ducts, hangers, brackets, collars and supports, except where items are prefinished.
- .5 Paint interior surfaces of air ducts, that are visible through grilles and louvres with one coat of flat black paint, to visible surfaces. Paint dampers exposed behind louvres, grilles, to match face panels.
- .6 Paint exposed conduit and electrical equipment occurring in finished areas.
- .7 Paint both sides and edges of plywood backboards for electrical and telephone equipment before installing equipment.
- .8 Colour code equipment, piping, conduit, and exposed duct work in accordance with requirements indicated.
- .9 Reinstall electrical cover plates, hardware, light fixture trim, escutcheons, and fittings removed prior to finishing.

3.5 CLEANING

- .1 Collect waste material which may constitute a fire hazard, place in closed metal containers and remove daily from site.

3.6 COLOUR SCHEDULES:

- .1 Where specific products are available in a restricted range of colours, selection will be based on the limited range.
- .2 Second coat in a three coat system to be tinted slightly lighter colour than top coat to show visible difference between coats.
- .3 Colour Scheme: For bidding purposes, colour scheme will be generally as follows:
 - .1 Maximum 4 colours for exterior.
 - .2 Maximum 7 field colours and 2 accent colours for interior.

- .3 Generally, no more than 3 colours to be used in any one area.
- .4 Allow approximately 10% of interior painted surfaces for deep colour tones.

3.7 SCHEDULE - EXTERIOR SURFACES

- .1 Steel - Galvanized:
 - .1 EXT 5.3B Alkyd semi gloss finish.
 - .2 Primer: AFM MetalCoat Acrylic Metal Primer.
 - .3 First and Second Coats: "All Purpose Exterior Satin" satin gloss.
 - .4 Colours: colour to be selected by Departmental Representative.

3.8 SCHEDULE - INTERIOR SURFACES

- .1 Wood - Transparent:
 - .1 INT 6.3Q Waterborne clear acrylic
- .2 Steel - Primed:
 - .1 INT 5.1K Waterborne epoxy finish.
 - .2 Premium Grade.
- .3 Steel - Galvanized:
 - .1 INT 5.3M High performance architectural latex.
 - .2 Premium Grade.
- .4 Plaster, Gypsum Board:
 - .1 INT 9.2A Latex eggshell finish.
 - .2 INT 9.2B High performance acrylic for locker rooms, kitchens and bathrooms.
- .5 Note: Paint grade doors to receive:
 - .1 One coat alkyd primer.
 - .2 Two coats enamel alkyd.
 - .3 Sand lightly between coats.

3.9 SCHEDULE – INTERIOR GLOSS LEVELS

- .1 Walls: Eggshell Finish (G3)
- .2 Painted Doors and Frames: Semi-Gloss Finish (G5).
- .3 Painted Ceiling: Flat Finish (G1)

END OF SECTION

Part 1 General**1.1 SUBMITTALS**

- .1 Comply with the requirements of Section 01 00 15
- .2 Shop Drawings: indicate types, sizes, panel arrangements, backing materials, hardware, anchor and mounting details and frame details.
- .3 Samples: submit duplicate 300 x 300 mm (12" x 12") samples of tackboard and 300 mm (12") long samples of frame.

1.2 DELIVERY, STORAGE AND HANDLING

- .1 Protect finished surfaces from damage while in transit, storage and handling.

Part 2 Products**2.1 MATERIALS**

- .1 Extruded Aluminum: Aluminum Association alloy AA6063-T5, 1.5 mm (1/16") minimum wall thickness.
- .2 Cork: synthetic cork linoleum, 6 mm (1/4") thick.
- .3 Anchor Clips, Brackets and Fasteners: concealed types as recommended by manufacturer.
- .4 Porcelain Enamel Whiteboards: Balanced, high pressure laminated, porcelain enamel boards of 3 ply construction consisting of face sheet, core material, and backing.
 - .1 Face Sheet: Minimum 0.64 mm (24 ga. (0.025")) enamelling grade steel specifically processed for temperatures used in coating porcelain on steel to manufacturers standard process.
 - .2 Finish Coat: manufacturer's standard, light coloured, special writing surface with gloss finish intended for use with erasable dry marker.
 - .3 Core: one of the following; 10 mm (3/8") thick, particleboard core material complying with requirements of ANSI A208.1, Grade 1 M 1; 6 mm (1/4") thick, tempered hardboard or 13 mm (1/2") gypsum board.
 - .4 Backing Sheet: manufacturer's standard.
 - .5 Laminating Adhesive: Manufacturer's standard, moisture resistant, thermoplastic type adhesive.

2.2 FINISHES

- .1 Tackboard Surfaces: colours as selected by the Departmental Representative from manufacturer's standard range.
- .2 Trim: Aluminum Association AA-A31 clear anodic finish.

2.3 FABRICATION

- .1 Fabricate whiteboards and tackboards to sizes indicated on drawings, consisting of cork facing and extruded aluminum frames.
- .2 Make mitres and intersecting joints to hairline fit. Secure together with concealed fasteners.
- .3 Overlap frames onto panels 6 mm (1/4").

Part 3 Execution

3.1 INSTALLATION

- .1 Ensure adequate in-wall backing has been installed in correct locations for securing whiteboards and tackboards before beginning installation.
- .2 Install whiteboards and tackboards to location indicated, rigid, secure and plumb in accordance with manufacturer's instructions.

3.2 CLEANING

- .1 Clean surfaces after completion of installation to manufacturer's recommendations.

END OF SECTION

Part 1. General

1.1 SUBMITTALS

- .1 Comply with requirements of Section 01 00 15.
- .2 Samples: submit duplicate samples of representative letter in size and finish specified.
- .3 Shop Drawings: submit shop drawings of building sign showing letter size, spacing and anchorage details.

1.2 DELIVERY, STORAGE AND PROTECTION

- .1 Deliver and store materials in unopened packaging or containers in accordance with manufacturer's recommendations.
- .2 Protect work of others from damage resulting from work of this Section.
- .3 Protect work of this Section against damage by disfiguration, contamination, mechanical abuse or other harmful materials.
- .4 Install protective coatings where exposure to damage is critical while other work is being performed.

Part 2. Products

2.1 MATERIALS

- .1 Aluminum Extrusions: Aluminum Association alloy AA6063-T5.
- .2 Sheet Aluminum: Aluminum Association alloy AA1100.
- .3 Steel Reinforcement: to CGSB G40.21-M1978.
- .5 Fasteners: aluminum or stainless steel, finish to match adjacent material.

2.2 FABRICATION

- .1 Fabricate signs to sizes appropriate to suit building exterior, font Arial.
- .2 Reinforce individual letters as required.
- .3 Provide mounting devices as required to suit application.

2.3 FINISHES

- .1 Upon completion of fabrication of letters, wash with metal cleaner and apply one coat yellow chromite.
 - .1 Apply 2 coats of primer-surfacer; wet sanded after each coat.
 - .2 Apply two coats air dried enamel to CGSB 1-GP-300M, semi-gloss finish.
 - .3 Colour: as selected by Departmental Representative from manufacturer's standard range

Part 3. Execution

3.1 INSTALLATION

- .1 Confirm exact location and mounting height of signs before commencing installation.
- .2 Install exterior building signs to locations as directed by Departmental Representative.
- .3 Secure letters in accordance with manufacturer's recommendations and instructions.

END OF SECTION

Part 1. General**1.1 REFERENCE DOCUMENTS**

- .1 American Society for Testing and Materials (ASTM):
 - .1 ASTM A167 Standard Specification for Stainless and Heat Resisting Chromium Nickel Steel Plate, Sheet, and Strip
 - .2 ASTM B456 Standard Specification for Electrodeposited Coatings of Copper Plus Nickel Plus Chromium and Nickel Plus Chromium
 - .3 ASTM A653/ A653M Standard Specification for Steel Sheet, Zinc Coated (Galvanized) or Zinc Iron Alloy Coated (Galvannealed) by the Hot Dip Process
 - .4 ASTM A666 Standard Specification for Annealed or Cold-Worked Austenitic Stainless Steel Sheet, Strip, Plate, and Flat Bar
 - .5 ASTM A924/ A924M Standard Specification for General Requirements for Steel Sheet, Metallic Coated by the Hot Dip Process

1.2 SUBMITTALS

- .1 Comply with requirements of Section 01 00 15.
- .2 Product Data: submit manufacturer's printed product literature, specifications and data sheet

1.3 CLOSEOUT SUBMITTALS

- .1 Operation and Maintenance Data:
 - .1 Provide maintenance data for toilet and bath accessories for incorporation into manual.

1.4 MAINTENANCE MATERIAL SUBMITTALS

- .1 Tools:
 - .1 Provide special tools required for accessing, assembly/disassembly or removal for toilet and bath.
 - .2 Deliver special tools to Departmental Representative.

Part 2. Products**2.1 FIXTURES**

- .1 Soap Dispenser: Recessed type. minimum 0.8 mm stainless steel door and covered soap tank, minimum 1100 mL capacity. Soap tank attached to minimum 0.8 mm galvanized steel wall box with continuous stainless steel hinge. Stainless steel soap valve mechanism. Soap level indicator.
- .2 Combination Paper Towel and Disposal Unit: for semi-recessed installation, fabricated from 1.3 mm x 302 stainless steel having #4 finish for towel and waste access doors, with other surfaces fabricated from 1.0 mm and 0.8 mm x 302 stainless steel having #4 finish. Waste receptacle to have removable 0.6 mm satin zinc coated steel liner. Towel cradle and wall box fabricated from 0.8 mm zinc coated steel, adjustable to accommodate paper towels of single, multi or roll applications.
- .3 Grab Bars: 32 mm dia. x 1.5 mm wall tubing of stainless steel, concealed screw attachment, flanges welded to tubular bar, provided with steel back plates and all accessories. Knurl bar at area of hand grip.
- .4 Shelf: surface mounted, 200 deep, 400 wide, stainless steel.
- .5 Tilt Mirror: wall mounted unit, adjustable. 12.5, stainless steel frame, 6 mm thick mirrored glass.
- .6 Robe hook: stainless steel with 75 mm projection.

Part 3. Execution**3.1 INSTALLATION**

- .1 Install and secure all fixtures rigidly in place using the following techniques.
 - .1 For stud walls install steel back plate to stud prior to plaster or drywall finish. Plate to have threaded studs or plugs provided.
 - .2 For hollow masonry units or existing plaster/drywall surfaces use toggle bolts drilled into cell/wall cavity.
- .2 For installation of grab bars to metal toilet partitions, provide templates and detail to partition manufacturer for shop fabrication of steel reinforcing plates. Instruct whether shop or field, drill and tap technique will be used.
- .3 Use tamper proof headed fasteners.

3.2 LOCATION AND QUANTITY

- .1 Locate accessories where indicated on drawings. Exact locations to be determined by Departmental Representative.

END OF SECTION

Part 1 General**1.1 ACTION AND INFORMATIONAL SUBMITTALS**

- .1 Submit in accordance with Section 01 00 15 - Submittal Procedures.
- .2 Product Data:
 - .1 Submit manufacturer's instructions, printed product literature and data sheets for mechanical equipment (Furnace, HRV, Water Heater, Fans, plumbing fixtures) 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 Alberta, Canada.
 - .2 Drawings to show:
 - .1 Mounting arrangements.
 - .2 Operating and maintenance clearances.
 - .3 Drawings and product data accompanied by:
 - .1 Detailed drawings of bases, supports, and anchor bolts.
 - .2 Acoustical sound power data, where applicable.
 - .3 Points of operation on performance curves.
 - .4 Manufacturer to certify current model production.
 - .5 Certification of compliance to applicable codes.
 - .4 In addition to transmittal letter referred to in Section 01 00 15 - Submittal Procedures: use MCAC "Shop Drawing Submittal Title Sheet". Identify section and paragraph number.

1.2 CLOSEOUT SUBMITTALS

- .1 Submit in accordance with Section 01 00 15 - Closeout Submittals.
- .2 Operation and Maintenance Data: submit operation and maintenance data for mechanical equipment for incorporation into manual.
 - .1 Operation and maintenance manual approved by, and final copies deposited with, Department Representative before final inspection.
 - .2 Operation data to include:
 - .1 Control schematics for systems including environmental controls.
 - .2 Description of systems and their controls.
 - .3 Description of operation of systems at various loads together with reset schedules and seasonal variances.
 - .4 Operation instruction for systems and component.
 - .5 Description of actions to be taken in event of equipment failure.
 - .6 Valves schedule and flow diagram.
 - .7 Colour coding chart.

- .3 Maintenance data to include:
 - .1 Servicing, maintenance, operation and trouble-shooting instructions for each item of equipment.
 - .2 Data to include schedules of tasks, frequency, tools required and task time.
- .4 Performance data to include:
 - .1 Equipment manufacturer's performance datasheets with point of operation.
 - .2 Equipment performance verification test results.
 - .3 Special performance data as specified.
 - .4 Testing, adjusting and balancing reports as specified in Section 23 05 93 - Testing, Adjusting and Balancing for HVAC.
- .5 Approvals:
 - .1 Submit 2 copies of draft Operation and Maintenance Manual to Department Representative for approval. Submission of individual data will not be accepted unless directed Department Representative.
 - .2 Make changes as required and re-submit as directed by Department Representative.
- .6 Additional data:
 - .1 Prepare and insert into operation and maintenance manual additional data when need for it becomes apparent during specified demonstrations and instructions.
- .7 Site records:
 - .1 Department Representative will provide 1 set of reproducible mechanical drawings. Provide sets of white prints as required for each phase of work. Mark changes as work progresses and as changes occur. Include changes to existing mechanical systems, control systems and low voltage control wiring.
 - .2 Transfer information monthly to reproducibles, revising reproducibles to show work as actually installed.
 - .3 Use different colour waterproof ink for each service.
 - .4 Make available for reference purposes and inspection.
- .8 As-Built drawings:
 - .1 Prior to start of Testing, Adjusting and Balancing for HVAC, finalize production of as-built drawings.
 - .2 Identify each drawing in lower right hand corner in letters at least 12 mm high as follows: "AS BUILT DRAWINGS: THIS DRAWING HAS BEEN REVISED TO SHOW MECHANICAL SYSTEMS AS INSTALLED" (Signature of Contractor) (Date).
 - .3 Submit Department Representative for approval and make corrections as directed.
 - .4 Perform testing, adjusting and balancing for HVAC using as-built drawings.

.5 Submit completed reproducible as-built drawings with Operating and Maintenance Manuals.

.9 Submit copies of as-built drawings for inclusion in final TAB report.

1.3 MAINTENANCE MATERIAL SUBMITTALS

.1 Submit in accordance with Section 01 00 15 - Closeout Submittals.

.2 Furnish spare parts as follows:

.1 One set of packing for each pump.

.2 One casing joint gasket for each size pump.

.3 One head gasket set for each heat exchanger.

.4 One glass for each gauge glass.

.5 One filter cartridge or set of filter media for each filter or filter bank in addition to final operating set.

.3 Provide one set of special tools required to service equipment as recommended by manufacturers.

.4 Furnish one commercial quality grease gun, grease and adapters to suit different types of grease and grease fittings.

1.4 DELIVERY, STORAGE AND HANDLING

.1 Deliver, store and handle materials in accordance with Section 01 00 15 - 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 or in dry location and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.

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

.3 Replace defective or damaged materials with new.

Part 2 Products

2.1 N/A

Part 3 Execution

3.1 EXAMINATION

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

.1 Visually inspect substrate in presence Department Representative.

- .2 Inform Department Representative of unacceptable conditions immediately upon discovery.
- .3 Proceed with installation only after unacceptable conditions have been remedied and after receipt of written approval to proceed Department Representative.

3.2 PAINTING REPAIRS AND RESTORATION

- .1 Do painting in accordance with Section 09 91 23 - Interior Painting.
- .2 Prime and touch up marred finished paintwork to match original.
- .3 Restore to new condition, finishes which have been damaged.

3.3 SYSTEM CLEANING

- .1 Clean interior and exterior of all systems including strainers. Vacuum interior of ductwork and air handling units.

3.4 FIELD QUALITY CONTROL

- .1 Site Tests: conduct following tests in accordance with Section 01 00 15 - Quality Control and submit report.
- .2 Manufacturer's Field Services:
 - .1 Obtain written report from manufacturer verifying compliance of Work, in handling, installing, applying, protecting and cleaning of product and submit Manufacturer's Field Reports.
 - .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.

3.5 DEMONSTRATION

- .1 Department Representative will use equipment and systems for test purposes prior to acceptance. Supply labour, material, and instruments required for testing.
- .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 Use operation and maintenance manual, as-built drawings, and audio visual aids as part of instruction materials.
- .4 Instruction duration time requirements as specified in appropriate sections.
- .5 Department Representative will record these demonstrations on video tape for future reference.

3.6 CLEANING

- .1 Progress Cleaning: clean in accordance with Section 01 00 15 - 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 00 15 - Cleaning.

3.7 PROTECTION

- .1 Protect equipment and systems openings from dirt, dust, and other foreign materials with materials appropriate to system.

END OF SECTION

Part 1 General**1.1 ACTION AND INFORMATIONAL SUBMITTALS**

- .1 Submit in accordance with Section 01 00 15 - Submittal Procedures.
- .2 Product Data:
 - .1 Submit manufacturer's instructions, printed product literature and data sheets and include product characteristics, performance criteria, physical size, finish and limitations.
- .3 Shop Drawings:
 - .1 Indicate on drawings:
 - .1 Mounting arrangements.
 - .2 Operating and maintenance clearances.
 - .2 Shop drawings and product data accompanied by:
 - .1 Detailed drawings of bases, supports, and anchor bolts.
 - .2 Acoustical sound power data, where applicable.
 - .3 Points of operation on performance curves.
 - .4 Manufacturer to certify current model production.
 - .5 Certification of compliance to applicable codes.
 - .3 In addition to transmittal letter referred to in Section 01 00 15 - Submittal Procedures: use MCAC "Shop Drawing Submittal Title Sheet". Identify section and paragraph number.

1.2 CLOSEOUT SUBMITTALS

- .1 Submit in accordance with Section 01 00 15 - Closeout Submittals.
- .2 Operation and Maintenance Data: submit operation and maintenance data for incorporation into manual.
 - .1 Operation and maintenance manual approved by, and final copies deposited with, Department Representative before final inspection.
 - .2 Operation data to include:
 - .1 Control schematics for systems including environmental controls.
 - .2 Description of systems and their controls.
 - .3 Description of operation of systems at various loads together with reset schedules and seasonal variances.
 - .4 Operation instruction for systems and component.
 - .5 Description of actions to be taken in event of equipment failure.
 - .6 Valves schedule and flow diagram.
 - .7 Colour coding chart.
 - .3 Maintenance data to include:

- .1 Servicing, maintenance, operation and trouble-shooting instructions for each item of equipment.
- .2 Data to include schedules of tasks, frequency, tools required and task time.
- .4 Performance data to include:
 - .1 Equipment manufacturer's performance datasheets with point of operation.
 - .2 Equipment performance verification test results.
 - .3 Special performance data as specified.
 - .4 Testing, adjusting and balancing reports as specified in Section 23 05 93 - Testing, Adjusting and Balancing for HVAC.
- .5 Approvals:
 - .1 Submit 2 copies of draft Operation and Maintenance Manual to Department Representative for approval. Submission of individual data will not be accepted unless directed by Department Representative.
 - .2 Make changes as required and re-submit as directed by Department Representative.
- .6 Additional data:
 - .1 Prepare and insert into operation and maintenance manual additional data when need for it becomes apparent during specified demonstrations and instructions.
- .7 Site records:
 - .1 Department Representative will provide 1 set of reproducible mechanical drawings. Provide sets of white prints as required for each phase of work. Mark changes as work progresses and as changes occur. Include changes to existing mechanical systems, control systems and low voltage control wiring.
 - .2 Transfer information monthly to reproducibles, revising reproducibles to show work as actually installed.
 - .3 Use different colour waterproof ink for each service.
 - .4 Make available for reference purposes and inspection.
- .8 As-built drawings:
 - .1 Prior to start of Testing, Adjusting and Balancing for HVAC, finalize production of as-built drawings.
 - .2 Identify each drawing in lower right hand corner in letters at least 12 mm high as follows: - "AS BUILT DRAWINGS: THIS DRAWING HAS BEEN REVISED TO SHOW MECHANICAL SYSTEMS AS INSTALLED" (Signature of Contractor) (Date).
 - .3 Submit Department Representative for approval and make corrections as directed.
 - .4 Perform testing, adjusting and balancing for HVAC using as-built drawings.
 - .5 Submit completed reproducible as-built drawings with Operating and Maintenance Manuals.

- .9 Submit copies of as-built drawings for inclusion in final TAB report.

1.3 MAINTENANCE MATERIAL SUBMITTALS

- .1 Submit in accordance with Section 01 00 15 - Closeout Submittals.
- .2 Furnish spare parts as follows:
 - .1 One set of packing for each pump.
 - .2 One casing joint gasket for each size pump.
 - .3 One glass for each gauge glass.
- .3 Provide one set of special tools required to service equipment as recommended by manufacturers.
- .4 Furnish one commercial quality grease gun, grease and adapters to suit different types of grease and grease fittings.

1.4 DELIVERY, STORAGE AND HANDLING

- .1 Deliver, store and handle materials in accordance with Section 01 00 15 - 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 or in dry location and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.
 - .2 Store and protect from nicks, scratches, and blemishes.
 - .3 Replace defective or damaged materials with new.

Part 2 Products

2.1 NOT USED

- .1 Not used.

Part 3 Execution

3.1 EXAMINATION

- .1 Verification of Conditions: verify that conditions of substrate previously installed under other Sections or Contracts are acceptable for installation in accordance with manufacturer's written instructions.
 - .1 Visually inspect substrate in presence of Department Representative.
 - .2 Inform Department Representative of unacceptable conditions immediately upon discovery.
 - .3 Proceed with installation only after unacceptable conditions have been remedied and after receipt of written approval to proceed from Department Representative.

3.2 PAINTING REPAIRS AND RESTORATION

- .1 Do painting in accordance with Section 01 00 15 - Interior Painting.
- .2 Prime and touch up marred finished paintwork to match original.
- .3 Restore to new condition, finishes which have been damaged.

3.3 SYSTEM CLEANING

- .1 Clean interior and exterior of all systems including strainers. Vacuum interior of ductwork and air handling units.

3.4 FIELD QUALITY CONTROL

- .1 Site Tests: conduct following tests in accordance with Section 01 00 15 - Quality Control and submit report.
- .2 Manufacturer's Field Services:
 - .1 Obtain written report from manufacturer verifying compliance of Work, in handling, installing, applying, protecting and cleaning of product and submit Manufacturer's Field Reports.
 - .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.

3.5 DEMONSTRATION

- .1 Departmental Representative will use equipment and systems for test purposes prior to acceptance. Supply labour, material, and instruments required for testing.
- .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 Use operation and maintenance manual, as-built drawings, and audio visual aids as part of instruction materials.
- .4 Instruction duration time requirements as specified in appropriate sections.
- .5 Department Representative will record these demonstrations on video tape for future reference.

3.6 CLEANING

- .1 Progress Cleaning: clean in accordance with Section 01 00 15 - 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 00 15 - Cleaning.

3.7 PROTECTION

- .1 Protect equipment and systems openings from dirt, dust, and other foreign materials with materials appropriate to system.

END OF SECTION

Part 1 General**1.1 REFERENCES**

- .1 American National Standards Institute (ANSI)/American Society of Mechanical Engineers International (ASME)
 - .1 ANSI/ASME B16.15-2013, Cast Bronze Threaded Fittings, Classes 125 and 250.
 - .2 ANSI/ASME B16.18-2012, Cast Copper Alloy Solder Joint Pressure Fittings.
 - .3 ANSI/ASME B16.22-2013, Wrought Copper and Copper Alloy Solder Joint Pressure Fittings.
 - .4 ANSI/ASME B16.24-2016, Cast Copper Alloy Pipe Flanges and Flanged Fittings, Class 150, 300, 400, 600, 900, 1500 and 2500.
- .2 ASTM International Inc.
 - .1 ASTM A307-14, Standard Specification for Carbon Steel Bolts and Studs, 60,000 PSI Tensile Strength.
 - .2 ASTM A536, Standard Specification for Ductile Iron Castings.
 - .3 ASTM B88M, 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, Rubber-Gasket Joints for Ductile-Iron Pressure Pipe and Fittings.
- .4 Canadian Standards Association (CSA International)
 - .1 CSA B242, Groove and Shoulder Type Mechanical Pipe Couplings.
- .5 Department of Justice Canada (Jus)
 - .1 Canadian Environmental Protection Act, 1999, c. 33 (CEPA).
- .6 Health Canada/Workplace Hazardous Materials Information System (WHMIS)
 - .1 Material Safety Data Sheets (MSDS).
- .7 Manufacturer's Standardization Society of the Valve and Fittings Industry (MSS).
 - .1 MSS-SP-67, Butterfly Valves.
 - .2 MSS-SP-70, Gray Iron Gate Valves, Flanged and Threaded Ends.
 - .3 MSS-SP-71, Gray Iron Swing Check Valves, Flanged and Threaded Ends.
 - .4 MSS-SP-80, Bronze Gate, Globe, Angle and Check Valves.
- .8 National Research Council (NRC)/Institute for Research in Construction
 - .1 NRCC 38728, National Plumbing Code of Canada (NPC) -2010.
- .9 Transport Canada (TC)
 - .1 Transportation of Dangerous Goods Act, 1992, c. 34 (TDGA).

1.2 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Provide submittals in accordance with Section 01 00 15 - 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 00 15 - Closeout Submittals.

1.3 DELIVERY, STORAGE AND HANDLING

- .1 Packaging Waste Management: remove for reuse and return by manufacturer of packaging materials in accordance with Section 01 00 15 - Construction/Demolition Waste Management and Disposal.
- .2 Place materials defined as hazardous or toxic in designated containers.
- .3 Handle and dispose of hazardous materials in accordance with CEPA, TDGA, Regional and Municipal regulations.

Part 2 Products**2.1 PIPING**

- .1 Domestic hot, cold and recirculation systems, within building.
 - .1 Above ground: copper tube, hard drawn, type [K] [L]: to ASTM B88M.
 - .2 Buried or embedded: copper tube, soft annealed, type [K] [L]: to ASTM B88M, in long lengths and with no buried joints.

2.2 FITTINGS

- .1 Bronze pipe flanges and flanged fittings, Class 150: 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 and smaller: wrought copper to ANSI/ASME B16.22, cast copper to ANSI/ASME B16.18; with 301 stainless steel internal components and EPDM seals. Suitable for operating pressure to 1380 kPa.

2.3 JOINTS

- .1 Rubber gaskets, latex-free 1.6 mm thick: to AWWA C111.
- .2 Bolts, nuts, hex head and washers: to ASTM A307, heavy series.

- .3 Solder: 95/5 tin copper alloy.
- .4 Teflon tape: for threaded joints.
- .5 Grooved couplings: designed with angle bolt pads to provide rigid joint, complete with EPDM 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.

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
- .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.

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.

2.7 BALL VALVES

- .1 NPS 2 and under, screwed:
 - .1 Class 150.
 - .2 Bronze body, stainless steel 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, stainless steel 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.

Part 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 2010, local authority having jurisdiction.
- .2 Install pipe work in accordance with Section 23 05 05 - Installation of Pipework, supplemented as specified herein.
- .3 Assemble piping using fittings manufactured to ANSI standards.
- .4 Install 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.
- .6 Buried tubing:
 - .1 Lay in well compacted washed sand in accordance with AWWA Class B bedding.
 - .2 Bend tubing without crimping or constriction. Minimize use of fittings.

3.3 VALVES

- .1 Isolate equipment, fixtures and branches with gate, or ball valves.
- .2 Balance recirculation system using lockshield globe valves. Mark settings and record on as-built drawings on completion.

3.4 PRESSURE TESTS

- .1 Conform to requirements of Section 21 05 01 - Common Work Results for Mechanical.
- .2 Test pressure: greater of 1 time maximum system operating pressure or 860 kPa.

3.5 FLUSHING AND CLEANING

- .1 Flush entire system for 8 h. 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. Let system flush for additional 2 hours, then draw off another sample for testing.

3.6 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.

3.7 DISINFECTION

- .1 Flush out, disinfect and rinse system to requirements of authority having jurisdiction approval of Department Representative.
- .2 Coordinate with Section 33 11 16- Site Water Utility Distribution Piping and Section 33 11 16.01 - Incoming Site Water Utility Distribution Piping.
- .3 Upon completion, provide laboratory test reports on water quality for Department Representative approval.

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 Bring HWS storage tank up to design temperature slowly.
 - .4 Monitor piping HWS and HWC piping systems for freedom of movement, pipe expansion as designed.
 - .5 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 TAB HWC in accordance with Section 23 05 93 - Testing, Adjusting and Balancing for HVAC.
 - .3 Adjust pressure regulating valves while withdrawal is maximum and inlet pressure is minimum.
 - .4 Sterilize HWS and HWC systems for Legionella control.

- .5 Verify performance of temperature controls.
- .6 Verify compliance with safety and health requirements.
- .7 Check for proper operation of water hammer arrestors. Run [one] outlet for 10 seconds, then shut of water immediately. If water hammer occurs, replace water hammer arrestor or re-charge air chambers. Repeat for outlets and flush valves.
- .8 Confirm water quality consistent with supply standards, and ensure no residuals remain as result of flushing or cleaning.
- .3 Reports:
 - .1 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.
- .2 Operational requirements: Operation, include:
 - .1 Cleaning materials and schedules.
 - .2 Repair and maintenance materials and instructions.

3.11 CLEANING

- .1 Clean in accordance with Section 01 00 15 - Cleaning.
- .2 Waste Management: separate waste materials for recycling in accordance with Section 01 00 15 - Construction/Demolition Waste Management and Disposal.

END OF SECTION

Part 1 General**1.1 REFERENCES**

- .1 ASTM International Inc.
 - .1 ASTM D2235, Standard Specification for Solvent Cement for Acrylonitrile-Butadiene-Styrene (ABS) Plastic Pipe and Fittings.
 - .2 ASTM D2564, Standard Specification for Solvent Cements for Poly(Vinyl-Chloride) (PVC) Plastic Piping Systems.
- .2 Canadian Standards Association (CSA International)
 - .1 CAN/CSA-Series B1800, Thermoplastic Nonpressure Pipe Compendium - B1800 Series.
- .3 Green Seal Environmental Standards (GSES)
 - .1 Standard GS-36, Commercial Adhesives.
- .4 Health Canada/Workplace Hazardous Materials Information System (WHMIS)
 - .1 Material Safety Data Sheets (MSDS).
- .5 South Coast Air Quality Management District (SCAQMD), California State
 - .1 SCAQMD Rule 1168-[A2005], Adhesive and Sealant Applications.

1.2 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Provide submittals in accordance with Section 01 00 15 - Submittal Procedures.
- .2 Product Data:
 - .1 Provide manufacturer's printed product literature and datasheets for piping and adhesives, and include product characteristics, performance criteria, physical size, finish and limitations.
 - .2 Provide two copies WHMIS MSDS - Material Safety Data Sheets in accordance with Section 01 00 15- Health and Safety Requirements and Environmental Procedures.

1.3 DELIVERY, STORAGE AND HANDLING

- .1 Deliver, store and handle in accordance with Section 01 00 15 - Common Product Requirements.
- .2 Deliver materials to site in original factory packaging, labelled with manufacturer's name, address.
- .3 Store at temperatures and conditions recommended by manufacturer.
- .4 Packaging Waste Management: remove for reuse and return by manufacturer packaging materials in accordance with Section 01 00 15 - Construction/Demolition Waste Management and Disposal.

Part 2 Products**2.1 PIPING AND FITTINGS**

- .1 For buried and above ground DWV piping to:
 - .1 CAN/CSA B1800.

2.2 JOINTS

- .1 Solvent weld for PVC: to ASTM D2564.
- .2 Solvent weld for ABS: to ASTM D2235.

Part 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 In accordance with Section 23 05 05 - Installation of Pipework.
- .2 Install in accordance with National Plumbing Code and local authority having jurisdiction.

3.3 TESTING

- .1 Pressure test buried systems before backfilling.
- .2 Hydraulically test to verify grades and freedom from obstructions.

3.4 PERFORMANCE VERIFICATION

- .1 Cleanouts:
 - .1 Ensure accessible and that access doors are correctly located.
 - .2 Open, cover with linseed oil and re-seal.
 - .3 Verify cleanout rods can probe as far as the next cleanout, at least.
- .2 Test to ensure traps are fully and permanently primed.
- .3 Storm water drainage:
 - .1 Verify domes are secure.
 - .2 Ensure weirs are correctly sized and installed correctly.
 - .3 Verify provisions for movement of roof system.
- .4 Ensure fixtures are properly anchored, connected to system and effectively vented.
- .5 Affix applicable label (storm, sanitary, vent, pump discharge) c/w directional arrows every floor or 4.5 m (whichever is less).

3.5 CLEANING

- .1 Clean in accordance with Section 01 00 15 - Cleaning.
 - .1 Remove surplus materials, excess materials, rubbish, tools and equipment.

END OF SECTION

Part 1 General**1.1 REFERENCES**

- .1 Canadian Standards Association (CSA International)
 - .1 CSA B51-[03(R2007)], Boiler, Pressure Vessel, and Pressure Piping Code.
 - .2 CAN/CSA C22.2 No.110-[94(R2004)], Construction and Test of Electric Storage Tank Water Heaters.
 - .3 CAN/CSA-C191-[04], Performance of Electric Storage Tank Water Heaters for Household Service.
 - .4 CAN/CSA-C309-[M90(R2003)], Performance Requirements for Glass-Lined Storage Tanks for Household Hot Water Service.

1.2 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Provide submittals in accordance with Section 01 00 15 - Submittal Procedures.
- .2 Product Data:
 - .1 Provide manufacturer's printed product literature and datasheets for domestic water heater, and include product characteristics, performance criteria, physical size, finish and limitations.
- .3 Shop Drawings:
 - .1 Provide drawings stamped and signed by professional engineer registered or licensed in Alberta, Canada.
 - .2 Indicate:
 - .1 Equipment, including connections, fittings, control assemblies and ancillaries, identifying factory and field assembled.

1.3 CLOSEOUT SUBMITTALS

- .1 Provide maintenance and engineering data for incorporation into manual specified in Section 01 00 15 - Closeout Submittals.

1.4 DELIVERY, STORAGE AND HANDLING

- .1 Deliver, store and handle in accordance with Section 01 00 15 - Common Product Requirements.
- .2 Deliver materials to site in original factory packaging, labelled with manufacturer's name, address.
- .3 Packaging Waste Management: remove for reuse and return by manufacturer packaging materials in accordance with Section 01 00 15 - Construction/Demolition Waste Management and Disposal.

1.5 WARRANTY

- .1 For the Work of this Section 22 30 05 - Domestic Water Heaters, 12 months warranty period prescribed in subsection GC 32.1 of General Conditions "C" is extended to number of years specified for each product.
- .2 Contractor hereby warrants domestic water heaters in accordance with CCDC2, but for number of years specified for each product.

Part 2 Products**2.1 ELECTRIC WATER HEATER**

- .1 To CAN/CSA C22.2 No.110, CAN/CSA-C191 and CAN/CSA-C309 for glass-lined storage tanks. Standby loss to meet NECB 2011 requirement.
- .2 Performance: refer to schedule on drawing. Standby loss to meet NECB 2011 requirement

2.2 TRIM AND INSTRUMENTATION

- .1 Drain valve: NPS 1 with hose end.
- .2 Thermometer: 100 mm dial type with red pointer and thermowell filled with conductive paste.
- .3 Pressure gauge: 75 mm dial type with red pointer, [syphon,] and shut-off cock.
- .4 Thermowell filled with conductive paste for control valve temperature sensor.
- .5 ASME rated temperature and pressure relief valve sized for full capacity of heater, having discharge terminating over floor drain and visible to operators.
- .6 Magnesium anodes adequate for 20 years of operation and located for easy replacement.

2.3 ANCHOR BOLTS AND TEMPLATES

- .1 Supply anchor bolts and templates for installation in concrete support pad in accordance with Section 03 30 00 - Cast-in-Place Concrete.

Part 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 manufacturer's recommendations and authority having jurisdiction.
- .2 Provide insulation between tank and supports.

3.3 FIELD QUALITY CONTROL

- .1 Manufacturer's factory trained, certified Engineer to start up and commission DHW heaters.

3.4 CLEANING

- .1 Clean in accordance with Section 01 00 15 - Cleaning.
 - .1 Remove surplus materials, excess materials, rubbish, tools and equipment.

END OF SECTION

Part 1 General**1.1 REFERENCES**

- .1 ASTM International
 - .1 ASTM A126, Standard Specification for Gray Iron Castings for Valves, Flanges and Pipe Fittings.
 - .2 ASTM B62, Standard Specification for Composition Bronze or Ounce Metal Castings.
- .2 American Water Works Association (AWWA)
 - .1 ANSI/AWWA C700, Standard for Cold Water Meters-Displacement Type, Bronze Main Case.
 - .2 ANSI/AWWA C701, Standard for Cold Water Meters-Turbine Type for Customer Service.
 - .3 ANSI/AWWA C702, Standard for Cold Water Meters-Compound Type.
- .3 CSA International
 - .1 CSA-B64 Series, Backflow Preventers and Vacuum Breakers.
 - .2 CSA B79, Commercial and Residential Drains and Cleanouts.
 - .3 CAN/CSA-B356, Water Pressure Reducing Valves for Domestic Water Supply Systems.
- .4 Efficiency Valuation Organization (EVO)
 - .1 International Performance Measurement and Verification Protocol (IPMVP).
 - .1 IPMVP Version.
- .5 Plumbing and Drainage Institute (PDI)
 - .1 PDI-G101, Testing and Rating Procedure for Grease Interceptors with Appendix of Installation and Maintenance.
 - .2 PDI-WH201, Water Hammer Arresters Standard.

1.2 ADMINISTRATIVE REQUIREMENTS

- .1 Pre-installation Meetings:
 - .1 Convene pre-installation meeting 1 week prior to beginning work of this Section with contractor's representative Departmental Representative Consultant in accordance with Section 01 00 15 - Project Meetings to:
 - .1 Verify project requirements.
 - .2 Review installation and substrate conditions.
 - .3 Co-ordination with other building construction subtrades.
 - .4 Review manufacturer's written installation instructions and warranty requirements.

1.3 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Submit in accordance with Section 01 00 15 - Submittal Procedures.
- .2 Product Data:
 - .1 Submit manufacturer's instructions, printed product literature and data sheets for [plumbing products] and include product characteristics, performance criteria, physical size, finish and limitations.
 - .2 Submit 2 copies of WHMIS MSDS in accordance with Section 01 00 15 - Health and Safety Requirements and Environmental Procedures. Indicate VOC's:
- .3 Shop Drawings:
 - .1 Submit drawings stamped and signed by professional engineer registered or licensed in Alberta, Canada.
 - .2 Indicate on drawings to indicate materials, finishes, method of anchorage, and number of anchors, dimensions construction and assembly details 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.
- .6 Manufacturers' Field Reports: manufacturers' field reports specified.

1.4 CLOSEOUT SUBMITTALS

- .1 Submit in accordance with Section 01 00 15 - Closeout Submittals.
- .2 Operation and Maintenance Data: submit operation and maintenance data for plumbing specialties and accessories for incorporation into manual.
 - .1 Description of plumbing specialties and accessories, giving manufacturers name, type, model, year and capacity.
 - .2 Details of operation, servicing and maintenance.
 - .3 Recommended spare parts list.

1.5 DELIVERY, STORAGE AND HANDLING

- .1 Deliver, store and handle materials in accordance with Section 01 00 15 - 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 or in dry location and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.
 - .2 Store and protect plumbing materials from nicks, scratches, and blemishes.
 - .3 Replace defective or damaged materials with new.
- .4 Packaging Waste Management: remove for reuse and return by manufacturer of packaging materials as specified in Construction Waste Management Plan Waste Reduction Workplan in accordance with Section 01 00 15 - Construction/Demolition Waste Management and Disposal.

Part 2 Products**2.1 FLOOR DRAINS**

- .1 Floor Drains and Trench Drains: to CSA B79.
- .2 Type 1: general duty; cast iron body round, square as indicated, adjustable head, nickel bronze strainer, integral seepage pan, and clamping collar.
- .3 Type 3: combination funnel floor drain; cast iron body with integral seepage pan, clamping collar, nickel-bronze adjustable head strainer with integral funnel.

2.2 CLEANOUTS

- .1 Cleanout Plugs: heavy cast iron male ferrule with brass screws and threaded brass or bronze plug. Sealing-caulked lead seat or neoprene gasket.
- .2 Access Covers:
 - .1 Wall Access: face or wall type, polished nickel bronze square cover with flush head securing screws, bevelled edge frame complete with anchoring lugs.
 - .2 Floor Access: rectangular 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: nickel bronze square, 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 nickel 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.

2.3 NON-FREEZE WALL HYDRANTS

- .1 Recessed type with integral vacuum breaker, NPS 3/4 hose outlet, removable operating key. Polished bronze finish.

2.4 WATER HAMMER ARRESTORS

- .1 Copper construction, bellows type: to PDI-WH201.

2.5 BACK FLOW PREVENTERS

- .1 Preventers: to CSA-B64 Series, application as indicated, double check valve assembly with intermediate vacuum breaker.

2.6 VACUUM BREAKERS

- .1 Breakers: to CSA-B64 Series, vacuum breaker atmospheric or hose connection.

2.7 BACKWATER VALVES

- .1 Coated extra heavy cast iron body with bronze seat, revolving bronze flapper and threaded cover.
- .2 Access:
 - .1 Surface access.
 - .2 Access pipe with cover: maximum 300 mm depth.
 - .3 Steel housing with gasketted steel cover.
 - .4 Concrete access pit with cover, as indicated.

2.8 TRAP SEAL PRIMERS

- .1 Brass, with integral vacuum breaker, NPS 1/2 solder ends, NPS 1/2 drip line connection.

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 plumbing specialties and accessories installation in accordance with manufacturer's written instructions.
 - .1 Visually inspect substrate in presence of Department Representative.
 - .2 Inform Department Representative of unacceptable conditions immediately upon discovery.
 - .3 Proceed with installation only after unacceptable conditions have been remedied and after receipt of written approval to proceed from Department Representative.

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 data sheet.

3.3 INSTALLATION

- .1 Install in accordance with National Plumbing Code of Canada, local authority having jurisdiction.
- .2 Install in accordance with manufacturer's instructions and as specified.

3.4 CLEANOUTS

- .1 Install cleanouts at base of soil and waste stacks, and rainwater leaders, at locations required 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 NPS 4.

3.5 NON-FREEZE WALL HYDRANTS

- .1 Install 600 mm above finished grade and as indicated.

3.6 WATER HAMMER ARRESTORS

- .1 Install on branch supplies to fixtures or group of fixtures.

3.7 BACK FLOW PREVENTERS

- .1 Install in accordance with CSA-B64 Series, where indicated and elsewhere as required by code.
 - .1 Drains.
 - .2 Backwater Valves.
 - .3 Water Make-up Assembly.
 - .4 Grease Interceptors.
- .2 Pipe discharge to terminate over nearest drain.

3.8 TRAP SEAL PRIMERS

- .1 Install for floor drains and elsewhere, as indicated.
- .2 Install on cold water supply to nearest frequently used plumbing fixture, in concealed space, to approval of Department Representative]
- .3 Install soft copper tubing to floor drain.

3.9 START-UP

- .1 General:
 - .1 In accordance with Section 01 00 15 - General Requirements, supplemented as specified herein.
- .2 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.
- .3 Provide continuous supervision during start-up.

3.10 TESTING AND ADJUSTING

- .1 General:
 - .1 Test and adjust plumbing specialties and accessories in accordance with Section 01 00 15- General Requirements, supplemented as specified.
- .2 Timing:
 - .1 After start-up deficiencies rectified.
 - .2 After certificate of completion has been issued by authority having jurisdiction.
- .3 Application tolerances:
 - .1 Pressure at fixtures: +/- [70] kPa.
 - .2 Flow rate at fixtures: +/- 20%.

- .4 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.
- .5 Floor drains:
 - .1 Verify operation of trap seal primer.
 - .2 Prime, using trap primer. Adjust flow rate to suit site conditions.
 - .3 Check operations of flushing features.
 - .4 Check security, accessibility, removability of strainer.
 - .5 Clean out baskets.
- .6 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.
- .7 Access doors:
 - .1 Verify size and location relative to items to be accessed.
- .8 Cleanouts:
 - .1 Verify covers are gas-tight, secure, yet readily removable.
- .9 Water hammer arrestors:
 - .1 Verify proper installation of correct type of water hammer arrester.
- .10 Wall, ground hydrants:
 - .1 Verify complete drainage, freeze protection.
 - .2 Verify operation of vacuum breakers.

3.11 CLOSEOUT ACTIVITIES

- .1 Reports: in accordance with Section 01 00 15 - General Requirements: reports, supplemented as specified.
- .2 Training: provide training in accordance with Section 01 00 15 - General Requirements: Training of O M Personnel, supplemented as specified.

3.12 CLEANING

- .1 Progress Cleaning: clean in accordance with Section 01 00 15 - 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 00 15 - Cleaning.
- .3 Waste Management: separate waste materials for recycling in accordance with Section 01 00 15 - Construction/Demolition Waste Management and Disposal.

- .1 Remove recycling containers and bins from site and dispose of materials at appropriate facility.

3.13 PROTECTION

- .1 Protect installed products and components from damage during construction.
- .2 Repair damage to adjacent materials caused by plumbing specialties and accessories installation.

END OF SECTION

Part 1 General**1.1 REFERENCES**

- .1 CSA Group
 - .1 CAN/CSA-B45 Series, Plumbing Fixtures, (Consists of B45.0, B45.1, B45.2, B45.3, B45.4, B45.5, B45.6, B45.7, B45.8 and B45.9).
 - .2 CSA B125.3, Plumbing Fittings.
 - .3 CSA B651, Accessible Design for the Built Environment.
- .2 Green Seal (GS)
 - .1 GS-36, Adhesives for Commercial Use.
- .3 South Coast Air Quality Management District (SCAQMD)
 - .1 SCAQMD Rule 1168, Adhesive and Sealant Applications.

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 washroom fixtures and include product characteristics, performance criteria, physical size, finish and limitations.
 - .2 Indicate fixtures and trim:
 - .1 Dimensions, construction details, roughing-in dimensions.
 - .2 Factory-set water consumption per flush at recommended pressure.
 - .3 For water closets: minimum pressure required for flushing.

1.3 CLOSEOUT SUBMITTALS

- .1 Include:
 - .1 Description of fixtures and trim, giving manufacturer's name, type, model, year, capacity.
 - .2 Details of operation, servicing, maintenance.
 - .3 List of recommended spare parts.

1.4 DELIVERY, STORAGE AND HANDLING

- .1 Deliver, store and handle materials in accordance with Section with manufacturer's written instructions 01 61 00 - Common Product Requirements.
- .2 Delivery and Acceptance Requirements: deliver materials to site in original factory packaging, labelled with manufacturer's name and address.
- .3 Storage and Handling Requirements:
 - .1 Store materials indoors in dry location and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.

- .2 Store and protect materials from nicks, scratches, and blemishes.
- .3 Replace defective or damaged materials with new.
- .4 Packaging Waste Management: remove for reuse and return by manufacturer of packaging materials as specified in Construction Waste Management Plan in accordance with Section [01 74 21 - Construction/Demolition Waste Management and Disposal.

Part 2 Products

2.1 MANUFACTURED UNITS

- .1 Fixtures: manufacture in accordance with CAN/CSA-B45 series.
- .2 Trim, fittings: manufacture in accordance with CSA B125.3.
- .3 Exposed plumbing brass to be chrome plated.
- .4 Number, locations: refer to floor plan.
- .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.
- .7 Water closets: refer to schedule on drawing.
- .8 Washroom Lavatories: refer to schedule on drawing.

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 washroom fixtures installation in accordance with manufacturer's written instructions.
 - .1 Visually inspect substrate in presence of Department Representative.
 - .2 Inform Department Representative of unacceptable conditions immediately upon discovery.
 - .3 Proceed with installation only after unacceptable conditions have been remedied and after receipt of written approval to proceed Department Representative.

3.2 INSTALLATION

- .1 Mounting heights:
 - .1 Standard: 375mm to top of bowl rim, measured from finished floor.
 - .2 Barrier-free: 450mm to top of bowl rim, to most stringent CSA B651 and ABC.

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 Adjust flush valves to suit actual site conditions.
- .4 Adjust urinal flush timing mechanisms.
- .5 Set controls of automatic flush valves for WCs and urinals to prevent unnecessary flush cycles.
- .3 Checks:
 - .1 Water closets, urinals: flushing action.
 - .2 Aerators: operation, cleanliness.
 - .3 Vacuum breakers, backflow preventers: operation under all conditions.
- .4 Thermostatic controls:
 - .1 Verify temperature settings, operation of control, limit and safety controls.

3.4 CLEANING

- .1 Progress Cleaning: clean in accordance with Section 01 00 15 - 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 00 15 - Cleaning.

END OF SECTION

Part 1 General**1.1 REFERENCES**

- .1 Canadian Standards Association (CSA International)
 - .1 CAN/CSA-B45 Series, Plumbing Fixtures.
 - .2 CAN/CSA-B125.3, Plumbing Fittings.
 - .3 CAN/CSA-B651, Accessible Design for the Built Environment.

1.2 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Provide submittals in accordance with Section 01 00 15 - Submittal Procedures.
- .2 Product Data:
 - .1 Provide manufacturer's printed product literature and datasheets for fixtures, and include product characteristics, performance criteria, physical size, finish and limitations.

1.3 CLOSEOUT SUBMITTALS

- .1 Provide maintenance data in accordance with Section 01 00 15 - Closeout Submittals.
- .2 Include:
 - .1 Description of fixtures and trim, giving manufacturer's name, type, model, year, capacity.
 - .2 Details of operation, servicing, maintenance.
 - .3 List of recommended spare parts.

1.4 DELIVERY, STORAGE AND HANDLING

- .1 Deliver, store and handle in accordance with Section 01 00 15 - Common Product Requirements.
- .2 Deliver materials to site in original factory packaging, labelled with manufacturer's name, address.
- .3 Packaging Waste Management: remove for reuse and return by manufacturer of packaging materials in accordance with Section 01 00 15 - Construction/Demolition Waste Management and Disposal.

Part 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 to be product of one manufacturer.
- .6 Trim to be product of one manufacturer.
- .7 Service sinks: refer to schedule on drawing.

Part 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 Mounting heights:
 - .1 Standard: 775mm to top of basin rim.
 - .2 Barrier free: 800mm to top of basin rim, or to comply with most stringent of either ABC or CAN/CSA-B651.

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: operation, cleanliness.
 - .2 Vacuum breakers, backflow preventers: operation under all conditions.
 - .3 Wash fountains: operation of flow-actuating devices.
- .4 Thermostatic controls:
 - .1 Verify temperature settings, operation of control, limit and safety controls.

3.4 CLEANING

- .1 Clean in accordance with Section 01 00 15 - Cleaning.
 - .1 Remove surplus materials, excess materials, rubbish, tools and equipment.

END OF SECTION

Part 1 General**1.1 REFERENCES**

- .1 Definitions:
 - .1 HVAC System: complete air duct system from outside air intake louvers to furthest air supply terminal unit and including:
 - .1 Rigid supply and return ductwork;
 - .2 Flexible ductwork;
 - .3 Mixing plenum boxes;
 - .4 Return air plenums including ceiling plenums;
 - .5 Fans, fan blades and fan housing;
 - .6 Filter housing and frames;
 - .7 Acoustically insulated duct linings;
 - .8 Diffusers, registers and terminal units;
 - .9 Dampers and controls;
- .2 Reference Standards:
 - .1 National Air Duct Cleaners Association (NADCA)
 - .1 ACR Standard: Assessment, Cleaning and Restoration of HVAC Systems.
 - .2 North American Insulation Manufacturers Association (NAIMA)
 - .1 NAIMA, Cleaning Fibrous Glass Insulated Duct Systems - Recommended Practices.
 - .3 United States Environmental Protection Agency (US EPA)
 - .1 US EPA, 40 CFR Parts 152 and 156.

1.2 ADMINISTRATIVE REQUIREMENTS

- .1 Site Evaluation: conduct site visit 2 weeks before start of work to establish specific co-ordinated video survey and cleaning plan to establish specific co-ordinated video survey and cleaning plan determining how areas of facility and HVAC systems will be protected during cleaning operations.
 - .1 Organize and lay out plan for video survey and identify camera and cleaning apparatus insertion points.
 - .2 Ensure plan identifies sequence and schedule of survey and cleaning operations for each individual HVAC system and for complete facility.
 - .1 Take account of elbows, bends, turning vanes, dampers, transitions, take-offs, and other internal features.
 - .3 Department Representative to review video survey and cleaning plan [1] week minimum prior to start of work.
 - .1 Proceed with survey and cleaning work only after receiving written approval from Department Representative.

- .2 Project Co-ordination: assign Project Co-ordinator to oversee air duct cleaning processes.
 - .1 Provide Department Representative with contact information of Project Co-ordinator including: name, telephone number, cell phone number.
- .3 Security: Departmental Representative will pay costs and provide security escort at times requested on Contractor's submitted work schedule.
 - .1 Cancellation of security escort requires 72 hours minimum written notice.
 - .2 Failure to cancel security escort requirements 72 hours minimum before scheduled event will result in Contractor paying for security costs.
- .4 Damaged or broken equipment and components found during initial testing and inspection will be repaired or replaced by Mechanical contractor.

1.3 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Provide submittals in accordance with Section 01 00 15 - Submittal Procedures.
- .2 Submit video survey and cleaning plan developed during site evaluation.
 - .1 Ensure plan includes sequence of operation, identification of camera and cleaning apparatus insertion points and schedule for work.
- .3 Product Data:
 - .1 Submit manufacturer's printed product literature and data sheets for antimicrobial agents and include product characteristics, performance criteria and limitations.
 - .2 Provide two copies of WHMIS MSDS in accordance with Section 01 00 15- Health and Safety Requirements and Environmental Procedures for antimicrobial agents or coatings.
- .4 Testing Laboratory Services: submit name and address of laboratory engaged for work of this Section.
 - .1 Submit laboratory analysis report of particulate collection indicating:
 - .1 Location of collection;
 - .2 Particulate grade;
 - .3 Particulate size;
 - .4 Percentage concentration of individual particulates in each sample.
- .5 US EPA Registration: submit verification of EPA Registration of antimicrobial agent.
- .6 Submit verification of delivery of hazardous or toxic waste materials to contaminated waste facility, as described in PART 3 - CLEANING - Waste Management.

1.4 CLOSEOUT SUBMITTALS

- .1 Provide submittals in accordance with Section 01 00 15 - Closeout Submittals.
- .2 Post Cleaning Inspection Report: submit [4] copies of Final Inspection Report, including data collected, observations and recommendations as well as following information:
 - .1 Name and address of facility;
 - .2 Name and address of HVAC cleaning contractor;

- .3 Description of HVAC systems with drawings identifying systems cleaned;
 - .4 Identification scheme for location points in systems that were inspected with accompanying notes describing methods of inspection or tests used;
 - .5 Identification of points where samples were collected and type of analysis used for each collection;
 - .6 Identification of each sample collected;
 - .7 Comments complete with photographs of each sampling location and other observed system features;
 - .8 Identify systems tested, observations, actions taken and recommendations for future maintenance.
- .3 Record post cleaning video survey: submit 2 copies of video survey USB Drive or memory card media, and include on video survey following:
- .1 Areas tested for particulate analysis or microbial growth evaluation;
 - .2 Areas of special interest and location;
 - .3 Special internal features;
 - .4 Problems such as broken or damaged controls or components;
 - .5 Ensure system tested, locations, observations, actions taken and recommendations are clearly identified in English and French on video using text or voice over.
- .4 Submit verification of delivery of hazardous or toxic waste materials to contaminated waste facility.

1.5 EXTRA MATERIALS

- .1 Extra Stock Materials:
- .1 Supply [4] extra filters for each HVAC System cleaned.
 - .2 Ensure filters are correct match, size, type and configuration of existing HVAC Systems.

1.6 QUALITY ASSURANCE

- .1 Contractor: verification of [5] years minimum experience in work similar to or exceeding work of this Section.
- .2 Project Co-ordinator: verification of [5] years minimum experience in work similar to or exceeding work of this Section.

Part 2 Products

2.1 ACCESS DOORS AND PANELS

- .1 Equipment Access Doors and Panels: construct from same materials as equipment panelling complete with sealing gasket and positive locking device.
 - .1 Size access doors and panels in equipment to allow for inspection and cleaning.
- .2 Ductwork Access Doors: construct access doors from 1.27 mm minimum galvanized sheet steel with gasketed seal.

- .1 Ensure access door is [25] mm greater in every dimension than access opening.
- .2 Access door size [200] mm x [200] mm minimum.
- .3 Secure access doors with sheet metal screws on 75 mm centres minimum. Ensure [3] screws per side minimum.
- .3 Access Doors and Panels Acoustic Lining:
 - .1 Install acoustic lining to match existing.
 - .2 Self-adhesive glass fibre tape capable of adhering to both acoustic lining and metal access door or panel materials.
 - .3 Water-based duct sealer for repairing cut acoustic lining.

2.2 ANTIMICROBIAL AGENT

- .1 Use antimicrobial agents registered with US EPA-40 CFR.

2.3 SYSTEM FILTERS

- .1 Supply and install new filters for each HVAC System cleaned.

2.4 AIR DUCT CLEANING EQUIPMENT

- .1 Manually propelled full contact brushes:
 - .1 Ensure brushes are specifically manufactured and shaped to fit individual ducts, equipment and components of HVAC system.
 - .1 Ensure brushes are sized to fit various duct sizes in HVAC system.
 - .2 Ensure brushes make scrubbing motion and full contact with HVAC system interior surfaces to be cleaned.
- .2 Brushes: manually propelled with integrally-mounted motor drive and nylon or other non-metallic material bristles.
 - .1 Ensure motor drive has capacity to continue to push brush after bristles are distorted.
 - .2 Replace worn and ineffective brushes when required.

Part 3 Execution

3.1 PREPARATION

- .1 Close down HVAC system.
- .2 Locate and identify externally visible HVAC system features which may affect cleaning process including:
 - .1 Control devices;
 - .2 Fire and smoke control dampers;
 - .3 Balancing dampers: indicate and record positions for resetting;
 - .4 Air volume control boxes: indicate and record positions for resetting;
 - .5 Fire alarm devices;
 - .6 Monitoring devices and controls;

- .3 Cut openings in equipment panels and ductwork for access to system interior.
 - .1 Square or rectangular opening sizes: [200] mm minimum each side.
 - .2 Circular opening sizes: [200] mm minimum diameter.
- .4 Installation of Access Doors and Panels: install access doors and panels for equipment where required to facilitate system inspection and cleaning.
 - .1 Install access doors and panels for inspection and cleaning of equipment as follows:
 - .1 Heating and cooling coils;
 - .2 Fan units;
 - .3 Filters;
 - .4 Dampers;
 - .5 Sensors;
- .5 Installation of Access Doors in Ductwork: install access doors in ductwork where required to facilitate system inspection and cleaning.
 - .1 Access door installation is not permitted in flexible ductwork.
 - .1 Inspect flexible ductwork only by disconnecting from main duct and inspecting from open end.
- .6 When acoustically lined duct is cut for access, repair cut edges of acoustic lining using self-adhesive fibre glass tape and water based duct sealer.
 - .1 Adhere new acoustic lining to match existing to inside of access panel or door to ensure continuity of acoustic properties of system.
- .7 Remove and reinstall ceiling [tiles] [panels] to gain access to HVAC system as required.
 - .1 Replace ceiling [tiles] [panels] damaged or soiled by air duct cleaning procedures.

3.2 EXAMINATION / PRE-CLEANING INSPECTION

- .1 Verification of Conditions:
 - .1 Make visual inspection of interior of HVAC system using remote controlled robotic camera.
 - .2 Insert camera at pre-established strategic locations to evaluate condition and cleanliness of HVAC systems and components.
- .2 Evaluation and Assessment:
 - .1 Identify location and type of internal components.
 - .2 Identify extent of potential problems.
 - .3 If toxic or hazardous materials or deposits are suspected after initial inspection immediately stop work and inform Department Representative.
 - .1 Do not proceed further with inspection operations until written approval from Department Representative.

3.3 PARTICULATE COLLECTION

- .1 Before starting duct cleaning, identify locations for sample collection and collect particulate samples.
- .2 Take samples from interior surfaces of HVAC system using sterile wipes for submission to independent testing laboratory.
- .3 For each HVAC system collect [4] samples from each HVAC unit as follows:
 - .1 Sample 1: collect from inside ventilation unit downstream of air filters but before fan discharge;
 - .2 Sample 2: collect downstream of fan discharge and [1] metre maximum downstream in first horizontal branch;
 - .3 Sample 3: collect at junction of last horizontal branch and start of low-pressure duct;
 - .4 Sample 4: collect at junction each air terminal unit and supply duct.

3.4 DUCT CLEANING

- .1 Do duct cleaning in accordance with NADCA ACR Standard.
- .2 Isolate and clean sections in zones to ensure that dirt deposits and debris from zone being cleaned does not pass through another zones which has already been cleaned.
 - .1 Isolate zone of duct using [closed-cell polyurethane foam] [air inflated zone bag] before cleaning.
- .3 Ensure vacuum units and evacuation fans are securely in place before starting cleaning operation of isolated section of HVAC air duct system.
- .4 Install HEPA filter evacuation fan at one end of zone section and insert full contact brushes at other end.
- .5 Clean HVAC supply air duct system and components where particulate sample collected from surfaces is greater than [75] mg of particulate per [0.01] square metres.
- .6 Clean exhaust, return, transfer ductwork and plenums, equipment and components where particulate sample collected from surfaces is greater than [75] mg of particulate per [0.01] square metres.
- .7 Energize brushes to travel from insertion point to HEPA filter evacuation fan.
 - .1 Pass brushes through sections as often as necessary to achieve required cleanliness.
 - .2 Change brush sizes as required to ensure positive contact with duct and component interiors.
 - .3 Clean corners and pockets where dirt and debris can accumulate.
- .8 Clean equipment, components and other features in isolated zone before moving to next zone of HVAC air duct system.
- .9 Clean diffusers, registers, louvers, and other terminal units.
- .10 Remove perforated supply diffusers from suspended tee-bar ceiling.
 - .1 Dismantle and clean perforated plates and supply diffuser duct collars.

- .2 Re-assemble perforated plate diffusers and reconnect to HVAC system using supply diffuser duct collar after cleaning.
- .11 Advise Department Representative [72] hours minimum before deactivation of fire alarm and smoke detectors duct cleaning operations.
 - .1 General contractor will pay for costs of deactivation of fire alarm and smoke detector system.

3.5 ACOUSTICALLY LINED DUCTWORK CLEANING

- .1 Clean glass fibre acoustically insulated ducts to NAIMA recommended practices.
 - .1 Use specifically designed robotic apparatus that has been demonstrated not to damage acoustic glass fibre lining.
 - .2 Monitor cleaning process progress by onboard camera.

3.6 COMPONENTS AND EQUIPMENT CLEANING

- .1 Brush and vacuum coils, air handling unit enclosures, and heat exchanger surfaces to achieve required cleanliness.
- .2 When cleaning equipment and components by brushing and vacuuming is inappropriate or insufficient, dismantle and remove equipment or component and move to area designated by Department Representative for cleaning.
 - .1 Pressure wash with water and cleaning solution until required cleanliness is achieved.
 - .2 Clean equipment and components in place only if there is no hazard to adjacent materials.
- .3 Compressed air and manual cleaning is acceptable only for cleaning individual components and small areas as follows and only after written approval from Department Representative:
 - .1 Fan blades;
 - .2 Dampers;
 - .3 Turning vanes;
 - .4 Controls;
 - .5 Sensor bulbs;
 - .6 Fire alarms;
 - .7 Smoke detectors;

3.7 FIELD QUALITY CONTROL/FINAL INSPECTIONS

- .1 Post Cleaning Inspection: carry out final inspection using robotic camera and other visual inspection methods after final cleaning has been completed.
 - .1 Carry out video survey as directed by Department Representative.
 - .2 Include in final survey areas inspected by Department Representative prior to cleaning.
 - .3 Identify on HVAC system record drawings access points used for inspection and cleaning.

- .4 Re-collect and analyze particulates collected at same locations where original samples were collected before cleaning.
- .5 Reset components including dampers and sensors, which have been disturbed during cleaning operations.

3.8 SYSTEM STARTUP

- .1 Install new system filters after cleaning operations are completed.
- .2 Cover each inspection opening with access door or panel and secure in place after inspection and cleaning are completed.
- .3 Restart each HVAC system.

3.9 CLEANING

- .1 Clean in accordance with Section 01 00 15 - Cleaning.
- .2 Waste Management: separate waste materials for recycling in accordance with Section 01 00 15 - Construction/Demolition Waste Management and Disposal.
 - .1 Dispose of hazardous or toxic waste materials extracted from ductwork system to appropriate contaminated waste facility and provide proof.
 - .2 Dispose of existing HVAC filter materials to appropriate contaminated waste facility.

END OF SECTION

Part 1 General**1.1 ACTION AND INFORMATIONAL SUBMITTALS**

- .1 Submit in accordance with Section 01 00 15 - Submittal Procedures.
- .2 Product Data:
 - .1 Submit manufacturer's instructions, printed product literature and data sheets 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 Alberta, Canada.
 - .2 Indicate on drawings:
 - .1 Mounting arrangements.
 - .2 Operating and maintenance clearances.
 - .3 Shop drawings and product data accompanied by:
 - .1 Detailed drawings of bases, supports, and anchor bolts.
 - .2 Acoustical sound power data, where applicable.
 - .3 Points of operation on performance curves.
 - .4 Manufacturer to certify current model production.
 - .5 Certification of compliance to applicable codes.
 - .4 In addition to transmittal letter referred to in Section 01 00 15 - Submittal Procedures: use MCAC "Shop Drawing Submittal Title Sheet". Identify section and paragraph number.

1.2 CLOSEOUT SUBMITTALS

- .1 Submit in accordance with Section 01 00 15 - Closeout Submittals.
- .2 Operation and Maintenance Data: submit operation and maintenance data for incorporation into manual.
 - .1 Operation and maintenance manual approved by, and final copies deposited with, Department Representative before final inspection.
 - .2 Operation data to include:
 - .1 Control schematics for systems including environmental controls.
 - .2 Description of systems and their controls.
 - .3 Description of operation of systems at various loads together with reset schedules and seasonal variances.
 - .4 Operation instruction for systems and component.
 - .5 Description of actions to be taken in event of equipment failure.
 - .6 Valves schedule and flow diagram.
 - .7 Colour coding chart.

- .3 Maintenance data to include:
 - .1 Servicing, maintenance, operation and trouble-shooting instructions for each item of equipment.
 - .2 Data to include schedules of tasks, frequency, tools required and task time.
- .4 Performance data to include:
 - .1 Equipment manufacturer's performance datasheets with point of operation.
 - .2 Equipment performance verification test results.
 - .3 Special performance data as specified.
 - .4 Testing, adjusting and balancing reports as specified in Section 23 05 93 - Testing, Adjusting and Balancing for HVAC.
- .5 Approvals:
 - .1 Submit [2] copies of draft Operation and Maintenance Manual to Department Representative for approval. Submission of individual data will not be accepted unless directed by Department Representative.
 - .2 Make changes as required and re-submit as directed by Department Representative.
- .6 Additional data:
 - .1 Prepare and insert into operation and maintenance manual additional data when need for it becomes apparent during specified demonstrations and instructions.
- .7 Site records:
 - .1 Department Representative will provide [1] set of reproducible mechanical drawings. Provide sets of white prints as required for each phase of work. Mark changes as work progresses and as changes occur. Include changes to existing mechanical systems, control systems and low voltage control wiring.
 - .2 Transfer information monthly to reproducibles, revising reproducibles to show work as actually installed.
 - .3 Use different colour waterproof ink for each service.
 - .4 Make available for reference purposes and inspection.
- .8 As-built drawings:
 - .1 Prior to start of Testing, Adjusting and Balancing for HVAC, finalize production of as-built drawings.
 - .2 Identify each drawing in lower right hand corner in letters at least 12 mm high as follows: - "AS BUILT DRAWINGS: THIS DRAWING HAS BEEN REVISED TO SHOW MECHANICAL SYSTEMS AS INSTALLED" (Signature of Contractor) (Date).
 - .3 Submit to Department Representative for approval and make corrections as directed.
 - .4 Perform testing, adjusting and balancing for HVAC using as-built drawings.

- .5 Submit completed reproducible as-built drawings with Operating and Maintenance Manuals.
- .9 Submit copies of as-built drawings for inclusion in final TAB report.

1.3 MAINTENANCE MATERIAL SUBMITTALS

- .1 Submit in accordance with Section 01 00 15 - Closeout Submittals.
- .2 Furnish spare parts as follows:
 - .1 One set of packing for each pump.
 - .2 One casing joint gasket for each size pump.
 - .3 One head gasket set for each heat exchanger.
 - .4 One glass for each gauge glass.
 - .5 One filter cartridge or set of filter media for each filter or filter bank in addition to final operating set.
- .3 Provide one set of special tools required to service equipment as recommended by manufacturers.
- .4 Furnish one commercial quality grease gun, grease and adapters to suit different types of grease and grease fittings.

1.4 DELIVERY, STORAGE AND HANDLING

- .1 Deliver, store and handle materials in accordance with Section 01 00 15 - Common Product Requirements with manufacturer's written instructions.
- .2 Delivery and Acceptance Requirements: deliver materials to site in original factory packaging, labelled with manufacturer's name and address.
- .3 Storage and Handling Requirements:
 - .1 Store materials indoors in dry location and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.
 - .2 Store and protect from nicks, scratches, and blemishes.
 - .3 Replace defective or damaged materials with new.
- .4 Develop Construction Waste Management Plan related to Work of this.
- .5 Packaging Waste Management: remove for reuse and return by manufacturer of packaging materials as specified in Construction Waste Management Plan in accordance with Section 01 00 15 - Construction/Demolition Waste Management and Disposal.

Part 2 Products

2.1 N/A

Part 3 Execution**3.1 EXAMINATION**

- .1 Verification of Conditions: verify that conditions of substrate previously installed under other Sections or Contracts are acceptable for installation in accordance with manufacturer's written instructions.
 - .1 Visually inspect substrate in presence of Department Representative.
 - .2 Inform Department Representative of unacceptable conditions immediately upon discovery.
 - .3 Proceed with installation only after unacceptable conditions have been remedied and after receipt of written approval to proceed from Department Representative.

3.2 PAINTING REPAIRS AND RESTORATION

- .1 Do painting in accordance with Section 00 00 15 - Interior Painting.
- .2 Prime and touch up marred finished paintwork to match original.
- .3 Restore to new condition, finishes which have been damaged.

3.3 SYSTEM CLEANING

- .1 Clean interior and exterior of all systems including strainers. Vacuum interior of ductwork and air handling units.

3.4 FIELD QUALITY CONTROL

- .1 Site Tests: conduct following tests in accordance with Section 01 00 15 - Quality Control and submit report.
- .2 Manufacturer's Field Services:
 - .1 Obtain written report from manufacturer verifying compliance of Work, in handling, installing, applying, protecting and cleaning of product and submit Manufacturer's Field Reports.
 - .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.

3.5 DEMONSTRATION

- .1 Department Representative will use equipment and systems for test purposes prior to acceptance. Supply labour, material, and instruments required for testing.
- .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 Use operation and maintenance manual, as-built drawings, and audio visual aids as part of instruction materials.
- .4 Instruction duration time requirements as specified in appropriate sections.
- .5 Department Representative will record these demonstrations on video tape for future reference.

3.6 CLEANING

- .1 Progress Cleaning: clean in accordance with Section 01 00 15 - 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 00 15 - Cleaning.
- .3 Waste Management: separate waste materials for recycling in accordance with Section 01 00 15 - Construction/Demolition Waste Management and Disposal.
 - .1 Remove recycling containers and bins from site and dispose of materials at appropriate facility.

3.7 PROTECTION

- .1 Protect equipment and systems openings from dirt, dust, and other foreign materials with materials appropriate to system.

END OF SECTION

Part 1 General**1.1 REFERENCES**

- .1 Canadian General Standards Board (CGSB)
 - .1 CAN/CGSB-1.18, Ready-Mixed Organic Zinc-Rich Coating.
- .2 Canadian Standards Association (CSA International)
 - .1 CSA B139, Installation Code for Oil Burning Equipment.
- .3 Green Seal Environmental Standards (GSES)
 - .1 Standard GS-11, Environmental Standard for Paints and Coatings.
- .4 National Fire Code of Canada
- .5 South Coast Air Quality Management District (SCAQMD), California State, Regulation XI. Source Specific Standards
 - .1 SCAQMD Rule 1113, Architectural Coatings.
 - .2 SCAQMD Rule 1168, Adhesive and Sealant Applications.

1.2 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Provide submittals in accordance with Section 01 00 15 - Submittal Procedures.
- .2 Product Data:
 - .1 Provide manufacturer's printed product literature, specifications and datasheets for piping and equipment and include product characteristics, performance criteria, physical size, finish and limitations.

1.3 DELIVERY, STORAGE AND HANDLING

- .1 Deliver, store and handle materials in accordance with Section 01 00 15 - Common Product Requirements with manufacturer's written instructions.
- .2 Delivery and Acceptance Requirements:
 - .1 Deliver materials to site in original factory packaging, labelled with manufacturer's name, address.
- .3 Packaging Waste Management: remove for reuse by manufacturer of packaging materials in accordance with Section 01 00 15 - Construction/Demolition Waste Management and Disposal.

Part 2 Products**2.1 MATERIAL**

- .1 Paint: zinc-rich to CAN/CGSB-1.181.
 - .1 Primers Paints and Coating: in accordance with manufacturer's recommendations for surface conditions.

- .2 Primer: maximum VOC limit [250] g/L to Standard GS-11.
- .3 Paints: maximum VOC limit [150] g/L to Standard GS-11.
- .2 Sealants: in accordance with Section 07 92 00 - Joint Sealants.
 - .1 Sealants: maximum VOC limit to GSES GS-36.
- .3 Sealants: maximum VOC limit to GSES GS-36.
- .4 Adhesives: maximum VOC limit to GSES GS-36.
- .5 Fire Stopping: in accordance with Section 07 84 00 - Fire Stopping.

Part 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 CONNECTIONS TO EQUIPMENT

- .1 In accordance with manufacturer's instructions unless otherwise indicated.
- .2 Use valves and either unions or flanges for isolation and ease of maintenance and assembly.
- .3 Use double swing joints when equipment mounted on vibration isolation and when piping subject to movement.

3.3 CLEARANCES

- .1 Provide clearance around systems, equipment and components for observation of operation, inspection, servicing, maintenance and as recommended by manufacturer and National Fire Code of Canada and CSA B139].
- .2 Provide space for disassembly, removal of equipment and components as recommended by manufacturer and CSA B139 without interrupting operation of other system, equipment, components.

3.4 DRAINS

- .1 Install piping with grade in direction of flow except as indicated.
- .2 Install drain valve at low points in piping systems, at equipment and at section isolating valves.
- .3 Pipe each drain valve discharge separately to above floor drain.
 - .1 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.

3.5 AIR VENTS

- .1 Install manual air vents to CSA B139 at high points in piping systems.

- .2 Install isolating valve at each automatic air valve.
- .3 Install drain piping to approved location and terminate where discharge is visible.

3.6 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.

3.7 PIPEWORK INSTALLATION

- .1 Install pipework to [CSA B139].
- .2 Screwed fittings jointed with Teflon tape.
- .3 Protect openings against entry of foreign material.
- .4 Install to isolate equipment and allow removal without interrupting operation of other equipment or systems.
- .5 Assemble piping using fittings manufactured to ANSI standards.
- .6 Saddle type branch fittings may be used on mains if branch line is no larger than half size of main.
 - .1 Hole saw (or drill) and ream main to maintain full inside diameter of branch line prior to welding saddle.
- .7 Install exposed piping, equipment, rectangular cleanouts and similar items parallel or perpendicular to building lines.
- .8 Install concealed pipework to minimize furring space, maximize headroom, conserve space.
- .9 Slope piping, except where indicated, in direction of flow for positive drainage and venting.
- .10 Install, except where indicated, to permit separate thermal insulation of each pipe.
- .11 Group piping wherever possible.
- .12 Ream pipes, remove scale and other foreign material before assembly.
- .13 Use eccentric reducers at pipe size changes to ensure positive drainage and venting.
- .14 Provide for thermal expansion as indicated.
- .15 Valves:
 - .1 Install in accessible locations.
 - .2 Remove interior parts before soldering.
 - .3 Install with stems above horizontal position unless indicated.
 - .4 Valves accessible for maintenance without removing adjacent piping.
 - .5 Install globe valves in bypass around control valves.
 - .6 Use ball valves at branch take-offs for isolating purposes except where specified.

3.8 SLEEVES

- .1 General: install where pipes pass through masonry, concrete structures, fire rated assemblies, and as indicated.
- .2 Material: schedule 40 black steel pipe.
- .3 Construction: use annular fins continuously welded at mid-point at foundation walls and where sleeves extend above finished floors.
- .4 Sizes: [6] mm minimum clearance between sleeve and uninsulated pipe or between sleeve and insulation.
- .5 Installation:
 - .1 Concrete, masonry walls, and 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:
 - .1 Provide space for firestopping.
 - .2 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.
 - .1 Chrome or nickel plated brass or type 302 stainless steel.
- .3 Sizes: outside diameter to cover opening or sleeve.
 - .1 Inside diameter to fit around pipe or outside of insulation if so provided.

3.10 PREPARATION FOR FIRE STOPPING

- .1 Install firestopping within annular space between pipes, ducts, insulation and adjacent fire separation in accordance with Section 07 84 00 - Fire Stopping.
- .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 Flush system in accordance with Section 23 08 02 - Cleaning and Start-up of Mechanical Piping Systems.
- .2 Before start-up, clean interior of piping systems in accordance with requirements of Section 01 00 15 - Cleaning supplemented as specified in relevant mechanical sections.
- .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 Department Representative] [48] hours minimum prior to performance of pressure tests.
- .2 Pipework: test as specified in relevant sections of heating, ventilating and air conditioning work.
- .3 Maintain specified test pressure without loss for [4] hours minimum unless specified for longer period of time in relevant mechanical sections.
- .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 Department Representative.
- .6 Pay costs for repairs or replacement, retesting, and making good. Department Representative to determine whether repair or replacement is appropriate.
- .7 Insulate or conceal work only after approval and certification of tests by Department Representative.

3.13 EXISTING SYSTEMS

- .1 Connect into existing piping systems at times approved by Department Representative.
- .2 Request written approval by Departmental Representative [10] days minimum, prior to commencement of work.
- .3 Be responsible for damage to existing plant by this work.

3.14 CLEANING

- .1 Clean in accordance with Section 01 00 15 - Cleaning.
 - .1 Remove surplus materials, excess materials, rubbish, tools and equipment.
- .2 Waste Management: separate waste materials for recycling in accordance with Section 01 00 15 - Construction/Demolition Waste Management and Disposal.

END OF SECTION

Part 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 and 23. Refer to Division 26 for quality of materials and workmanship.

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 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Submittals: in accordance with Section 01 00 15 - Submittal Procedures.
- .2 Product Data:
 - .1 Submit manufacturer's printed product literature, specifications and datasheet in accordance with Section 01 00 15 - 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 00 15 - Submittal Procedures.
 - .2 Shop Drawings: submit drawings stamped and signed by professional engineer registered or licensed in Alberta
- .3 Quality Control: in accordance with Section 01 00 15 - Quality Control.
 - .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 Departmental Representative will make available 1 copy of systems supplier's installation instructions.

- .4 Closeout Submittals
 - .1 Provide maintenance data for motors, drives and guards for incorporation into manual specified in Section 01 00 15 - Closeout Submittals.

1.4 QUALITY ASSURANCE

- .1 Regulatory Requirements: work to be performed in compliance with applicable Provincial regulations.
- .2 Health and Safety Requirements: do construction occupational health and safety in accordance with Section 01 00 15 - 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 00 15 - Common Product Requirements.
 - .2 Deliver, store and handle materials in accordance with manufacturer's written instructions.
- .2 Waste Management and Disposal:
 - .1 Construction/Demolition Waste Management and Disposal: separate waste materials for recycling in accordance with Section 01 00 15 - Construction/Demolition Waste Management and Disposal.

Part 2 Products

2.1 GENERAL

- .1 Motors: high efficiency, in accordance with local Hydro company standards and to ASHRAE 90.1.

2.2 MOTORS

- .1 Provide motors for mechanical equipment as specified.
- .2 Motors under 373 W: speed as indicated, continuous duty, built-in overload protection, resilient mount, single phase, 120 V, unless otherwise specified or indicated.
- .3 Motors 373 W 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: 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 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 00 15 - 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 dia 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.
 - .1 "U" shaped, minimum 1.6 mm thick galvanized mild steel.
 - .2 Securely fasten in place.
 - .3 Removable for servicing.
- .5 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.

Part 3 Execution**3.1 MANUFACTURER'S INSTRUCTIONS**

- .1 Compliance: comply with manufacturer's written recommendations or specifications, including product technical bulletins, handling, storage and installation instructions, and datasheet.

3.2 INSTALLATION

- .1 Fasten securely in place.
- .2 Make removable for servicing, easily returned into, and positively in position.

3.3 FIELD QUALITY CONTROL

- .1 Site Tests: conduct following tests in accordance with Section 01 00 15 - Quality Control and submit report.
- .2 Manufacturer's Field Services:
 - .1 Obtain written report from manufacturer verifying compliance of Work, in handling, installing, applying, protecting and cleaning of product and submit Manufacturer's Field Reports.
 - .2 Provide manufacturer's field services consisting of product use recommendations and periodic site visits for inspection of product installation in accordance with manufacturer's instructions.
 - .3 Schedule site visits, to review Work, as directed in PART 1 - QUALITY ASSURANCE.
- .3 Verification requirements: Contractor's Verification, include:
 - .1 Materials and resources.
 - .2 Storage and collection of recyclables.
 - .3 Construction waste management.
 - .4 Resource reuse.
 - .5 Recycled content.
 - .6 Local/regional materials.
 - .7 Certified wood.
 - .8 Low-emitting materials.

3.4 CLEANING

- .1 Proceed in accordance with Section 01 00 15 - 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 SUMMARY**

- .1 TAB is used throughout this Section to describe the process, methods and requirements of testing, adjusting and balancing for HVAC.
- .2 TAB means to test, adjust and balance to perform in accordance with requirements of Contract Documents and to do other work as specified in this section.

1.2 QUALIFICATIONS OF TAB PERSONNEL

- .1 Submit names of personnel to perform TAB to Departmental Representative within [90] days of award of contract.
- .2 Provide documentation confirming qualifications, successful experience.
- .3 TAB: performed in accordance with the requirements of standard under which TAB Firm's qualifications are approved:
 - .1 Associated Air Balance Council, (AABC) National Standards for Total System Balance, MN-1-[2002].
 - .2 National Environmental Balancing Bureau (NEBB) TABES, Procedural Standards for Testing, Adjusting, Balancing of Environmental Systems.
 - .3 Sheet Metal and Air Conditioning Contractors' National Association (SMACNA), HVAC TAB HVAC Systems - Testing, Adjusting and Balancing.
- .4 Recommendations and suggested practices contained in the TAB Standard: mandatory.
- .5 Use TAB Standard provisions, including checklists, and report forms to satisfy Contract requirements.
- .6 Use TAB Standard for TAB, including qualifications for TAB Firm and Specialist and calibration of TAB instruments.
- .7 Where instrument manufacturer calibration recommendations are more stringent than those listed in TAB Standard, use manufacturer's recommendations.
- .8 TAB Standard quality assurance provisions such as performance guarantees form part of this contract.
 - .1 For systems or system components not covered in TAB Standard, use TAB procedures developed by TAB Specialist.
 - .2 Where new procedures, and requirements, are applicable to Contract requirements have been published or adopted by body responsible for TAB Standard used requirements and recommendations contained in these procedures and requirements are mandatory.

1.3 PURPOSE OF TAB

- .1 Test to verify proper and safe operation, determine actual point of performance, evaluate qualitative and quantitative performance of equipment, systems and controls at design, average and low loads using actual or simulated loads

- .2 Adjust and regulate equipment and systems to meet specified performance requirements and to achieve specified interaction with other related systems under normal and emergency loads and operating conditions.
- .3 Balance systems and equipment to regulate flow rates to match load requirements over full operating ranges.

1.4 EXCEPTIONS

- .1 TAB of systems and equipment regulated by codes, standards to satisfaction of authority having jurisdiction.

1.5 CO-ORDINATION

- .1 Schedule time required for TAB (including repairs, re-testing) into project construction and completion schedule to ensure completion before acceptance of project.
- .2 Do TAB of each system independently and subsequently, where interlocked with other systems, in unison with those systems.

1.6 PRE-TAB REVIEW

- .1 Review contract documents before project construction is started confirm in writing to Departmental Representative adequacy of provisions for TAB and other aspects of design and installation pertinent to success of TAB.
- .2 Review specified standards and report to Departmental Representative in writing proposed procedures which vary from standard.
- .3 During construction, co-ordinate location and installation of TAB devices, equipment, accessories, measurement ports and fittings.

1.7 START-UP

- .1 Follow start-up procedures as recommended by equipment manufacturer unless specified otherwise.
- .2 Follow special start-up procedures specified elsewhere in Division 23.

1.8 OPERATION OF SYSTEMS DURING TAB

- .1 Operate systems for length of time required for TAB and as required by Departmental Representative for verification of TAB reports.

1.9 START OF TAB

- .1 Notify Departmental Representative 7 days prior to start of TAB.
- .2 Start TAB when building is essentially completed, including:
- .3 Installation of ceilings, doors, windows, other construction affecting TAB.
- .4 Application of weatherstripping, sealing, and caulking.
- .5 Pressure, leakage, other tests specified elsewhere Division 23.
- .6 Provisions for TAB installed and operational.

- .7 Start-up, verification for proper, normal and safe operation of mechanical and associated electrical and control systems affecting TAB including but not limited to:
 - .1 Proper thermal overload protection in place for electrical equipment.
 - .2 Air systems:
 - .1 Filters in place, clean.
 - .2 Duct systems clean.
 - .3 Ducts, air shafts, ceiling plenums are airtight to within specified tolerances.
 - .4 Correct fan rotation.
 - .5 Fire, smoke, volume control dampers installed and open.
 - .6 Coil fins combed, clean.
 - .7 Access doors, installed, closed.
 - .8 Outlets installed, volume control dampers open.
 - .3 Liquid systems:
 - .1 Flushed, filled, vented.
 - .2 Correct pump rotation.
 - .3 Strainers in place, baskets clean.
 - .4 Isolating and balancing valves installed, open.
 - .5 Calibrated balancing valves installed, at factory settings.
 - .6 Chemical treatment systems complete, operational.

1.10 APPLICATION TOLERANCES

- .1 Do TAB to following tolerances of design values:
 - .1 HVAC air systems: plus 5 %, minus 5 %.
 - .2 HVAC Acoustic: ASHRAE recommendations.

1.11 ACCURACY TOLERANCES

- .1 Measured values accurate to within plus or minus 2 % of actual values.

1.12 INSTRUMENTS

- .1 Prior to TAB, submit to Departmental Representative list of instruments used together with serial numbers.
- .2 Calibrate in accordance with requirements of most stringent of referenced standard for either applicable system or HVAC system.
- .3 Calibrate within [3] months of TAB. Provide certificate of calibration to Departmental Representative.

1.13 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Submit, prior to commencement of TAB:

- .2 Proposed methodology and procedures for performing TAB if different from referenced standard.

1.14 PRELIMINARY TAB REPORT

- .1 Submit for checking and approval of Departmental Representative prior to submission of formal TAB report, sample of rough TAB sheets. Include:
 - .1 Details of instruments used.
 - .2 Details of TAB procedures employed.
 - .3 Calculations procedures.
 - .4 Summaries.

1.15 TAB REPORT

- .1 Format in accordance with [referenced standard].
- .2 TAB report to show results in SI units and to include:
 - .1 Project record drawings.
 - .2 System schematics.
- .3 Submit [6] copies of TAB Report to Departmental Representative for verification and approval, in both official languages in D-ring binders, complete with index tabs.

1.16 VERIFICATION

- .1 Reported results subject to verification by Departmental Representative.
- .2 Provide personnel and instrumentation to verify up to [30] % of reported results.
- .3 Number and location of verified results as directed by Departmental Representative.
- .4 Pay costs to repeat TAB as required to satisfaction of Departmental Representative.

1.17 SETTINGS

- .1 After TAB is completed to satisfaction of Departmental Representative replace drive guards, close access doors, lock devices in set positions, 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.

1.18 COMPLETION OF TAB

- .1 TAB considered complete when final TAB Report received and approved by Departmental Representative.

1.19 AIR SYSTEMS

- .1 Standard: TAB to most stringent of this section, SMACNA, ASHRAE.
- .2 Do TAB of systems, equipment, components, controls specified Division 23, following systems, equipment, components, controls:

- .1 Air system.
- .3 Qualifications: personnel performing TAB current member in good standing of AABC or qualified to standards of AABC.
- .4 Quality assurance: perform TAB under direction of supervisor qualified to standards of AABC.
- .5 Measurements: to include as appropriate for systems, equipment, components, controls: air velocity, static pressure, flow rate, pressure drop (or loss), temperatures (dry bulb, wet bulb, dewpoint), duct cross-sectional area, RPM, electrical power, voltage, noise, vibration.
- .6 Locations of equipment measurements: to include as appropriate:
 - .1 Inlet and outlet of dampers, filter, coil, humidifier, fan, other equipment causing changes in conditions.
 - .2 At controllers, controlled device.
- .7 Locations of systems measurements to include as appropriate: main ducts, main branch, sub-branch, run-out (or grille, register or diffuser).

1.20 OTHER TAB REQUIREMENTS

- .1 General requirements applicable to work specified this paragraph:
 - .1 Qualifications of TAB personnel: as for air systems specified this section.
 - .2 Quality assurance: as for air systems specified this section.
- .2 Building pressure conditions:
 - .1 Adjust HVAC systems, equipment, controls to ensure specified pressure conditions at all times design conditions.
- .3 Measurement of noise from equipment specified in Division 23.

1.21 POST-OCCUPANCY TAB

- .1 Measure DBT, WBT (or %RH), air velocity, NC levels, in occupied rooms.

Part 2 Products

2.1 NOT USED

- .1 Not used.

Part 3 Execution

3.1 NOT USED

- .1 Not used.

END OF SECTION

Part 1 General**1.1 SUMMARY****.1 Section Includes:**

- .1 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.

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.

1.3 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Make submittals in accordance with Section 01 00 15 - Submittal Procedures.
- .2 Test Reports: submit certified test reports from approved independent testing laboratories indicating compliance with specifications for specified performance characteristics and physical properties. 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 [24] hours 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 on-site installations in accordance with Section 01 00 15 - Construction Progress Schedules - Bar (GANTT) Char.
 - .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.
- .2 Health and Safety:
 - .1 Do construction occupational health and safety in accordance with Section 01 00 15 - Health and Safety Requirements.

Part 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 [three] months 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.

Part 3 Execution

3.1 MANUFACTURER'S INSTRUCTIONS

- .1 Compliance: comply with manufacturer's written recommendations or specifications, including product technical bulletins, handling, storage and installation instructions, and datasheet.

3.2 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.
- .3 Repeat tests until specified 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.

3.3 SITE TOLERANCES

- .1 System leakage tolerances specified are stated as percentage of total flow rate handled by system. Pro-rate specified system leakage tolerances. Leakage for sections of duct systems: not to exceed total allowable leakage.
- .2 Leakage tests on following systems not to exceed specified leakage rates.
 - .1 Small duct systems up to 250 Pa: leakage [2]%.
 - .2 Large low pressure duct systems up to 500 Pa: leakage [2]%.
- .3 Evaluation of test results to use surface area of duct and pressure in duct as basic parameters.

3.4 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 Flexible connections to VAV boxes.

3.5 FIELD QUALITY CONTROL

- .1 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 product[s] 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 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.
- .2 Verification requirements: Contractor's Verification, include:

- .1 Materials and resources.
- .2 Storage and collection of recyclables.
- .3 Construction waste management.
- .4 Resource reuse.
- .5 Recycled content.
- .6 Local/regional materials.
- .7 Certified Wood.
- .8 Low-emitting materials.
- .3 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.

3.6 CLEANING

- .1 Upon completion and verification of performance of installation, remove surplus materials, excess materials, rubbish, tools and equipment.

END OF SECTION

Part 1 General**1.1 REFERENCES**

- .1 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" - means "not concealed" as previously defined.
 - .3 Insulation systems - insulation material, fasteners, jackets, and other accessories.
 - .2 TIAC Codes:
 - .1 CRD: Code Round Ductwork,
 - .2 CRF: Code Rectangular Finish.
- .2 Reference Standards:
 - .1 American Society of Heating, Refrigeration and Air Conditioning Engineers (ASHRAE)
 - .1 ANSI/ASHRAE/IESNA 90.1, SI; Energy Standard for Buildings Except Low-Rise Residential Buildings.
 - .2 NECB 2011. ABC 2014
 - .3 ASTM International Inc.
 - .1 ASTM B209M, Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate (Metric).
 - .2 ASTM C335, Standard Test Method for Steady State Heat Transfer Properties of Pipe Insulation.
 - .3 ASTM C411, Standard 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, Standard Specification for Mineral Fiber Pipe Insulation.
 - .6 ASTM C553, Standard Specification for Mineral Fiber Blanket Thermal Insulation for Commercial and Industrial Applications.
 - .7 ASTM C612, Standard Specification for Mineral Fiber Block and Board Thermal Insulation.
 - .8 ASTM C795, Standard Specification for Thermal Insulation for Use in Contact with Austenitic Stainless Steel.
 - .9 ASTM C921, Standard Practice for Determining the Properties of Jacketing Materials for Thermal Insulation.
 - .4 Canadian General Standards Board (CGSB)
 - .1 CGSB 51-GP-52Ma-[89], Vapour Barrier, Jacket and Facing Material for Pipe, Duct and Equipment Thermal Insulation.
 - .5 South Coast Air Quality Management District (SCAQMD), California State

- .1 SCAQMD Rule 1168, Adhesive and Sealant Applications.
- .6 Thermal Insulation Association of Canada (TIAC): National Insulation Standards.
- .7 Underwriters Laboratories of Canada (ULC)
 - .1 CAN/ULC-S102, Method of Test for Surface Burning Characteristics of Building Materials and Assemblies.
 - .2 CAN/ULC-S701, Standard for Thermal Insulation, Polystyrene, Boards and Pipe Covering.

1.2 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Provide submittals in accordance with Section 01 00 15 - Submittal Procedures.
- .2 Product Data:
 - .1 Provide manufacturer's printed product literature and datasheets for duct insulation, and include product characteristics, performance criteria, physical size, finish and limitations.
 - .1 Description of equipment giving manufacturer's name, type, model, year and capacity.
 - .2 Details of operation, servicing and maintenance.
 - .3 Recommended spare parts list.
- .3 Shop Drawings:
 - .1 Provide drawings stamped and signed by professional engineer registered or licensed in Alberta, Canada.
- .4 Samples:
 - .1 Submit for approval: complete assembly of each type of insulation system, insulation, coating, and adhesive proposed.
 - .2 Mount sample on 12 mm plywood board.
 - .3 Affix typewritten label beneath sample indicating service.
- .5 Manufacturers' Instructions:
 - .1 Provide manufacture's written duct insulation jointing recommendations, and special handling criteria, installation sequence, cleaning procedures.

1.3 QUALITY ASSURANCE

- .1 Qualifications:
 - .1 Installer: specialist in performing work of this section, and have at least [3] years successful experience in this size and type of project, qualified to standards member of TIAC].

1.4 DELIVERY, STORAGE AND HANDLING

- .1 Deliver, store and handle in accordance with Section 01 00 15 - Common Product Requirements.

- .2 Deliver materials to site in original factory packaging, labelled with manufacturer's name, address and ULC markings.
- .3 Packaging Waste Management: remove for reuse by manufacturer of packaging materials in accordance with Section 01 00 15 - Construction/Demolition Waste Management and Disposal.

Part 2 Products

2.1 FIRE AND SMOKE RATING

- .1 To 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 resistance not to less the specified values in the following table at 24 degrees C mean temperature when tested in accordance with ASTM C177.

Temperature Difference °C	Minimum thermal Resistance of duct and plenums m ² .C°/W	Minimum Thermal Resistance of Run-outs m ² .C°/W
<5	0	0
5 to 22	0.58	0.58
>22	0.88	0.58

- .3 TIAC Code C-1: Rigid mineral fibre board to ASTM C612, with factory applied vapour retarder jacket to CGSB 51-GP-52Ma (as scheduled in PART 3 of this Section).
- .4 TIAC Code C-2: Mineral fibre blanket to ASTM C553 faced with factory applied vapour retarder jacket to CGSB 51-GP-52Ma (as scheduled in PART 3 of this section).
 - .1 Mineral fibre: to ASTM C553.
 - .2 Jacket: to CGSB 51-GP-52Ma.
 - .3 Maximum "k" factor: to ASTM C553.

2.3 JACKETS

- .1 Canvas:
 - .1 [220] gm/m² cotton, plain weave, treated with dilute fire retardant lagging adhesive to ASTM C921.
- .2 Lagging adhesive: compatible with insulation.

- .1 Maximum VOC limit 50g/L to SCAQMD Rule 1168.
- .3 Aluminum:
 - .1 To ASTM B209 with moisture barrier as scheduled in PART 3 of this section.
 - .2 Thickness: [0.50] mm sheet.
 - .3 Finish: Smooth.
 - .4 Jacket banding and mechanical seals: [12] mm wide, 0.5 mm thick stainless steel.
 - .1 Stainless steel:
 - .5 Type: 304.
 - .6 Thickness: [0.25] mm sheet.
 - .7 Finish: Smooth.
 - .8 Jacket banding and mechanical seals: [12] mm wide, 0.5 mm thick stainless steel.

2.4 ACCESSORIES

- .1 Vapour retarder lap adhesive:
 - .1 Water based, fire retardant type, compatible with insulation.
 - .1 Maximum VOC limit [50] g/L to SCAQMD Rule 1168.
- .2 Indoor Vapour Retarder Finish:
 - .1 Vinyl emulsion type acrylic, compatible with insulation.
- .3 Insulating Cement: [hydraulic] setting on mineral wool, to ASTM C449.
- .4 ULC Listed Canvas Jacket:
 - .1 [220] gm/m² cotton, plain weave, [treated with dilute fire retardant lagging adhesive to ASTM C921] [untreated].
- .5 Outdoor Vapour Retarder Mastic:
 - .1 Vinyl emulsion type acrylic, compatible with insulation.
 - .2 Reinforcing fabric: Fibrous glass, untreated 305 g/m².
- .6 Tape: self-adhesive, aluminum, [plain], [50] mm wide minimum.
- .7 Contact adhesive: quick-setting
 - .1 Maximum VOC limit [50] g/L to SCAQMD Rule 1168.
- .8 Canvas adhesive: washable.
 - .1 Maximum VOC limit [50] g/L to SCAQMD Rule 1168.
- .9 Tie wire: [1.5] mm stainless steel.
- .10 Banding: [12] mm wide, [0.5] mm thick stainless steel.
- .11 Facing: [25] mm stainless steel hexagonal wire mesh stitched on one face of insulation with expanded metal lath on other face of insulation.
- .12 Fasteners: [2] mm diameter pins with [35] mm [diameter] clips, length to suit thickness of insulation.

Part 3 Execution**3.1 APPLICATION**

- .1 Manufacturer's Instructions: comply with manufacturer's written recommendations, including product technical bulletins, handling, storage and installation instructions, and datasheets.

3.2 PRE-INSTALLATION REQUIREMENTS

- .1 Pressure test ductwork systems complete, witness and certify.
- .2 Ensure surfaces are clean, dry, free from foreign material.

3.3 INSTALLATION

- .1 Install in accordance with TIAC National Standards.
- .2 Apply materials in accordance with manufacturers 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 Hangers and supports in accordance with [Section 23 05 29 - Hangers and Supports for HVAC Piping and Equipment].
 - .1 Apply high compressive strength insulation where insulation may be compressed by weight of ductwork.
- .6 Fasteners: install at 300 mm on centre in horizontal and vertical directions, minimum [2] rows each side.

3.4 DUCTWORK INSULATION SCHEDULE

- .1 Insulation types and thicknesses: conform to following table:

TIAC Code	Vapour Retarder	Thickness (mm)	
Rectangular cold and dual temperature supply air ducts	[C-1]	[yes]	[50]
Round cold and dual temperature supply air ducts	[C-2]	[yes]	[50]
Rectangular warm air ducts	[C-1]	[no]	[25]
Round warm air ducts	[C-1]	[no]	[25]
Supply, return and exhaust ducts exposed in space being served	[none]		
Outside air ducts to mixing plenum	[C-1]	[yes]	[25]
Mixing plenums	[C-1]	[yes]	[25]
Exhaust duct between	[C-1]	[no]	[25]

dampers and louvres			
Rectangular ducts outside	[C-1]	[special]	[50]
Round ducts outside	[C-1]	[special]	[50]
Acoustically lined ducts	[none]		

.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 table:

TIAC Code		
Rectangular	Round	
Indoor, concealed	none	none
Indoor, exposed within mechanical room	CRF/1	CRD/2
Indoor, exposed elsewhere	CRF/2	CRD/3
Outdoor, exposed to precipitation	CRF/3	CRD/4
Outdoor, elsewhere	CRF/4	CRD/5

3.5 CLEANING

.1 Clean in accordance with Section 01 00 15 - Cleaning.

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

.2 Waste Management: separate waste materials for recycling in accordance with Section 01 00 15 - Construction/Demolition Waste Management and Disposal.

END OF SECTION

Part 1 General**1.1 SUMMARY**

- .1 Section Includes:
 - .1 Thermal insulation for piping and piping accessories in commercial type applications.

1.2 REFERENCES

- .1 American Society of Heating, Refrigeration and Air Conditioning Engineers (ASHRAE)
 - .1 ASHRAE Standard 90.1, Energy Standard for Buildings Except Low-Rise Residential Buildings (IESNA co-sponsored; ANSI approved; Continuous Maintenance Standard).
- .2 NECB 2011, ABC 2014
- .3 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.
- .4 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) Jacketing Sheet, for Insulated Pipes, Vessels and Round Ducts
- .5 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.
- .6 Health Canada/Workplace Hazardous Materials Information System (WHMIS)
 - .1 Material Safety Data Sheets (MSDS).

- .7 Manufacturer's Trade Associations
 - .1 Thermal Insulation Association of Canada (TIAC): National Insulation Standards (Revised 2004).
- .8 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 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Submittals: in accordance with Section 01 00 15 - Submittal Procedures.
- .2 Product Data:
 - .1 Submit manufacturer's printed product literature, specifications and datasheet in accordance with Section 01 00 15 - 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 00 15 - Submittal Procedures.
- .3 Shop Drawings:
 - .1 Submit shop drawings in accordance with Section 01 00 15 - Submittal Procedures.
 - .1 Shop drawings: submit drawings stamped and signed by professional engineer registered or licensed in Alberta, Canada.
- .4 Samples:
 - .1 Submit samples in accordance with Section 01 00 15 - 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 label beneath sample indicating service.

- .5 Quality assurance submittals: submit following in accordance with Section 01 00 15 - 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 Departmental Representative will make available [1] copy of systems supplier's installation instructions.

1.5 QUALITY ASSURANCE

- .1 Qualifications:
- .2 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 member of TIAC.
- .3 Health and Safety:
 - .1 Do construction occupational health and safety in accordance with Section 01 00 15 - Health and Safety Requirements.

1.6 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 00 15 - Common Product Requirements.
 - .2 Deliver, store and handle materials in accordance with manufacturer's written instructions.
 - .3 Deliver materials to site in original factory packaging, labelled with manufacturer's name, address.
- .2 Storage and Protection:
 - .1 Protect from weather, construction traffic.
 - .2 Protect against damage.
 - .3 Store at temperatures and conditions required by manufacturer.
- .3 Waste Management and Disposal:
 - .1 Construction/Demolition Waste Management and Disposal: separate waste materials for recycling in accordance with Section 01 00 15 - Construction/Demolition Waste Management and Disposal.
 - .2 Place excess or unused insulation and insulation accessory materials in designated containers.
 - .3 Divert unused metal materials from landfill to metal recycling facility approved by Departmental Representative.
 - .4 Dispose of unused adhesive material at official hazardous material collections site approved by Departmental Representative.

Part 2**Products**

- .1 Cold Piping: Formed fine fibrous glass or formed mineral fibre pipe insulation meeting requirements of ULC S702; with factory applied vapour barrier jacket, factory moulded to conform to piping and as follows:
 - .2 K Value: Maximum 0.033 W/m°C at 24°C
 - .3 Service Temperature: 4°C to 100°C
- .4 Hot Piping: Formed fine fibrous glass or mineral fibre pipe insulation meeting requirements of ULC S702; with factory applied general purpose jacket, factory moulded to conform to piping and as follows:
 - .5 K Value: Maximum 0.033 W/m°C at 24°C
 - .6 Service Temperature: Up to 150°C
- .7 Refrigerant Piping: Foamed plastic of closed cell structure or closed cell elastomer meeting requirements of ULC S704 and as follows:
 - .8 K Value: Maximum 0.039 W/m°C at 24°C
 - .9 Maximum Water Vapour Transmission Rating:
 - .10 Unjacketed: 0.1 perm
 - .11 Jacketed: 0.1 perm
- .12 Roof Drains and Vents: Flexible fibrous glass or mineral fibre insulation meeting requirements of ULC S702; with factory applied reinforced aluminium foil vapour barrier and as follows:
 - .13 K Value: Maximum 0.033 W/m°C at 24°C
 - .14 Service Temperature: -14°C to 50°C
- .15 Fire Retardant Insulation for PVC [and Polypropylene] Piping: Formed fine fibrous glass or mineral fibre pipe insulation with cover material having flame spread 0 and smoke developed rating of 35 or less, plenum rated where exposed in return air installations or exposed ceiling installations.

2.2**INSULATION**

- .1 Mineral fibre specified includes glass fibre, rock wool, slag wool.
- .2 Thermal conductivity ("k" factor) not to exceed specified values at 24 degrees C mean temperature when tested in accordance with ASTM C335.
- .3 TIAC Code A-1: rigid moulded mineral fibre without factory applied vapour retarder jacket.
 - .1 Mineral fibre: to [CAN/ULC-S702] [ASTM C547].
 - .2 Maximum "k" factor: to CAN/ULC-S702.
- .4 TIAC Code A-3: rigid moulded mineral fibre with factory applied vapour retarder jacket.
 - .1 Mineral fibre: to [CAN/ULC-S702] [ASTM C547].
 - .2 Jacket: to CGSB 51-GP-52Ma.
 - .3 Maximum "k" factor: to [CAN/ULC-S702] [ASTM C547].
- .5 TIAC Code C-2: mineral fibre blanket faced [with] [without] factory applied vapour retarder jacket (as scheduled in PART 3 of this section).

- .1 Mineral fibre: to [CAN/ULC-S702] [ASTM C547].
- .2 Jacket: to CGSB 51-GP-52Ma.
- .3 Maximum "k" factor: to [CAN/ULC-S702] [ASTM C547].

2.3 INSULATION SECUREMENT

- .1 Tape: self-adhesive, aluminum, [plain], [50] mm wide minimum.
- .2 Contact adhesive: quick setting.
- .3 Canvas adhesive: washable.
- .4 Tie wire: [1.5] mm diameter stainless steel.
- .5 Bands: stainless steel, [19] mm wide, [0.5] mm thick.

2.4 VAPOUR RETARDER LAP ADHESIVE

- .1 Water based, fire retardant type, compatible with insulation.

2.5 INDOOR VAPOUR RETARDER FINISH

- .1 Vinyl emulsion type acrylic, compatible with insulation.

2.6 OUTDOOR VAPOUR RETARDER FINISH

- .1 Vinyl emulsion type acrylic, compatible with insulation.
- .2 Reinforcing fabric: fibrous glass, untreated 305 g/m².

2.7 JACKETS

- .1 Polyvinyl Chloride (PVC):
 - .1 One-piece moulded type [and sheet] to CAN/CGSB-51.53 with pre-formed shapes as required.
 - .2 Colours: to match adjacent finish paint.
 - .3 Minimum service temperatures: -20 degrees C.
 - .4 Maximum service temperature: 65 degrees C.
 - .5 Moisture vapour transmission: 0.02 perm.
 - .6 Thickness: 0.35 mm.
 - .7 Fastenings:
 - .1 Use solvent weld adhesive compatible with insulation to seal laps and joints.
 - .2 Tacks.
 - .3 Pressure sensitive vinyl tape of matching colour.
- .2 ABS Plastic:
 - .1 One-piece moulded type [and sheet] with pre-formed shapes as required.
 - .2 Colours: to match adjacent finish paint.
 - .3 Minimum service temperatures: -40 degrees C.
 - .4 Maximum service temperature: 82 degrees C.

- .5 Moisture vapour transmission: 0.012 perm.
- .6 Thickness: [0.75] mm.
- .7 Fastenings:
 - .1 Solvent weld adhesive compatible with insulation to seal laps and joints.
 - .2 Tacks.
 - .3 Pressure sensitive vinyl tape of matching colour.
- .8 Locations:
 - .1 For outdoor use ONLY.
- .3 Canvas:
 - .1 220 gm/m² cotton, plain weave, treated with dilute fire retardant lagging adhesive to ASTM C921.
 - .2 Lagging adhesive: compatible with insulation.
- .4 Aluminum:
 - .1 To ASTM B209.
 - .2 Thickness: [0.50] mm sheet.
 - .3 Finish: smooth.
 - .4 Joining: longitudinal and circumferential slip joints with [50] mm laps.
 - .5 Fittings: [0.5] mm thick die-shaped fitting covers with factory-attached protective liner.
 - .6 Metal jacket banding and mechanical seals: stainless steel, [19] mm wide, [0.5] mm thick at [300] mm spacing.
- .5 Stainless steel:
 - .1 Type: 304.
 - .2 Thickness: [0.25] mm.
 - .3 Finish: [smooth] [corrugated] [stucco embossed].
 - .4 Joining: longitudinal and circumferential slip joints with [50] mm laps.
 - .5 Fittings: [0.5] mm thick die-shaped fitting covers with factory-attached protective liner.
 - .6 Metal jacket banding and mechanical seals: stainless steel, [19] mm wide, [0.5] mm thick at [300] mm spacing.

2.8 WEATHERPROOF CAULKING FOR JACKETS INSTALLED OUTDOORS

- .1 Caulking to: Section 07 92 00 - Joint Sealants.

Part 3 Execution

3.1 MANUFACTURER'S INSTRUCTIONS

- .1 Compliance: comply with manufacturer's written recommendations or specifications, including product technical bulletins, handling, storage and installation instructions, and datasheet.

3.2 PRE-INSTALLATION REQUIREMENT

- .1 Pressure testing of piping systems and adjacent equipment to be complete, witnessed and certified.
- .2 Surfaces clean, dry, free from foreign material.

3.3 INSTALLATION

- .1 Install in accordance with TIAC National Standards.
- .2 Apply materials in accordance with manufacturers instructions and this specification.
- .3 Use two layers with staggered joints when required nominal wall thickness exceeds 75 mm.
- .4 Maintain uninterrupted continuity and integrity of vapour retarder jacket and finishes.
 - .1 Install hangers, supports outside vapour retarder jacket.
- .5 Supports, Hangers:
 - .1 Apply high compressive strength insulation, suitable for service, at oversized saddles and shoes where insulation saddles have not been provided.

3.4 REMOVABLE, PRE-FABRICATED, INSULATION AND ENCLOSURES

- .1 Application: at expansion joints, valves, primary flow measuring elements flanges and unions at equipment.
- .2 Design: to permit movement of expansion joint to permit periodic removal and replacement without damage to adjacent insulation.
- .3 Insulation:
 - .1 Insulation, fastenings and finishes: same as system.
 - .2 Jacket: PVC.

3.5 INSTALLATION OF ELASTOMERIC INSULATION

- .1 Insulation to remain dry. Overlaps to manufacturers instructions. Ensure tight joints.
- .2 Provide vapour retarder as recommended by manufacturer.

3.6 PIPING INSULATION SCHEDULES

- .1 Includes valves, valve bonnets, strainers, flanges and fittings unless otherwise specified.
- .2 TIAC Code: [A-1].
 - .1 Securements: SS bands at [300] mm on centre.
 - .2 Seals: lap seal adhesive, lagging adhesive.
 - .3 Installation: TIAC Code [1501-H].
- .3 TIAC Code: [A-3].
 - .1 Securements: SS bands at [300] mm on centre.
 - .2 Seals: VR lap seal adhesive, VR lagging adhesive.
 - .3 Installation: TIAC Code: [1501-C].

- .4 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.

Minimum Thickness of Piping Insulation (mm)

Application	Temp degrees C	Pipe sizes (NPS) inch				
		Runouts <=2	<=1	1 ¼ to 2	2 ½ to 4	>=5
Domestic HWS	[A-1]	25.4	25.4	25.4	25.4	38.1
Domestic CWS	[A-3]	25.4	25.4	25.4	38.1	38.1
Refrigerant[hot gas] [liquid] [suction]	4 - 13	25.4	25.4	25.4	25.4	25.4
Refrigerant[hot gas] [liquid] [suction]	below 4	25.4	25.4	38.1	38.1	38.1

- .5 Finishes:
- .1 Exposed indoors: aluminum jacket.
- .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 insulation compatible with insulation.
- .5 Outdoors: water-proof aluminum jacket.
- .6 Finish attachments: SS bands, at [150] mm on centre. Seals: closed.
- .7 Installation: to appropriate TIAC code CRF/1 through CPF/5.

3.7 FIELD QUALITY CONTROL

- .1 Verification requirements: Contractor's Verification, include:
- .1 Materials and resources.
- .2 Storage and collection of recyclables.
- .3 Construction waste management.
- .4 Resource reuse.
- .5 Recycled content.
- .6 Local/regional materials.
- .7 Certified wood.
- .8 Low-emitting materials.

3.8 CLEANING

- .1 Proceed in accordance with Section 01 00 15 - Cleaning.

- .2 Upon completion and verification of performance of installation, remove surplus materials, excess materials, rubbish, tools and equipment.

END OF SECTION

General**1.1 REFERENCE DOCUMENTS**

- .1 American Society for Testing and Materials (ASTM):
 - .1 ASTM A653/A653M-09 Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot Dip Process
- .3 National Fire Protection Association (NFPA):
 - .1 NFPA 90A-2009 Standard for the Installation of Air Conditioning and Ventilation Systems
 - .2 NFPA 90B-2009 Standard for the Installation of Warm Air Heating and Air Conditioning Systems
- .4 Model National Energy Building Code of Canada for Buildings.

1.2 ALTERNATIVES

- .1 Size round ducts installed in place of rectangular ducts indicated from ASHRAE table of equivalent rectangular and round ducts. No variation of duct configuration of sizes permitted except by written permission.

1.3 DEFINITIONS

- .1 Low Pressure: Static pressure in duct less than 0.5 kPa and velocities less than 10 m/s.
- .2 Medium Pressure: Static pressure in duct less than 1.5 kPa and velocities greater than 10 m/s.
- .3 High Pressure: Static pressure over 1.5 kPa and less than 2.5 kPa and velocities greater than 10 m/s.
- .4 Duct Sizes: Inside clear dimensions. For acoustically lined or internally insulated ducts, maintain sizes inside ducts.

1.4 SUBMITTALS

- .1 Shop Drawings:
 - .1 Submit shop drawings in accordance with Section 20 00 13 – Mechanical General Requirements.
 - .1 Submit shop drawings and samples of duct fittings for approval, including particulars such as thicknesses, welds and configurations prior to start of work.
 - .2 Submit shop drawings for fibrous glass ducts including manufacturers fabrication and installation manual.
 - .2 Submit written inspection report of manufacturers acceptance of fabrication and installation of fibrous glass ductwork. Confirm ductwork has been fabricated and installed in accordance with recommendations and SMACNA standards. Inspection shall occur at beginning of installation.

1.5 QUALITY ASSURANCE

- .1 Ductwork shall meet the requirements of NFPA 90A, Air Conditioning and Ventilating Systems [, NFPA No. 90B, Standard for the Installation of Warm Air Heating and Air Conditioning 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.

1.6 DELIVERY, STORAGE, AND HANDLING

- .1 Separate waste materials for recycling in accordance with Section 01 00 15 – Waste Management and Disposal.

2. Products**2.1 MATERIALS**

- .1 Ducts: Galvanized steel lock forming quality, having galvanized coating to ASTM A653M, G90 designation for both sides.
- .2 Fasteners: Use rivets and bolts throughout; sheet metal screws accepted on low pressure ducts.
- .3 Sealant: Water resistant, fire resistive, compatible with mating materials.

- .4 Flexible Ducts: Corrugated aluminum or fabric supported by helically wound steel wire or flat steel strips.
- .5 Flexible Fibrous Glass Ducts: Flexible duct wrapped with flexible fibrous glass insulation, enclosed by seamless aluminum pigmented plastic vapour barrier jacket, "K" value at 24°C maximum 0.033 W/m.°C
- .6 Fibrous Glass Duct: 25 mm thick rigid fibrous glass with aluminum foil, glass scrim and kraft or plastic jacket vapour barrier, "K" value at 24°C maximum 0.033 W/m.°C
- .7 Kitchen Exhaust Ducts: Minimum 1.6 mm galvanized steel or 1.2 mm stainless steel with welded joints.

2.2 FABRICATION

- .1 Complete metal ducts with themselves with no single partition between ducts. Where width of duct exceeds 450 mm cross break for rigidity. Open corners are not acceptable.
- .2 Lap metal ducts in direction of air flow. Hammer down edges and slips to leave smooth duct interior.
- .3 Construct tees, bends, and elbows with radius of not less than 1 1/2 times width of duct on centre line. Where not possible and where rectangular elbows used, provide approved type air foil turning vanes. Where acoustical lining is provided, provide turning vanes of perforated metal type with fibreglass inside.
- .4 Increase duct sizes gradually, not exceeding 15 degree divergence wherever possible. Maximum divergence upstream of equipment to be 30 degree and 45 degree convergence downstream.
- .5 Rigidly construct metal ducts with joints mechanically tight, substantially airtight, braced and stiffened so as not to breathe, rattle, vibrate or sag. Caulk duct joints and connections with sealant as ducts are being assembled.
- .6 Provide easements where low pressure ductwork conflicts with piping and structure where easements exceed 10% duct area, split into two ducts maintaining original duct area.
- .7 Provide necessary baffling in mixed air plenums to ensure good mixed air temperature with variations of not more than $\pm 15^{\circ}\text{C}$ under all operating conditions.

-
- .8 Fabricate continuously welded medium and high pressure round and oval duct fittings of one gauge heavier than gauges indicated for duct size. Joints shall be 100 mm cemented slip joint, brazed or electric welded. Prime coat welded joints. Fabricate elbows of five piece construction. Provide standard 45° take-offs unless otherwise indicated where conical 90° tee take-off connections may be used. Adequately brace with truss couplings or comparison angle flanges with asbestos gaskets bolted at 150 mm centers.
 - .9 Fabricate plenums and casings to configurations shown on drawings. Construct plenums of galvanized panels joined standing seams on outside of casing riveted or bolted on approximately 300 mm centers. Reinforce with suitable angles and provide diagonal bracing as required. Tightly fit at apparatus and caulk with sealant.
 - .10 Provide 75 mm reinforced concrete curb for plenum walls and floor mounted casings. At floor, rivet panels on 200 mm centers to angles. Where floors are acoustically insulated, provide liner at 1.2 mm galvanized expanded metal mesh, turned up 300 mm at sides with sheet metal shields.
 - .11 Reinforce door frames with angle iron tied to horizontal and vertical plenum supporting angles. Install hinged access doors where shown, specified or where required for access to equipment for cleaning and inspection.
 - .12 Fabricate acoustic plenums of galvanized steel. Provide 1.6 mm back facing and 0.8 mm perforated front facing with 3 mm diameter holes on 4 mm centers. Construct panels 75 mm thick packed with 72 kg/m³ minimum fibrous glass media, on inverted channels of 1.6 mm [on 75 mm reinforced concrete curb].
 - .13 Fabricate fibrous glass ducts and fittings by fabrication machine. Make only minor on site manual adjustments. Wipe clean surfaces being joined. Join with heat activated chemical bonding closure strip [equal to Johns-Manville ThermLock closure system. Provide at duct support locations, an extra wrapping of closure strip].
 - .14 Fabricate seams and joints in kitchen exhaust ducts liquid tight with continuous external welds.

3. Execution**3.1 INSTALLATION**

- .1 Provide openings in ductwork where required to accommodate thermometers and controllers. Provide pivot tube openings where required for testing of systems, complete with metal can with spring device or screw to ensure against air leakage. Where openings are provided in insulated ductwork, install insulation material inside a metal ring.
- .2 Clean duct systems and force air at high velocity through duct to remove accumulated dust. To obtain sufficient air, clean half the system at a time. Protect equipment which may be harmed by excessive dirt with filters, or bypass during cleaning.
- .3 Locate ducts with sufficient space around equipment to allow normal operating and maintenance activities.
- .4 Provide floor drains in fresh air and humidifier sections with deep seal traps.
- .5 Set plenum doors 150 mm to 300 mm above floor. Arrange door swings so that fan static holds door in closed position.
- .6 Connect terminal units to medium or high pressure ducts with 300 mm maximum length of flexible duct. Do not use flexible duct to change direction.
- .7 Connect diffusers or troffer boots to low pressure ducts with 1.5 m maximum length of flexible duct. Hold in place with caulking compound and strap or clamp.

3.2 LOW PRESSURE DUCT THICKNESSES (MINIMUM)

.1 Rectangular Ducts	
Maximum Width	mm
Up to 300 mm	0.6
330 mm to 760 mm	0.8
790 mm to 1370 mm	0.8
1400 mm to 2130 mm	1.0
2160 mm and Over	1.2

.2	Round Ducts		
	Duct Diameter	mm	
	Up to 330 mm	0.6	
	350 mm to 550 mm	0.8	
	580 mm to 1270 mm	0.8	
	890 mm to 910 mm	1.0	
	1300 mm to 1520 mm	1.2	
	1550 mm to 2130 mm	1.6	
.3	Underground Ducts		
		Spiral Lock	Longitudinal
		Seam	Seam
	Duct Diameter	mm	mm
	Up to 380 mm	0.8	0.8
	400 to 510 mm	0.8	1.0
	530 to 890 mm	1.0	1.2
	Over 910 mm	1.2	1.6

3.3 MEDIUM PRESSURE DUCT THICKNESS

.1	Rectangular Ductwork	
	Maximum	mm
	Up to 460 mm	0.8
	480 mm to 1220 mm	0.8
	1250 mm to 1830 mm	1.0
	1850 mm to 2440 mm	1.2
	2460 mm and Over	1.6

3.4 MEDIUM & HIGH PRESSURE DUCT THICKNESSES

.1	Round Ducts	Spiral Lock	Longitudinal
		Seam	Seam
		mm	mm
		Up to 200 mm	0.6
		230 to 560 mm	0.8
		580 to 910 mm	0.8
		940 to 1270 mm	1.0
		1300 to 1520 mm	1.0
		1550 mm and Over	1.2
			1.2
			0.6

3.5 OVAL DUCTWORK (FACTORY MADE WITH SPIRAL LOCK SEAMS)

.1	Maximum Width	mm	Centers	Reinforcement
	Up to 500 mm	0.8		none
	280 to 500 mm	0.8	1220 mm	L50 x 50 x 3 mm
	530 to 1020 mm	1.2	760 mm	L50 x 50 x 5 mm
	1040 to 1830 mm	1.6	600 mm	L75 x 75 x 5 mm

3.6 PLENUM GAUGES

- .1 Fabricate fan plenums and plenums downstream of fan in accordance with duct gauges.
- .2 Fabricate plenums upstream of fan between apparatus of 1.6 mm.
- .3 Fabricate plenums upstream of filters of 1.2 mm

3.7 FIBROUS GLASS DUCTS

- .1 Fibrous glass ductwork may be substituted for internally or externally insulated or uninsulated low pressure sheet metal ductwork.

3.7 KITCHEN EXHAUST DUCTS

- .1 Protect galvanized ductwork exposed to outside elements by painting or coating with suitable weather resistant material.
- .2 Provide residue traps at base of vertical risers with provisions for cleanout.

END OF SECTION

Part 1 General**1.1 REFERENCES**

- .1 Sheet Metal and Air Conditioning Contractors' National Association (SMACNA)
 - .1 SMACNA - HVAC Duct Construction Standards - Metal and Flexible.

1.2 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Submit in accordance with Section 01 00 15 - Submittal Procedures.
- .2 Product Data:
 - .1 Submit manufacturer's instructions, printed product literature and data sheets for air duct accessories and include product characteristics, performance criteria, physical size, finish and limitations.
 - .2 Indicate:
 - .1 Flexible connections.
 - .2 Duct access doors.
 - .3 Turning vanes.
 - .4 Instrument test ports.

1.3 DELIVERY, STORAGE AND HANDLING

- .1 Deliver, store and handle materials in accordance with Section 01 00 15 - Common Product Requirements with manufacturer's written instructions.
- .2 Delivery and Acceptance Requirements: deliver materials to site in original factory packaging, labelled with manufacturer's name and address.
- .3 Storage and Handling Requirements:
 - .1 Store materials indoors in dry location and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.
 - .2 Store and protect air duct accessories from nicks, scratches, and blemishes.
 - .3 Replace defective or damaged materials with new.
- .4 Packaging Waste Management: remove for reuse by manufacturer of packaging materials as specified in Construction Waste Management Plan Waste Reduction Workplan in accordance with Section 01 00 15 - Construction/Demolition Waste Management and Disposal.

Part 2 Products**2.1 GENERAL**

- .1 Manufacture in accordance with SMACNA - HVAC Duct Construction Standards.

2.2 FLEXIBLE CONNECTIONS

- .1 Frame: galvanized sheet metal frame 1.2 mm thick with fabric clenched by means of double locked seams.
- .2 Material:
 - .1 Fire resistant, self-extinguishing, neoprene coated glass fabric, temperature rated at minus [40] degrees C to plus [90] degrees C, density of [1.3] kg/m².

2.3 ACCESS DOORS IN DUCTS

- .1 Non-Insulated Ducts: sandwich construction of same material as duct, one sheet metal thickness heavier, minimum 0.6 mm thick complete with sheet metal angle frame.
- .2 Insulated Ducts: sandwich construction of same material as duct, one sheet metal thickness heavier, minimum 0.6 mm thick complete with sheet metal angle frame and 25 mm thick rigid glass fibre insulation.
- .3 Gaskets: [neoprene] [foam rubber].
- .4 Hardware:
 - .1 Up to [300 x 300] mm: two sash locks [complete with safety chain].
 - .2 [301 to 450] mm: four sash locks [complete with safety chain].
 - .3 [451 to 1000] mm: piano hinge and minimum two sash locks.
 - .4 Doors over [1000] mm: piano hinge and two handles operable from both sides.
 - .5 Hold open devices.

2.4 TURNING VANES

- .1 Factory or shop fabricated single thickness with trailing edge, to recommendations of SMACNA and as indicated.

2.5 INSTRUMENT TEST

- .1 [1.6] mm thick steel zinc plated after manufacture.
- .2 Cam lock handles with neoprene expansion plug and handle chain.
- .3 28 mm minimum inside diameter. Length to suit insulation thickness.
- .4 Neoprene mounting gasket.

2.6 SPIN-IN COLLARS

- .1 Conical galvanized sheet metal spin-in collars with lockable butterfly damper.
- .2 Sheet metal thickness to co-responding round duct standards.

Part 3 Execution**3.1 EXAMINATION**

- .1 Verification of Conditions: verify that conditions of substrate previously installed under other Sections or Contracts are acceptable for air duct accessories installation in accordance with manufacturer's written instructions.
 - .1 Visually inspect substrate in presence of Departmental Representative.
 - .2 Inform Departmental Representative of unacceptable conditions immediately upon discovery.
 - .3 Proceed with installation only after unacceptable conditions have been remedied and after receipt of written approval to proceed from Departmental Representative.

3.2 INSTALLATION

- .1 Flexible Connections:
 - .1 Install in following locations:
 - .1 Inlets and outlets to supply air units and fans.
 - .2 Inlets and outlets of exhaust and return air fans.
 - .3 As indicated.
 - .2 Length of connection: [100] mm.
 - .3 Minimum distance between metal parts when system in operation: [75] mm.
 - .4 Install in accordance with recommendations of SMACNA.
 - .5 When fan is running:
 - .1 Ducting on sides of flexible connection to be in alignment.
 - .2 Ensure slack material in flexible connection.
- .2 Access Doors and Viewing Panels:
 - .1 Size:
 - .1 600 x 600 mm for servicing entry.
 - .2 300 x 300 mm for viewing.
 - .3 As indicated.
 - .2 Locations:
 - .1 Fire and smoke dampers.
 - .2 Control dampers.
 - .3 Devices requiring maintenance.
 - .4 Required by code.
 - .5 Reheat coils.
 - .6 Elsewhere as indicated.
- .3 Instrument Test Ports:
 - .1 General:
 - .1 Install in accordance with recommendations of SMACNA and in accordance with manufacturer's instructions.

- .2 Locate to permit easy manipulation of instruments.
- .3 Install insulation port extensions as required.
- .4 Locations:
 - .1 For traverse readings:
 - .1 Ducted inlets to roof and wall exhausters.
 - .2 Inlets and outlets of other fan systems.
 - .3 Main and sub-main ducts.
 - .4 And as indicated.
 - .2 For temperature readings:
 - .1 At outside air intakes.
 - .2 In mixed air applications in locations as approved by Departmental Representative.
 - .3 At inlet and outlet of coils.
 - .4 Downstream of junctions of two converging air streams of different temperatures.
 - .5 And as indicated.
- .4 Turning Vanes:
 - .1 Install in accordance with recommendations of SMACNA and as indicated.

3.3 CLEANING

- .1 Progress Cleaning: clean in accordance with Section 01 00 15 - 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 00 15 - Cleaning.
- .3 Waste Management: separate waste materials for recycling in accordance with Section 01 00 15 - Construction/Demolition Waste Management and Disposal.
 - .1 Remove recycling containers and bins from site and dispose of materials at appropriate facility.

END OF SECTION

Part 1 General**1.1 REFERENCES**

- .1 Sheet Metal and Air Conditioning National Association (SMACNA)
 - .1 SMACNA HVAC Duct Construction Standards, Metal and Flexible.

1.2 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Submit in accordance with Section 01 00 15 - Submittal Procedures.
- .2 Product Data:
 - .1 Submit manufacturer's instructions, printed product literature and data sheets for dampers and include product characteristics, performance criteria, physical size, finish and limitations.

1.3 CLOSEOUT SUBMITTALS

- .1 Submit in accordance with Section 01 00 15 - Closeout Submittals.
- .2 Operation and Maintenance Data: submit operation and maintenance data for dampers for incorporation into manual.

1.4 DELIVERY, STORAGE AND HANDLING

- .1 Deliver, store and handle materials in accordance with Section 01 00 15 - Common Product Requirements] [with manufacturer's written instructions.
- .2 Delivery and Acceptance Requirements: deliver materials to site in original factory packaging, labelled with manufacturer's name and address.
- .3 Storage and Handling Requirements:
 - .1 Store materials indoors in dry location and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.
 - .2 Store and protect dampers from nicks, scratches, and blemishes.
 - .3 Replace defective or damaged materials with new.
- .4 Packaging Waste Management: remove for reuse by manufacturer packaging materials as specified in Construction Waste Management Plan Waste Reduction Workplan in accordance with Section 01 00 15 - Construction/Demolition Waste Management and Disposal.

Part 2 Products**2.1 GENERAL**

- .1 Manufacture to SMACNA standards.

2.2 SPLITTER DAMPERS

- .1 Fabricate from same material as duct but one sheet metal thickness heavier, with appropriate stiffening.
- .2 Double thickness construction.
- .3 Control rod with locking device and position indicator.
- .4 Rod configuration to prevent end from entering duct.
- .5 Pivot: piano hinge.
- .6 Folded leading edge.

2.3 SINGLE BLADE DAMPERS

- .1 Fabricate from same material as duct, but one sheet metal thickness heavier. V-groove stiffened.
- .2 Size and configuration to recommendations of SMACNA, except maximum height 100 mm.
- .3 Locking quadrant with shaft extension to accommodate insulation thickness.
- .4 Inside and outside nylon end bearings.
- .5 Channel frame of same material as adjacent duct, complete with angle stop.

2.4 MULTI-BLADED DAMPERS

- .1 Factory manufactured of material compatible with duct.
- .2 Opposed blade: configuration, metal thickness and construction to recommendations of SMACNA.
- .3 Maximum blade height: 100 mm.
- .4 Bearings: pin in bronze bushings.
- .5 Linkage: shaft extension with locking quadrant.
- .6 Channel frame of same material as adjacent duct, complete with angle stop.

Part 3 Execution**3.1 EXAMINATION**

- .1 Verification of Conditions: verify that conditions of substrate previously installed under other Sections or Contracts are acceptable for damper installation in accordance with manufacturer's written instructions.
 - .1 Visually inspect substrate in presence of Departmental Representative.
 - .2 Inform Departmental Representative of unacceptable conditions immediately upon discovery.
 - .3 Proceed with installation only after unacceptable conditions have been remedied and after receipt of written approval to proceed from Departmental Representative.

3.2 INSTALLATION

- .1 Install where indicated.
- .2 Install in accordance with recommendations of SMACNA and in accordance with manufacturer's instructions.
- .3 Locate balancing dampers in each branch duct, for supply, return and exhaust systems.
- .4 Runouts to registers and diffusers: install single blade damper located as close as possible to main ducts.
- .5 Dampers: vibration free.
- .6 Ensure damper operators are observable and accessible.
- .7 Corrections and adjustments conducted by Departmental Representative.

3.3 CLEANING

- .1 Progress Cleaning: clean in accordance with Section 01 00 15 - 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 00 15 - Cleaning.
- .3 Waste Management: separate waste materials for recycling in accordance with Section 01 00 15 - Construction/Demolition Waste Management and Disposal.
 - .1 Remove recycling containers and bins from site and dispose of materials at appropriate facility.

END OF SECTION

Part 1 General**1.1 REFERENCES**

- .1 American Society of Heating, Refrigerating and Air-Conditioning Engineers, Inc. (ASHRAE)
- .2 National Fire Protection Association (NFPA)
 - .1 NFPA 90A, Standard for the Installation of Air-Conditioning and Ventilating Systems.
 - .2 NFPA 90B, Standard for Installation of Warm Air Heating and Air-Conditioning Systems.
- .3 Sheet Metal and Air-Conditioning Contractors' National Association (SMACNA)
 - .1 SMACNA HVAC Duct Construction Standards - Metal and Flexible.
 - .2 SMACNA IAQ Guideline for Occupied Buildings under Construction.
- .4 Underwriters' Laboratories (UL)
 - .1 UL 181, Standard for Factory-Made Air Ducts and Air Connectors.
- .5 Underwriters' Laboratories of Canada (ULC)
 - .1 CAN/ULC-S110, Standard Methods of Tests for Air Ducts.

1.2 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Submit in accordance with Section 01 00 15 - Submittal Procedures.
- .2 Product Data:
 - .1 Submit manufacturer's instructions, printed product literature and data sheets for flexible ducts and include product characteristics, performance criteria, physical size, finish and limitations.
 - .2 Indicate:
 - .1 Thermal properties.
 - .2 Friction loss.
 - .3 Acoustical loss.
 - .4 Leakage.
 - .5 Fire rating.
- .3 Test and Evaluation Reports:
 - .1 Catalogue or published ratings to be those obtained from tests carried out by manufacturer or independent testing agency signifying adherence to codes and standards.

1.3 DELIVERY, STORAGE AND HANDLING

- .1 Deliver, store and handle materials in accordance with Section 01 00 15 - 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 material indoors in dry location and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.
 - .2 Store and protect flexible ducts from nicks, scratches, and blemishes.
 - .3 Replace defective or damaged materials with new.
- .4 Packaging Waste Management: remove for reuse by manufacturer of packaging materials as specified in Construction Waste Management Plan Waste Reduction Workplan in accordance with Section 01 00 15 - Construction/Demolition Waste Management and Disposal.

Part 2 Products

2.1 GENERAL

- .1 Factory fabricated to CAN/ULC-S110.
- .2 Pressure drop coefficients listed below are based on relative sheet metal duct pressure drop coefficient of 1.00.
- .3 Flame spread rating not to exceed 25. Smoke developed rating not to exceed 50.

2.2 METALLIC - UNINSULATED

- .1 [Type 1]: spiral wound flexible aluminum, as indicated.
- .2 Performance:
 - .1 Factory tested to [2.5] kPa without leakage.
 - .2 Maximum relative pressure drop coefficient: [3].

2.3 METALLIC - INSULATED

- .1 [Type 2]: spiral wound flexible aluminum with factory applied, [37] mm thick flexible glass fibre thermal insulation with vapour barrier and [vinyl] [reinforced mylar/neoprene laminate] [aluminum] jacket, as indicated.
- .2 Performance:
 - .1 Factory tested to [2.5] kPa without leakage.
 - .2 Maximum relative pressure drop coefficient: [3].

2.4 NON-METALLIC - UNINSULATED

- .1 [Type 3]: non-collapsible, coated [mineral base fabric] [aluminum foil mylar] type, mechanically bonded to, and helically supported by, external [steel] wire, as indicated.
- .2 Performance:
 - .1 Factory tested to [2.5] kPa without leakage.
 - .2 Maximum relative pressure drop coefficient: [3].

2.5 NON-METALLIC - INSULATED

- .1 [Type 4]: non-collapsible, coated [mineral base fabric] [aluminum foil/mylar] type mechanically bonded to, and helically supported by, external [steel] wire with factory applied, [37] mm thick flexible mineral fibre thermal insulation with vapour barrier and [vinyl] [reinforced mylar/neoprene laminate] jacket, as indicated.
- .2 Performance:
 - .1 Factory tested to [2.5] kPa without leakage.
 - .2 Maximum relative pressure drop coefficient: [3].

2.6 NON-METALLIC - ACOUSTIC INSULATED

- .1 [Type 7]: non-collapsible, coated mineral base perforated fabric type helically supported by and mechanically bonded to [steel] wire with factory applied flexible mineral fibre acoustic insulation and encased in [aluminum foil/mylar laminate] [Type M] vapour barrier[, as indicated].
- .2 Performance:
 - .1 Factory tested to [2.5] kPa without leakage.
 - .2 Maximum relative pressure drop coefficient: [3].
 - .3 Acoustical performance: Minimum attenuation (dB/m) to following table:

Frequency (Hz)					
Duct Diam:	125	250	500	1000	2000
[100]	[0.6]	[3]	[12]	[27]	[0]
[150]	[1.2]	[3]	[12]	[22]	[27]
[200]	[2.0]	[5]	[12]	[19]	[20]
[300]	[2.4]	[5]	[12]	[16]	[15]

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 flexible ducts installation in accordance with manufacturer's written instructions.
 - .1 Visually inspect substrate in presence of Departmental Representative.
 - .2 Inform Departmental Representative of unacceptable conditions immediately upon discovery.
 - .3 Proceed with installation only after unacceptable conditions have been remedied and after receipt of written approval to proceed from Departmental Representative.

3.2 DUCT INSTALLATION

- .1 Install in accordance with: CAN/ULC-S110, NFPA 90A, SMACNA.

3.3 CLEANING

- .1 Progress Cleaning: clean in accordance with Section 01 00 15 - 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 00 15 - Cleaning.
- .3 Waste Management: separate waste materials for recycling] in accordance with Section 01 00 15 - Construction/Demolition Waste Management and Disposal.
 - .1 Remove recycling containers and bins from site and dispose of materials at appropriate facility.

END OF SECTION

Part 1 General**1.1 REFERENCES**

- .1 ASTM International
 - .1 ASTM C423, Standard Test Method for Sound Absorption and Sound Absorption Coefficients by the Reverberation Room Method.
 - .2 ASTM C916, Standard Specification for Adhesives for Duct Thermal Insulation.
 - .3 ASTM C1071, Standard specification for Fibrous Glass Duct Lining Insulation (Thermal and Sound Absorbing Material).
 - .4 ASTM C1338, Standard Test Method for Determining Fungi Resistance of Insulation Materials and Facings.
 - .5 ASTM G21, Standard Practice for Determining Resistance of Synthetic Polymeric Materials to Fungi.
- .2 National Fire Protection Association (NFPA)
 - .1 NFPA 90A, Standard for the Installation of Air Conditioning and Ventilating Systems.
 - .2 NFPA 90B, Standard for the Installation of Warm Air Heating and Air Conditioning Systems.
- .3 North American Insulation Manufacturers Association (NAIMA)
 - .1 NAIMA AH116, Fibrous Glass Duct Construction Standards.
- .4 Sheet Metal and Air Conditioning Contractor's National Association (SMACNA)
 - .1 SMACNA, HVAC Duct Construction Standards, Metal and Flexible.
- .5 Underwriter's Laboratories of Canada (ULC)
 - .1 CAN/ULC-S102, Standard Method of Test for Surface Burning Characteristics of Building Materials and Assemblies.

1.2 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Submit in accordance with Section 01 00 15 - Submittal Procedures.
- .2 Product Data:
 - .1 Submit manufacturer's instructions, printed product literature and data sheets for duct liners and include product characteristics, performance criteria, physical size, finish and limitations.

1.3 CLOSEOUT SUBMITTALS

- .1 Submit in accordance with Section 01 00 15 - Closeout Submittals.
- .2 Operation and Maintenance Data: submit operation and maintenance data for duct liners for incorporation into manual.

1.4 DELIVERY, STORAGE AND HANDLING

- .1 Deliver, store and handle materials in accordance with Section 01 00 15 - Common Product Requirements with manufacturer's written instructions.
- .2 Delivery and Acceptance Requirements: deliver materials to site in original factory packaging, labelled with manufacturer's name and address.
- .3 Storage and Handling Requirements:
 - .1 Store materials indoors in dry location and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.
 - .2 Store and protect duct liners from nicks, scratches, and blemishes.
 - .3 Replace defective or damaged materials with new.
- .4 Packaging Waste Management: remove for reuse by manufacturer of packaging materials as specified in Construction Waste Management Plan Waste Reduction Workplan in accordance with Section 01 00 15 - Construction/Demolition Waste Management and Disposal.

Part 2 Products**2.1 DUCT LINER**

- .1 General:
 - .1 Mineral Fibre duct liner: air surface coated mat facing.
 - .2 Flame spread rating shall not exceed 25. Smoke development rating shall not exceed 50 when tested in accordance with [CAN/ULC-S102] [NFPA 90A] [NFPA 90B].
 - .3 Fungi resistance: to [ASTM C1338] [ASTM G21].
- .2 Rigid:
 - .1 Use on flat surfaces.
 - .2 [25] mm thick, to [ASTM C1071] Type [2], fibrous glass rigid board duct liner.
 - .3 Density: [48] kg/m³ minimum.
 - .4 Thermal resistance to be minimum 0.76 (m². degrees C)/W for 25 mm thickness when tested in accordance with ASTM C177, at 24 degrees C mean temperature.
 - .5 Maximum velocity on faced air side: 20.3] m/s.
 - .6 Minimum NRC of [0.70 at 25 mm] thickness based on Type A mounting to ASTM C423.

2.2 ADHESIVE

- .1 Adhesive: to [NFPA 90A and NFPA 90B] [ASTM C916].
- .2 Flame spread rating shall not exceed 25. Smoke development rating shall not exceed 50. Temperature range minus 29 degrees C to plus 93 degrees C.
- .3 Water-based [fire retardant] type.

2.3 FASTENERS

- .1 Weld pins [2.0] mm diameter, length to suit thickness of insulation. Metal retaining clips, [32] mm square.

2.4 JOINT TAPE

- .1 Poly-Vinyl treated open weave fiberglass membrane [50] mm wide.

2.5 SEALER

- .1 Meet requirements of [NFPA 90A] [NFPA 90B].
- .2 Flame spread rating shall not exceed 25. Smoke development rating shall not exceed 50. Temperature range minus 68 degrees C to plus 93 degrees C.

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 duct liner installation in accordance with manufacturer's written instructions.
 - .1 Visually inspect substrate in presence of Departmental Representative.
 - .2 Inform Departmental Representative of unacceptable conditions immediately upon discovery.
 - .3 Proceed with installation only after unacceptable conditions have been remedied and after receipt of written approval to proceed from Departmental Representative.

3.2 GENERAL

- .1 Do work in accordance with [SMACNA HVAC Duct Construction Standard] [NAIMA AH116] [as indicated] except as specified otherwise.
- .2 Line inside of ducts where indicated.
- .3 Duct dimensions, as indicated, are clear inside duct lining.

3.3 DUCT LINER

- .1 Install in accordance with manufacturer's recommendations, and as follows:
 - .1 Fasten to interior sheet metal surface with 100% coverage of adhesive [to ASTM C916].
 - .1 Exposed leading edges and transverse joints to be factory coated or coated with adhesive during fabrication.
 - .2 In addition to adhesive, [install weld pins not less than 2 rows per surface and not more than 425 mm on centres] [impact driven mechanical fasteners] to compress duct liner sufficiently to hold it firmly in place.
 - .1 Spacing of mechanical fasteners in accordance with SMAC HVAC Duct Construction Standard.

- .2 In systems, where air velocities exceeds [20.3] m/s, install galvanized sheet metal nosing to leading edges of duct liner.

3.4 JOINTS

- .1 Seal butt joints, exposed edges, weld pin and clip penetrations and damaged areas of liner with joint tape and sealer. Install joint tape in accordance with manufacturer's written recommendations, and as follows:
 - .1 Bed tape in sealer.
 - .2 Apply [2] coats of sealer over tape.
- .2 Replace damaged areas of liner at discretion of Departmental Representative.
- .3 Protect leading [and trailing] edges of duct sections with sheet metal nosing having [15] mm overlap and fastened to duct.

3.5 CLEANING

- .1 Progress Cleaning: clean in accordance with Section 01 00 15 - 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 00 15 - Cleaning.
- .3 Waste Management: separate waste materials for recycling in accordance with Section 01 00 15 - Construction/Demolition Waste Management and Disposal.
 - .1 Remove recycling containers and bins from site and dispose of materials at appropriate facility.

END OF SECTION

Part 1 General**1.1 REFERENCES****1.2 ACTION AND INFORMATIONAL SUBMITTALS**

- .1 Submit in accordance with Section 01 00 15 - Submittal Procedures.
- .2 Product Data:
 - .1 Submit manufacturer's instructions, printed product literature and data sheets for diffusers, registers and grilles and include product characteristics, performance criteria, physical size, finish and limitations.
 - .2 Indicate following:
 - .1 Capacity.
 - .2 Throw and terminal velocity.
 - .3 Noise criteria.
 - .4 Pressure drop.
 - .5 Neck velocity.
- .3 Samples:
 - .1 Samples are required for following:
 - .1 Submit duplicate 300 x 300 mm samples of each type.

1.3 MAINTENANCE MATERIAL SUBMITTALS

- .1 Extra Materials:
 - .1 Provide maintenance materials in accordance with Section 01 00 15 - Closeout Submittals.
 - .2 Include:
 - .1 Keys for volume control adjustment.
 - .2 Keys for air flow pattern adjustment.

1.4 DELIVERY, STORAGE AND HANDLING

- .1 Deliver, store and handle materials in accordance with Section 01 00 15 - Common Product Requirements with manufacturer's written instructions.
- .2 Delivery and Acceptance Requirements: deliver materials to site in original factory packaging, labelled with manufacturer's name and address.
- .3 Storage and Handling Requirements:
 - .1 Store materials indoors in dry location] and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.
 - .2 Store and protect diffuser, registers and grilles from nicks, scratches, and blemishes.
 - .3 Replace defective or damaged materials with new.

- .4 Packaging Waste Management: remove for reuse by manufacturer packaging materials as specified in Construction Waste Management Plan Waste Reduction Workplan in accordance with Section 01 00 15 - Construction/Demolition Waste Management and Disposal.

Part 2 Products

2.1 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.

2.2 GENERAL

- .1 To meet capacity, pressure drop, terminal velocity, throw, noise level, neck velocity as indicated.
- .2 Frames:
 - .1 Full perimeter gaskets.
 - .2 Plaster frames where set into plaster or gypsum board.
 - .3 Concealed fasteners.
- .3 Concealed manual volume control damper operators.
- .4 Colour: as directed by Departmental Representative.

2.3 MANUFACTURED UNITS

- .1 Grilles, registers and diffusers of same generic type, products of one manufacturer.
- .2 Performance: refer to schedule.

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 diffuser, register and grille installation in accordance with manufacturer's written instructions.
 - .1 Visually inspect substrate in presence of Departmental Representative.
 - .2 Inform Departmental Representative of unacceptable conditions immediately upon discovery.
 - .3 Proceed with installation only after unacceptable conditions have been remedied and after receipt of written approval to proceed from Departmental Representative.

3.2 INSTALLATION

- .1 Install in accordance with manufacturer's instructions.
- .2 Install with flat head screws in countersunk holes where fastenings are visible.
- .3 Bolt grilles, registers and diffusers, in place, in gymnasium and similar game rooms.
- .4 Provide concealed safety chain on each grille, register and diffuser in gymnasium and similar game rooms [and elsewhere as indicated].

3.3 CLEANING

- .1 Progress Cleaning: clean in accordance with Section 01 00 15 - 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 00 15 - Cleaning.
- .3 Waste Management: separate waste materials for recycling in accordance with Section 01 00 15 - Construction/Demolition Waste Management and Disposal.
 - .1 Remove recycling containers and bins from site and dispose of materials at appropriate facility.

END OF SECTION

Part 1 General**1.1 REFERENCES**

- .1 ASTM International
 - .1 ASTM E90, Standard Test Method for Laboratory Measurement of Airborne Sound Transmission Loss of Building Partitions and Elements.
- .2 National Fire Protection Association (NFPA)
 - .1 NFPA 96, Standard for Ventilation Control and Fire Protection of Commercial Cooking Operations.
- .3 Sheet Metal and Air Conditioning Contractors' National Association (SMACNA)
- .4 Society of Automotive Engineers (SAE)

1.2 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Submit in accordance with Section 01 00 15 - Submittal Procedures.
- .2 Product Data:
 - .1 Submit manufacturer's instructions, printed product literature and data sheets for louvers, intakes and vents and include product characteristics, performance criteria, physical size, finish and limitations.
 - .2 Indicate following:
 - .1 Pressure drop.
 - .2 Face area.
 - .3 Free area.
- .3 Certificates: submit certificates signed by manufacturer certifying that materials comply with specified performance characteristics and physical properties.
- .4 Test Reports: submit certified data from independent laboratory substantiating acoustic and aerodynamic performance to ASTM E90.

1.3 DELIVERY, STORAGE AND HANDLING

- .1 Deliver, store and handle materials in accordance with Section 01 00 15 - 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 indoor in dry location and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.
 - .2 Store and protect louvers, intakes and vents from nicks, scratches, and blemishes.
 - .3 Replace defective or damaged materials with new.
- .4 Packaging Waste Management: remove for reuse by manufacturer packaging materials as specified in Construction Waste Management Plan Waste Reduction Workplan in

accordance with Section 01 00 15 - Construction/Demolition Waste Management and Disposal.

Part 2 Products

2.1 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.

2.2 GRAVITY ROOF OUTSIDE AIR INTAKES AND RELIEF VENTS

.1 Factory manufactured aluminum

- .1 Complete with integral birdscreen of 2.7 mm diameter aluminum wire.
- .2 Maximum throat velocity: 3.3 m/s intake.
- .3 Maximum loss through unit: 15 Pa exhaust static pressure.
- .4 Maximum velocity through damper area: 1.5 m/s.
- .5 Shape: as indicated.

2.3 GOOSENECK HOODS

.1 Thickness: to SMACNA.

- .1 Elsewhere: to ASHRAE

.2 Fabrication: to SMACNA

- .1 Elsewhere: to ASHRAE

.3 Joints: to SMACNA

.4 Supports: as indicated.

.5 Complete with integral birdscreen of 2.7 mm diameter S.S wire. Use 12 mm mesh on exhaust, 19 mm mesh on intake.

.6 Vertical backdraft dampers on 4 faces.

2.4 FIXED LOUVRES - ALUMINUM

.1 Construction: welded with exposed joints ground flush and smooth.

.2 Material: extruded aluminum alloy 6063-T5.

.3 Blade: stormproof pattern with centre watershed in blade, reinforcing bosses and maximum blade length of 1500 mm.

.4 Frame, head, sill and jamb: 150 mm deep one piece extruded aluminum, minimum 3 mm thick [with approved caulking slot, integral to unit].

.5 Mullions: at 1500 mm maximum centres.

- .6 Fastenings: stainless steel SAE-194-8F with SAE-194-SFB nuts and resilient neoprene washers between aluminum and head of bolt, or between nut, ss washer and aluminum body.
- .7 Screen: 12 mm exhaust, 19 mm intake mesh, 2 mm diameter wire aluminum birdscreen on [inside] face of louvres in formed U-frame.
- .8 Finish: [factory applied enamel. Colour: to Departmental Representative's approval.

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 louvres, intakes and vents installation in accordance with manufacturer's written instructions.
 - .1 Visually inspect substrate in presence of Departmental Representative.
 - .2 Inform Departmental Representative of unacceptable conditions immediately upon discovery.
 - .3 Proceed with installation only after unacceptable conditions have been remedied and after receipt of written approval to proceed from Departmental Representative.

3.2 INSTALLATION

- .1 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 Progress Cleaning: clean in accordance with Section 01 00 15 - 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 00 15 - Cleaning.
- .3 Waste Management: separate waste materials for recycling] in accordance with Section 01 00 15 - Construction/Demolition Waste Management and Disposal.
 - .1 Remove recycling containers and bins from site and dispose of materials at appropriate facility.

END OF SECTION

Part 1 General**1.1 REFERENCES**

- .1 Sheet Metal and Air Conditioning Contractors National Association (SMACNA)
- .2 Underwriters' Laboratories of Canada (ULC)

1.2 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Submit in accordance with Section 01 00 01 - Submittal Procedures.
- .2 Product Data:
 - .1 Submit manufacturer's instructions, printed product literature and data sheets for [chimneys and stacks] 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 Alberta, Canada.
 - .2 Indicate following:
 - .1 Methods of sealing sections.
 - .2 Methods of expansion.
 - .3 Details of thimbles.
 - .4 Bases/Foundations.
 - .5 Supports.
 - .6 Guy details.
 - .7 Rain caps.
- .4 Certificates: submit certificates signed by manufacturer certifying that materials comply with specified performance characteristics and physical properties.

1.3 QUALITY ASSURANCE

- .1 Regulatory Requirements: work to be performed in compliance with applicable Provincial regulations.
- .2 Certifications:
 - .1 Catalogued or published ratings: obtained from tests carried out by independent testing agency or manufacturer signifying adherence to codes and standards.

1.4 DELIVERY, STORAGE AND HANDLING

- .1 Deliver, store and handle materials in accordance with Section 01 00 15 - Common Product Requirements with manufacturer's written instructions.
- .2 Delivery and Acceptance Requirements: deliver materials to site in original factory packaging, labelled with manufacturer's name and address.
- .3 Storage and Handling Requirements:

- .1 Store materials indoors in dry location and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.
- .2 Store and protect chimneys and stacks from nicks, scratches, and blemishes.
- .3 Replace defective or damaged materials with new.
- .4 Packaging Waste Management: remove for reuse and return by manufacturer of packaging materials as specified in Construction Waste Management Plan Waste Reduction Workplan in accordance with Section 01 00 15 - Construction/Demolition Waste Management and Disposal.

Part 2 Products

2.1 BREECHINGS

- .1 Shop fabricated [3.5] mm thick stainless steel with sweep bends from boiler outlet to thimble or chimney as indicated.

2.2 TYPE B GAS VENT

- .1 ULC labelled, [288] degrees C rating maximum, atmospheric gas vent only.
- .2 Sectional, prefabricated, double wall with 13 mm air space. Aluminum inner wall. Galvanized steel outer wall. Mated fittings and couplings.

2.3 STEEL CHIMNEY REFRACTORY LINED

- .1 Material:
 - .1 Prefabricated sections with 9 mm thick high temperature impervious insulating refractory lining, centrifugally spun into 3 mm thick circular casing.
- .2 Construction:
 - .1 Prefabricated sections, welded at factory. Use high temperature insulating cement at joints in refractory lining.
- .3 Welding:
 - .1 To full thickness; grind welds smooth.
- .4 Supports:
 - .1 Welded gussets, cleats and bolts for installation on concrete base.
 - .2 Chimney laterally braced, as indicated.
 - .3 Concrete base by Section 03 30 00 - Cast-in-Place Concrete.
- .5 Breeching entry:
 - .1 Tee section with 150 mm minimum refractory lined projection.
- .6 Access door: in bottom section.
- .7 Drain connection: at base of stack.
- .8 Dimensions: as indicated.

2.4 ACCESSORIES

- .1 Cleanouts: bolted, gasketed type, full size of breeching, as indicated.
- .2 Barometric dampers: double acting, 70% of full size of breeching area.
- .3 Hangers and supports: in accordance with recommendations SMACNA.
- .4 Rain cap.
- .5 Expansion sleeves with heat resistant caulking, held in place as indicated.

Part 3 Execution**3.1 EXAMINATION**

- .1 Verification of Conditions: verify that conditions of substrate previously installed under other Sections or Contracts are acceptable for chimney and stack installation in accordance with manufacturer's written instructions.
 - .1 Visually inspect substrate in presence of Departmental Representative.
 - .2 Inform Departmental Representative of unacceptable conditions immediately upon discovery.
 - .3 Proceed with installation only after unacceptable conditions have been remedied and after receipt of written approval to proceed from Departmental Representative.

3.2 INSTALLATION - GENERAL

- .1 Follow manufacturer's and SMACNA installation recommendations for shop fabricated components.
- .2 Suspend breeching at 1.5 m centres and at each joint.
- .3 Support chimneys at bottom, roof and intermediate levels as indicated.
- .4 Install thimbles where penetrating roof, floor, ceiling and where breeching enters masonry chimney. Pack annular space with heat resistant caulking.
- .5 Install flashings on chimneys penetrating roofs, as indicated.
- .6 Install rain caps and cleanouts, as indicated.

3.3 INSTALLATION - REFRACTORY LINED STEEL CHIMNEY

- .1 Grind welds smooth to form appearance of single tube.
- .2 Seal insulating refractory at top of stack.
- .3 Pack annular space around breeching at entry tee with heat resistant caulking.
- .4 Run drain line from drain connection to nearest floor drain.
- .5 On completion, paint one coat of rust inhibitive primer and two coats of heat resisting paint of colour, make and quality approved by Departmental Representative.

3.4 CLEANING

- .1 Progress Cleaning: clean in accordance with Section 01 00 15 - 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 00 15 - Cleaning.
- .3 Waste Management: separate waste materials for recycling in accordance with Section 01 00 15 - Construction/Demolition Waste Management and Disposal.
 - .1 Remove recycling containers and bins from site and dispose of materials at appropriate facility.

END OF SECTION

Part 1 General**1.1 REFERENCES**

- .1 American National Standard Institute (ANSI)/American Society of Heating, Refrigerating and Air-Conditioning Engineers (ASHRAE)
 - .1 ANSI/ASHRAE 52.2, Method of Testing General Ventilation Air-Cleaning Devices for Removal Efficiency by Particulate Size (ANSI approved).
- .2 American National Standards Institute (ANSI)/CSA Group
 - .1 ANSI Z21.47/CSA 2.3, Gas-Fired Central Furnaces.
 - .2 ANSI Z83.8/CSA 2.6, Gas Unit Heaters, Gas Packaged Heaters, Gas Utility Heaters and Gas-Fired Duct Furnaces.
- .3 CSA Group
 - .1 CGA 3.2, Industrial and Commercial Gas-Fired Package Furnaces.
 - .2 CSA B140.2.2-1971(R2011), Pressure Atomizing Oil Burner Nozzles.
 - .3 CSA B149.1, Natural Gas and Propane Installation Code.
 - .4 CSA C22.1, Canadian Electrical Code, Part 1, Safety Standard for Electrical Installations.
 - .5 CSA C22.2 No.24, Temperature-Indicating and Regulating Equipment.

1.2 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Submit in accordance with Section 01 00 15 - Submittal Procedures.
- .2 Product Data:
 - .1 Submit manufacturer's instructions, printed product literature and data sheets for furnace units and parts 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 Alberta, Canada.
 - .2 Submit manufacturer's written recommendations.
- .4 Sustainable Design Submittals:
 - .1 Construction Waste Management:
 - .1 Submit project Waste Management Plan Waste Reduction Workplan highlighting recycling and salvage requirements.

1.3 CLOSEOUT SUBMITTALS

- .1 Submit in accordance with Section 01 00 15 - Closeout Submittals.
- .2 Operation and Maintenance Data: submit operation and maintenance data for incorporation into manual.

1.4 MAINTENANCE MATERIAL SUBMITTALS

- .1 Submit in accordance with Section 01 00 15 - Closeout Submittals.
- .2 Extra Stock Parts:
 - .1 Spare filters: in addition to filters installed immediately prior to acceptance by Departmental Representative, supply 1 complete set of filters for each filter unit or filter bank.

1.5 DELIVERY, STORAGE AND HANDLING

- .1 Deliver, store and handle materials in accordance with Section 01 00 15 - Common Product Requirements with manufacturer's written instructions.
- .2 Delivery and Acceptance Requirements: deliver materials to site in original factory packaging, labelled with manufacturer's name and address.
- .3 Storage and Handling Requirements:
 - .1 Store materials indoors in dry location] and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.
 - .2 Store and protect furnaces from nicks, scratches, and blemishes.
 - .3 Replace defective or damaged materials with new.
- .4 Develop Construction Waste Management Plan Waste Reduction Workplan related to Work of this Section.
- .5 Packaging Waste Management: remove for reuse by manufacturer of packaging materials as specified in Construction Waste Management Plan Waste Reduction Workplan in accordance with Section 01 00 15 - Construction/Demolition Waste Management and Disposal.

Part 2 Products**2.1 GENERAL**

- .1 Provide CSA approved, packaged factory assembled unit consisting of cabinet, fan, fan motor, intake/exhaust assembly, heat exchanger, combustion chamber, burner, controls, air filter, condensate drain.
- .2 High efficiency level range: 90%.
- .3 Certification of components and construction of factory assembled gas-fired unit: to ANSI Z21.47/CSA 2.3 for forced air central furnace.

2.2 CAPACITY

- .1 Refer to schedule on drawing.

2.3 CABINET

- .1 1.0 mm thick minimum steel with baked enamel finish.
- .2 Welded steel base for floor type.
- .3 Easily removed and secured access doors for components requiring service.

- .4 Thermally insulated cabinet.

2.4 HEAT EXCHANGER

- .1 Primary: heavy gauge aluminized steel.
- .2 Secondary: stainless steel tube with aluminum fins.
- .3 Warranty: non-prorated 20 years.

2.5 COMBUSTION CHAMBER

- .1 Power vent, induced draft: to manufacturer's standard.
- .2 Sealed type: 100% outside air, to ANSI Z21.47/CSA 2.3.

2.6 CIRCULATION BLOWER MOTOR ASSEMBLY

- .1 Blower: centrifugal type:
 - .1 Statically and dynamically balanced.
 - .2 Rubber mounted.
 - .3 Speed adjustment: multi-speed direct drive or variable speed drive.
 - .4 Wiring adjustment of multi-speed motor.
- .2 Motor: multi-speed or variable speed, overload protection, adjustable mounts.

2.7 AIR FILTER(S)

- .1 Filter(s): disposable type, MERV 13.

2.8 HEATER BURNER

- .1 General: to bear CSA and ULC labels.
- .2 Gas burner:
 - .1 Continuous port steel or multi-slotted, non-clogging cast iron with adjustable combustion air supply.
 - .2 Electronic ignition combustion type gas burner.

2.9 CONDENSER

- .1 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 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 -29 degrees C.
 - .7 Head pressure control for low outdoor ambient of -29 degrees C operation.

2.10 COILS

- .1 Direct expansion refrigerant coils:
 - .1 Straight tube type arranged to prevent trapping of oil.
 - .1 Liquid distributors to ensure even distribution of liquid refrigerant to all circuits.
 - .2 Silver solder or braze joints in refrigerant tubing.
 - .3 Evacuate and charge coil with nitrogen and seal before sending to site.
 - .2 Tubes: copper.
 - .3 Fins: aluminum spiral wound.
 - .4 Headers: copper.
 - .5 Pressure tests: to Canadian Refrigeration Code. Dehydrated. Sealed with nitrogen charge.

2.11 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.

2.12 INTAKE AND VENT ASSEMBLY

- .1 Provide manufacturer's standard wall combined concentric vent and intake complete with termination assembly for high efficiency gas or condensing furnace.
- .2 As per manufacturer's recommendation.

2.13 CONDENSATE DRAIN

- .1 Provide PVC condensate drain trap.
- .2 Condensate filter/neutralizer kit.

2.14 CONTROLS

- .1 Solid state electronic control system.
- .2 General: conform to CSA C22.2 No.24.
- .3 Gas firing:
 - .1 Operating controls:
 - .1 Set-back and Heating-cooling thermostat.

- .2 Intermittent ignition.
- .3 Manual main shut-off valve, automatic safety pilot, automatic electric valve and gas pressure regulator.
- .4 Fan operating control switch with adjustable set points and continuous operating switch.
- .5 Automatic vent damper.
- .2 Safety controls:
 - .1 Electronic combustion control relay with flame rectification sensor to detect and supervise flame by shutting off fuel upon flame failure or safety interlock signal within seconds, in sequence pre-purge-pilot ignition, supervision-main valve opening-pilot cut-off-burner operation and roll out switch.
 - .2 Blocked vent shut-off switch or control system.
 - .3 Limit control to shut down furnace if heat exchanger temperature exceeds limit setting. Combination fan and limit control to be spiral wound.
 - .4 Door interlock switch on fan compartment access panel to shut down furnace when panel is removed.
 - .5 Internal float switch to shut off furnace if condensate do not drain properly.
 - .6 Electronic board built-in diagnostics.

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 fuel-fired furnaces installation in accordance with manufacturer's written instructions.
 - .1 Visually inspect substrate in presence of Departmental Representative.
 - .2 Inform Departmental Representative of unacceptable conditions immediately upon discovery.
 - .3 Proceed with installation only after unacceptable conditions have been remedied and after receipt of written approval to proceed from Departmental Representative.

3.2 INSTALLATION

- .1 Install in accordance with manufacturer's instructions, regulations of authorities having jurisdiction and to CSA B149.1 Canadian Electric Code.
- .2 Co-ordinate with Concrete Division regarding concrete base[s] as indicated.
- .3 Provide Departmental Representative written report of test results.

3.3 EQUIPMENT PREPARATION

- .1 Provide services of manufacturer's field engineer to set and adjust equipment for operation as specified.

3.4 CLEANING

- .1 Progress Cleaning: clean in accordance with Section 01 00 15 - 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 00 15 - Cleaning.
- .3 Waste Management: separate waste materials for recycling in accordance with Section 01 00 15 - Construction/Demolition Waste Management and Disposal.
 - .1 Remove recycling containers and bins from site and dispose of materials at appropriate facility.

END OF SECTION

1 General**1.1 SUMMARY****.1 Section includes:**

- .1 Labour, products, equipment and services necessary to complete the work of this Section.

1.2 CODES, PERMITS AND INSPECTIONS**.1 Applicable Codes and Standards**

- .1 Canadian Electrical Code, CSA C22.1 Part-I, 2015 edition
- .2 CSA C22.2, Part II
- .3 CSA C22.3, Part III, Overhead system
- .4 CAN3-C235-[83(R2010)], Preferred Voltage Levels for AC Systems, 0 to 50,000 V.
- .5 Electrical Safety Authority (ESA)
- .6 Electrical and Electronic Manufacturers Association of Canada (EEMAC)
- .7 National Electrical Manufacturers Association (NEMA)
- .8 Alberta Building Code 2006
- .9 Canadian Standards Association (CSA)
- .10 Underwriters' Laboratories of Canada (ULC)
- .11 National Building Code of Canada (NBC) 2005
- .12 Illuminating Engineering Society (IES)
- .13 American Society of Heating, Refrigerating and Air Conditioning Engineers, Inc., (ASHRAE)
- .14 CSA C282-09, Emergency Electrical Power Supply for Buildings
- .15 CSA Z32-09, Electrical safety and Essential Electrical Systems in Health Care Facilities
- .16 National Fire Protection Association (NFPA)
- .17 American Standards Association (ASA or ANSI)
- .18 Institute of Electrical and Electronic Engineers (IEEE)
- .19 Electronic Industries Association (EIA)
- .20 Telecommunications Industry Association (TIA)
- .21 Building Industry Consulting Services, International (BICSI)
- .22 Material Safety Data Sheets by product manufacturers
- .23 Hydro inspection permits
- .24 Codes, standards, and regulations of local governing authorities having jurisdiction

- .25 Additional codes and standards listed in Trade Sections
- .26 Departmental Representative's standards
- .27 Local Hydro Standards
- .2 Comply with Canadian Electrical Code, all local, provincial and federal laws, where applicable and with authorities having jurisdiction. Make any changes or alterations required by authorized inspector of authority having jurisdiction.
- .3 Equipment and material must be acceptable to Electrical Safety Authority.
- .4 Where materials are specified which require special inspection and approval, obtain such approval for the particular installation with the co-operation of the material supplier.
- .5 Obtain and pay for permits and inspections required for work performed.
- .6 Supply and install warning signs, nameplates and glass covered Single Line Diagrams as required by Electrical Safety Authority.
- .7 Submit required Documents and shop drawings to authorities having jurisdiction in order to obtain approval for the Work. Copies of Contract Drawings and Specifications may be used for this purpose.

1.3 REFERENCE STANDARDS

- .1 These Specifications supplement the referenced standards.
- .2 Where standards differ between authorities, the most rigid apply.
- .3 Where requirements of the specifications exceed referenced standards, the specifications apply.
- .4 Electrical and electronic terms: unless otherwise specified or indicated, terms used in these specifications, and on drawings, are those defined by IEEE SP1122.

1.4 DEFINITIONS

- .1 Electrical and electronic terms: unless otherwise specified or indicated, terms used in these specifications, and on drawings, are those defined by IEEE STD 100.

1.5 DRAWING AND SPECIFICATIONS COORDINATION

- .1 In the case of discrepancies or conflicts between the Drawings and Specifications and local governing authority standards, contact Departmental Representative and obtain direction. If direction is not available prior to close of Bids, include for the most costly arrangement, but ensure that direction is obtained prior to start of the Work.

1.6 COORDINATION

- .1 Carefully examine Work and Drawings of all related trades and thoroughly plan the Work so as to avoid interferences. Report defects which would adversely affect the Work. Do not commence installation until such defects have been corrected.
- .2 Coordinate Work of this Division such that items will properly interface with Work of other Divisions.

- .3 All embedded openings shall be considered by structural and architectural disciplines.
- .4 Architectural Drawings, all equipment arrangement and cable or cable tray route shall be rechecked with Architectural drawing before starting installation.
- .5 Mechanical Drawings, all mechanical related loads (location and required power / voltage) shall be rechecked by Mechanical final drawing.
- .6 Coordinate work of this Division to ensure that damage does not occur to the fireproofing work of any other Division.

1.7 SUBSTITUTIONS

- .1 When only one manufacturer's catalogued trade name is specified, provide only that catalogued trade name, material or product.
- .2 When more than one manufacturer's trade name is specified for a material or product, the choice is the bidders.
- .3 No substitution is allowed upon award of contract.

1.8 DIMENSIONS AND QUANTITIES

- .1 Dimensions shown on Drawings are approximate. Verify dimensions by reference to shop drawings and field measurement.
- .2 Quantities or lengths indicated in Contract Documents are approximate only and shall not be held to gauge or limit the Work.
- .3 Make necessary changes or additions to routing of conduit, cables, cable trays, and the like to accommodate structural, mechanical and architectural conditions. Where raceways are shown diagrammatically run them parallel to building column lines.

1.9 EQUIPMENT LOCATIONS

- .1 Devices, fixtures and outlets may be relocated, prior to installation, from the location shown on the Contract Drawings, to a maximum distance of 3 m, without adjustment to Contract price.
- .2 Switch, control device and outlet locations are shown diagrammatically.

1.10 WORKING DRAWINGS AND DOCUMENTS

- .1 Where the word "HOLD" appears on Drawings and other Contract Documents, the Work is included in the Contract. Execute such Work only after verification of dimensions and materials and obtaining Departmental representative's written permission to proceed.

1.11 INSTALLATION DRAWINGS

- .1 Prepare installation drawings for equipment, based upon approved Vendor drawings, to check required Code clearances, raceway, busway and cable entries, sizing of housekeeping pads and structure openings. Submit installation drawings to Departmental Representative for review.

1.12 "AS BUILT" RECORD DRAWINGS

- .1 Maintain a set of Contract Drawings on site and record all deviations from the Contract Documents. As a mandatory requirement, recording must be done on the same day deviation is made. Be responsible for full compliance with this requirement.
- .2 Mark locations of feeder conduits, junction and terminal boxes and ducts or conduits run underground either below the building or outside the building.
- .3 Where conduit and wiring are underground or underfloor, furnish field dimension with respect to building column lines and inverts with respect to finished floor levels or grades.
- .4 Record deviations from branch circuit numbers shown on Drawings.
- .5 Prepare diagrams of interconnecting wiring between items of equipment including equipment supplied by Departmental Representative and under other Specification Sections.

1.13 SINGLE LINE DIAGRAM

- .1 Reproduce this diagram in drawing form under glazed frame and mount in Main Electrical Room. Provide a copy of this diagram to the Departmental Representative and include in the Maintenance Manuals.

1.14 TEST REPORTS

- .1 For each check and test performed prepare and submit a Test Report, signed by the Test engineer, and where witnessed, by the Departmental representative.
- .2 Include record of all tests performed, methods of calculation, date and time of test, ambient conditions, names of testing company, test engineer, witnesses, also calibration record of all test instruments used together with manufacturers name, serial number and model number.
- .3 Include calibration record, percentage error and applicable correction factors.
- .4 Submit a Certified Test Report from each manufacturer, signed by the certifying inspector, confirming correct installation and operation of each product and part of Work. Include name of certifying inspector, date and times of inspection, ambient conditions.

1.15 SUBMITTALS

- .1 Submittals to be in accordance with Division 01 Submittal Procedures, the articles below and/or as indicated in each electrical specification section.
- .2 Submit manufacturer's printed product literature, specifications and datasheet. Include product characteristics, performance criteria, and limitations.
- .3 Submit two copies of Workplace Hazardous Materials Information System (WHMIS) Material Safety Data Sheets (MSDS) in accordance with Division 01 Submittal Procedures.
- .4 Submit shop drawings in accordance with Division 01 Submittal Procedures.
 - .1 Shop drawings: submit drawings stamped and signed by professional engineer registered or licensed in Province of Alberta, Canada.
 - .2 Provide separate shop drawings for each isolated system complete with performance and product data.

- .5 Submit to the Departmental Representative, the necessary number of electrical drawings and specifications for examination, special inspection and/or approval, prior to the commencement of the work, and pay for all costs and associated fees. If required prepare any additional drawings/documents required by either Authority.
- .6 Obtain and pay for permits and inspections required for the work performed.
- .7 Shop drawings:
 - .1 Submit wiring diagrams and installation details of equipment indicating proposed location, layout and arrangement, control panels, accessories, piping, ductwork, and other items that must be shown to ensure co-ordinated installation.
 - .2 Identify on wiring diagrams circuit terminals and indicate internal wiring for each item of equipment and interconnection between each item of equipment.
 - .3 Indicate of drawings clearances for operation, maintenance, and replacement of operating equipment devices.
- .8 Quality Control:
 - .1 Provide CSA certified equipment and material.
 - .2 Where CSA certified equipment and material is not available, submit such equipment and material to authority having jurisdiction for special approval before delivery to site.
 - .3 Submit test results of installed electrical systems and instrumentation.
 - .4 Permits and fees: in accordance with contract.
 - .5 Submit, upon completion of Work, load balance report as described in PART 3 - LOAD BALANCE.
 - .6 Submit certificate of acceptance from authority having jurisdiction upon completion of Work to Departmental Representative.
- .9 Manufacturer's Field Reports: submit to Departmental Representative the manufacturer's written report, within 3 days of review, verifying compliance of Work and electrical system and instrumentation testing, as described in PART 3 - FIELD QUALITY CONTROL.
- .10 Where materials are specified which require special inspection and approval, obtain such approval for the particular installation with the co-operation of the material supplier.

1.16 QUALITY ASSURANCE

- .1 Quality Control and Assurance: in accordance with Division 01 Quality Control.
- .2 Qualifications: electrical Work to be carried out by qualified, licensed electricians or apprentices in accordance with authorities having jurisdiction as per the conditions of Provincial Act respecting manpower vocational training and qualification.
 - .1 Employees registered in provincial apprentices program: permitted, under direct supervision of qualified licensed electrician, to perform specific tasks.
 - .2 Permitted activities: determined based on training level attained and demonstration of ability to perform specific duties.

- .3 Health and Safety Requirements: do construction and occupational health and safety in accordance with Division 01 Health and Safety Requirements.

1.17 FACTORY WITNESS TESTS

- .1 Prior to Departmental Representative attendance at factory for witness testing, perform the following:
 - .1 Successfully conduct test to be witnessed.
 - .2 Following successful testing, inform the Departmental representative, in writing, that tests to be witnessed have been successfully performed.

1.18 SYSTEM STARTUP

- .1 Instruct operating personnel in the operation, care and maintenance of systems, system equipment and components.
- .2 Arrange and pay for services of Factory Service Engineer for major systems, to supervise start-up of installation, check, adjust, balance and calibrate components and instruct operating personnel.
- .3 Provide these services for such period, and for as many visits as necessary to put equipment in operation, and ensure that operating personnel are conversant with aspects of its care and operation.

1.19 OPERATING AND MAINTENANCE MANUALS

- .1 Refer to and comply with Division 01 and related Sections.
- .2 Provide for each system and principal item of equipment as specified in technical sections for use by operation and maintenance personnel.
- .3 Operating instructions to include following:
 - .1 Wiring diagrams, control diagrams, and control sequence for each principal system and item of equipment.
 - .2 Start up, proper adjustment, operating, lubrication, and shutdown procedures.
 - .3 Safety precautions.
 - .4 Procedures to be followed in event of equipment failure.
 - .5 Other items of instruction as recommended by manufacturer of each system or item of equipment.
- .4 Provide a video recording of the training sessions for all major electrical equipment and electrical systems.
- .5 Print or engrave operating instructions and frame under glass or in approved laminated plastic.
- .6 Post instructions where directed.
- .7 For operating instructions exposed to weather, provide weather-resistant materials or weatherproof enclosures.

- .8 Ensure operating instructions will not fade when exposed to sunlight and are secured to prevent easy removal or peeling.

1.20 AREA CLASSIFICATION

- .1 Patient Care Areas:
 - .1 Patient care areas are identified on drawings.
 - .2 Comply with the requirements for patient care areas included in the Work as required by Section 24 of the Canadian Electrical Code.
 - .3 Comply with the requirements for patient care areas included in the Work as required by CSA Z32 Electrical Safety and Essential Electrical Systems in Health Care Facilities.

1.21 COMMISSIONING

- .1 A Commissioning Agent will be appointed by the Departmental Representative to oversee the commissioning activities of the project. This contractor is to:
 - .1 Interface, cooperate and coordinate with the Commissioning Agent and attend commissioning meetings.
 - .2 Perform commissioning activities for aspects of work provided in Electrical Divisions and perform corrective work identified by the Commissioning Agent.
 - .3 Refer to Section 26 08 06 Field Testing and Commissioning Low Voltage for additional requirements.
- .2 Refer to Division 01 for additional commissioning requirements.
- .3 The Commissioning Agent may also be present for any testing/commissioning activities and are to be notified by the Contractor in advance of these activities.
- .4 Submit a copy of test reports of systems and equipment to the Commissioning Agent, prior to start of commissioning activity or as directed by Commissioning Agent.
- .5 Where commissioning specifications are included as part of Division 01, the requirements of the Section entitled Electrical Commissioning are to supplement commissioning requirements of Division 01. Where variances or contradictions exist, the more stringent requirement will apply unless otherwise directed by Departmental representative.

1.22 LOCAL ELECTRICAL UTILITY REQUIREMENTS

- .1 Comply with the latest conditions of supply requirements of the local electrical Utility having jurisdiction. Execute infrastructure work related to the local Utility in accordance with requirements and coordinated Utility requirements with the respective Divisions of the Work providing such work. Include for the following in relation to Utility:
 - .1 Two preconstruction meeting;
 - .2 Access for electrical Utility's Inspector to be on duty for duration of work or as required by the Utility;
 - .3 Underground inspection: submission of approval drawings and application for inspection prior to any inspection of work;

- .4 Approval of work and materials by electrical Utility's Inspector prior to any backfilling work.

1.23 SERIES RATED COMBINATIONS

- .1 Series rated combinations of over-current protective devices are not permitted. Provide full rating distribution as shown on plans.

2 Products

2.1 APPROVALS AND QUALITY

- .1 Provide new materials bearing certification marks or labels acceptable under Canadian Electrical Code.
- .2 Equipment must bear, on manufacturer's label, certification mark or label acceptable under Electrical Safety Authority.
- .3 Provide units of same manufacture where two or more units of same class or type of equipment are required.
- .4 Manufacturer's names are stated in this Specification to establish a definite basis for tender submission and to clearly describe the quality of product that is desired for the work.

2.2 STANDARD SPECIFICATIONS

- .1 Ensure that the chemical and physical properties, design, performance characteristics and methods of construction of all products provided comply with latest issue of applicable Standard Specifications issued by authorities having jurisdiction, but such Standard Specifications shall not be applied to decrease the quality of workmanship, products and services required by the Contract Documents.

2.3 MATERIALS AND EQUIPMENT

- .1 Material and equipment to be CSA certified. Where CSA certified material and equipment are not available, obtain special approval from authority having jurisdiction before delivery to site and submit such approval as described in PART 1 - SUBMITTALS.
- .2 Factory assemble control panels and component assemblies.
- .3 Ensure no counterfeit breakers are used in the project. Do random sample checks in non-factory supplied breakers.
- .4 Enclosure CSA types referred to in this specification to be in accordance to CAN/CSA 22.2 No.94-M91(R2011)-Special Enclosures and/or their EEMAC/NEMA equivalent, whichever is more stringent.
- .5 Delivery and Acceptance Requirements: deliver materials to site in original factory packaging, labelled with manufacturer's name and address.
- .6 Storage and Handling Requirements:
- .7 Store materials in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.

- .8 Replace defective or damaged materials with new.

2.4 ELECTRIC MOTORS, EQUIPMENT AND CONTROLS

- .1 Verify installation and co-ordination responsibilities related to motors, equipment and controls as indicated.
- .2 Control Wiring and Conduit: in accordance with section 26 05 05 – Electrical Requirements for Mechanical Equipment, except for conduit wiring and connections below 50V which are related to control systems specified in mechanical sections and as shown on mechanical drawings.

2.5 WARNING SIGNS

- .1 Warning Signs: in accordance with requirements of departmental Representative having jurisdiction.
- .2 Decal signs, minimum size 175 x 250 mm.

2.6 WIRING TERMINATIONS

- .1 Ensure lugs, terminals, screws used for termination of wiring are suitable for copper conductors.

2.7 SPRINKLER PROOF EQUIPMENT

- .1 Ensure that electrical equipment installed in electrical rooms and other areas containing sprinklers is constructed such that exposure to water from the sprinkler heads does not impair the effectiveness of the enclosed equipment.
- .2 Provide a separate cover or roof on all 2285 mm high equipment. Provide an overhang at the front, rear and sides to effectively prevent the entrance of water either at the top or through projecting faceplates, meters, etc.
- .3 Where penetrations are made in drip shields, flash and seal using manufacturer's approved caulking to maintain drip shield integrity.
- .4 Ensure that enclosure louvres are of outdoor design such that falling water or water running down the sides will not enter the enclosure.
- .5 Where enclosure openings in the top or sides are required for outgoing conduits, provide waterproof conduit fittings.
- .6 Provide panels and transformers with hoods.
- .7 Provide sprinkler proof busways.
- .8 In electrical rooms containing sprinklers provide wall mounted equipment such as pull boxes, junction boxes, splitter troughs, wireways, auxiliary gutters, cable troughs and disconnect switches located below the level of the sprinkler heads with the following accessories:

- .1 Gaskets on doors and drip shields on equipment, panelboards, panels and enclosures.
- .2 Louvres facing outward and downward where openings are required for heat dissipation. Expanded metal screening is not acceptable.

2.8 HOUSEKEEPING PADS

- .1 Provide 100 mm high concrete pads under floor mounted electrical equipment. Extend pads 50 mm outside the equipment perimeter.

2.9 FIRE STOPPING AND SMOKE SEALS

- .1 Where electrical material or devices pass through fire rated separations, make penetrations and provide fire barrier seals with a fire resistance rating equivalent to the rating of the separation.
- .2 Prior to installation, submit for review, proposed fire barrier seal materials, method of installation and ULC system number.
- .3 Provide fire stopping and smoke seals in accordance with Section 07 84 00.

2.10 MISCELLANEOUS METAL FABRICATIONS

- .1 Provide miscellaneous structural supports, platforms, braces, brackets and preformed channel struts necessary for suspension, attachment or support of electrical equipment in accordance with Section 05 50 00.

2.11 SILICONE

- .1 Products and materials containing silicone are not permitted.

2.12 EQUIPMENT COLOUR CODING

- .1 Exterior finish paint colour for control panels, panelboards and devices on emergency and UPS systems:
 - .1 Emergency systems: red
 - .2 UPS systems: blue

2.13 EQUIPMENT IDENTIFICATION

- .1 Identify electrical equipment with nameplates and labels as follows:
 - .1 Nameplates: lamicoid 3 mm, black face, white core, lettering accurately aligned and engraved into core mechanically attached with self tapping screws.
 - .2 Sizes as follows:

NAMEPLATE SIZES

Size 1	10 x 50 mm	1 line	3 mm high letters
Size 2	12 x 70 mm	1 line	5 mm high letters
Size 3	12 x 70 mm	2 lines	3 mm high letters

NAMEPLATE SIZES

Size 4	20 x 90 mm	1 line	8 mm high letters
Size 5	20 x 90 mm	2 lines	5 mm high letters
Size 6	25 x 100 mm	1 line	12 mm high letters
Size 7	25 x 100 mm	2 lines	6 mm high letters

- .2 Labels: embossed plastic labels with 6 mm high letters unless specified otherwise.
- .3 Wording on nameplates and labels to be approved by Departmental Representative prior to manufacturing.
- .4 Allow for minimum of twenty-five (25) letters per nameplate and label.
- .5 Nameplates for terminal cabinets and junction boxes to indicate system and/or voltage characteristics.
- .6 Disconnects, starters and contactors: indicate equipment being controlled, voltage and power source.
- .7 Terminal cabinets and pull boxes: indicate system and voltage.
- .8 Transformers: indicate capacity, primary and secondary voltages and power source.
- .9 Panelboards: indicate system, rated ampacity, voltage, phase, wire configuration and power source.
- .10 Switchboard: indicate rated ampacity, voltage, phase, wire configuration.
- .11 Receptacles: indicate circuit numbers using P-Touch type labels.

2.14 WIRING IDENTIFICATION

- .1 Identify wiring with permanent indelible identifying markings, 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 coding: to CSA C22.1 as follows:
 - .1 Phase A – Red
 - .2 Phase B – Black
 - .3 Phase C – Blue
 - .4 Neutral – White
 - .5 Ground – Green
 - .6 Isolated Ground – Green and Yellow

2.15 CONDUIT AND CABLE IDENTIFICATION

- .1 Colour code conduits, boxes and metallic sheathed cables.

- .2 Code with plastic tape or paint at conduit system couplings.
- .3 Colours: 25 mm wide prime colour and 20 mm wide auxiliary colour.

System	Normal	Emergency	UPS
up to 15 kV	Yellow	-	-
347/600 V	Orange	Orange/Red	Orange/Blue
120/208 V	Black	Black / Red	Black / Blue
Fire Alarm	Red	-	-
Emergency Voice	Red / Blue	-	-
LAN	Green	-	-
Security	Red/Yellow	-	-
Low Voltage Control	White	-	-

2.16 FINISHES

- .1 Shop finish metal enclosure surfaces by application of rust resistant primer inside and outside, and at least two coats of finish enamel.
 - .1 Paint outdoor electrical equipment "equipment green" finish to EEMAC standard.
 - .2 Paint indoor switchgear and distribution enclosures light gray to EEMAC 2Y-1 (ANSI 61).

2.17 PRODUCTS FURNISHED BY DEPARTMENTAL REPRESENTATIVE

- .1 Carefully examine the Vendor or Manufacturers' drawings and provide any incidental and miscellaneous materials, mounting hardware and supports required for complete systems.

3 Execution

3.1 EXAMINATION

- .1 Verification of Conditions: verify that conditions of substrate previously installed under other Sections or Contracts are acceptable for installation in accordance with manufacturer's written instructions.
 - .1 Visually inspect substrate in presence of Departmental Representative.
 - .2 Inform Departmental Representative of unacceptable conditions immediately upon discovery.
 - .3 Proceed with installation only after unacceptable conditions have been remedied and after receipt of written approval to proceed from Departmental Representative.

3.2 INSTALLATION

- .1 Do complete installation in accordance with the Canadian Electrical Code except where specified otherwise.
- .2 Do overhead and underground systems in accordance with CAN/CSA-C22.3 No.1 except where specified otherwise.

- .3 Complete installation in accordance with Alberta Building Code and Canadian Electrical Code.
- .4 Elevator Systems: Provide for "Related Work" listed and identified under Section 14 20 00, Elevators, to be executed by Electrical Contractor.
- .5 Mechanical Systems: Provide for 'Related Work' listed and identified for Divisions 26, 27 and 28, under Mechanical Divisions 21, 22, 23 and 25, to be executed by Electrical Contractor.
- .6 Feature Water Fountain Systems: This contractor is to provide all electrical branch wiring tight-ins at panelboard 'RP-RBA' in Fountain Pump Room (B135) Room for electrical wiring brought to panelboard by Water Fountain Contractor electrical subcontractor.

3.3 MANUFACTURER'S ATTENDANCE

- .1 Provide manufacturer's representatives to initially start-up each part of the Work, as specified, to check, adjust, calibrate and balance as applicable all components including controls and field wiring. Provide these services for such period and for as many visits as necessary to achieve complete working order in the subject Work.

3.4 FIELD INSPECTION

- .1 Provide Field Engineer for inspection and certification of equipment during installation, testing and commissioning as required.

3.5 HOUSEKEEPING PADS

- .1 Provide concrete pads to the requirements of Division 03.

3.6 FIRE BARRIERS

- .1 Provide fire stopping to the requirements of Division 07

3.7 PAINTING

- .1 Touch up finishes on electrical equipment found to be marred on completion of the Work using same colour and type of finish as originally used.
- .2 Prime paint field fabricated metalwork.

3.8 CORE DRILLING

- .1 Core Drilling Procedure
 - .1 Examine locations to be core drilled where:
 - .1 Diameter is greater than 25 mm
 - .2 Multiple drillings required and where the distance between centres is less than 10 times the diameter of the hole
 - .2 Examine by most suitable method including:
 - .1 X-ray

- .2 Ferro scan
- .3 Cable detection
- .3 Examine from both sides of the structure to be drilled.
- .4 Examine proposed core drilling locations to determine:
 - .1 Possible interference with
 - .1 Services
 - .2 Structural components
- .5 Select locations as suitable for core drilling and label them:
 - .1 Uniquely number each drilling location and core so that markings will be legible after drilling
 - .2 Mark each core with a north pointing arrow where drilling a slab or upward pointing arrow where drilling a wall
- .6 Without interfering with or damaging any services or structural elements, drill pilot holes sufficient to verify location of potential obstructions or for alignment purposes.
- .7 Use impact drill when drilling holes of 25 mm diameter or less. For holes of greater diameter use core drill.
- .8 Prepare report showing intended core drill locations including printouts, X-ray images. Submit the report for approval prior to drilling to Departmental representative.
- .9 Proceed with core drilling only after approval has been received from Departmental representative.
- .10 Confine drilling operation to time-of-day as stipulated by Departmental representative.
- .11 Position suitable warning notices of a type acceptable to Departmental Representative and exercise caution to ensure safety and protection of personnel and property during drilling especially from effects of water, dust damage, or falling objects below the slab or behind the wall being drilled.
- .12 Stop drilling immediately, and report to Departmental representative, if contact is made with foreign objects such as reinforcing steel (rebar), electrical conduit, water pipes, drainage pipes.
- .13 Cover open holes with secured covers to guard against fall through of objects.
- .14 Provide necessary firestopping, temporary or otherwise, sufficient to firestop holes that would be otherwise open during hours that the location is unattended. Coordinate placement of firestopping with Departmental representative.
- .15 Store all cores or core fragments on site and make them available for inspection by Departmental representative. Dispose of the cores or core fragments after permission is received from Departmental representative.

3.9 SLEEVES, CONDUIT AND CABLE INSTALLATION

- .1 Install conduit and sleeves prior to pouring of concrete.
 - .1 Sleeves through concrete: sized for free passage of conduit, and protruding 50mm.
 - .2 Sleeves through concrete floors: sized for free passage of conduit, protruding 50 mm and water-tight.
- .2 If plastic sleeves are used in fire rated walls or floors, remove before conduit installation.
- .3 Install cables, conduits and fittings embedded or plastered over, close to building structure so furring can be kept to minimum.

3.10 LOCATION OF OUTLETS

- .1 Do not install outlets back-to-back in wall; install boxes in adjacent stud wall partitions to preserve STC ratings of compartments.
- .2 Change location of outlets at no extra cost or credit, providing distance does not exceed 3000 mm, and information is given before installation.
- .3 Locate light switches on latch side of doors.
 - .1 Locate disconnect devices in mechanical and elevator machine rooms on latch side of floor.

3.11 MOUNTING HEIGHTS

- .1 Mounting height of equipment is from finished floor to centreline of equipment unless specified or indicated otherwise.
- .2 If mounting height of equipment is not specified or indicated, verify before proceeding with installation.
- .3 Install electrical equipment at following heights unless indicated otherwise.
 - .1 Light switches and Dimmer Controls: 1400 mm.
 - .2 Wall receptacles:
 - .1 Mount vertically, unless directed otherwise on drawings.
 - .2 General: 300 mm.
 - .3 Above top of continuous baseboard heater: 200 mm.
 - .4 Above top of counters or counter splash backs: 175 mm.
 - .5 Mechanical Rooms: 1400 mm
 - .6 Hazardous Areas: 1400 mm
 - .3 LAN Outlets: 400 mm.
 - .4 Fire alarm pull stations: 1500 mm
 - .5 Fire alarm bells: 2100] m.
 - .6 Wall mounted speakers or strobes: 2300 mm or 150 mm below ceiling
 - .7 Card readers: 900 mm

- .8 Door operators: 900 mm
- .9 Television outlets: [300] mm.
- .10 Panelboards: as required by Canadian Electrical Code or as indicated on plans
- .11 Wall mounted speakers: 2100 mm.
- .12 Clocks: 2100 mm.
- .13 Door bell pushbuttons: 1500 mm.
- .14 Wall mounted exit signs: 150 mm above door frame
- .15 Suspended mounted exit signs:

3.12 COORDINATION OF PROTECTIVE DEVICES

- .1 Ensure circuit protective devices such as overcurrent trips, relays and fuses are installed to required values and settings as determined in accordance with Section 26 05 73.
- .2 Ensure all distribution equipment is labelled in accordance with the Arc Flash Study.
- .3 Provide a signed letter from a Professional Engineer licensed in the Province of Alberta confirming the following:
 - .1 Settings of the protective devices have been adjusted as per the short circuit coordination study.
 - .2 Arc flash classification labels to all items of electrical distribution equipment have been installed as per the Arc-flash study.

3.13 FIELD QUALITY CONTROL AND COMMISSIONING

- .1 Carry out testing and commissioning for electrical systems and equipment in in presence of Departmental Representative and in accordance with relevant standards such as CSA, ULC, ANSI. Comply with the Acceptance Testing Specifications for the International Electrical Testing Association Inc (NETA).
- .2 Refer to division 1 of additional commissioning requirements.
- .3 Conduct and pay for all testing and commissioning.
- .4 Refer to each Section of Division 26, 27 and 28 for additional testing requirements for specific equipment components.
- .5 Provide the instruments, meters, equipment and personnel required to conduct the tests during and at the conclusion of the project.
- .6 In addition to the requirements of Division 1, all the electrical generic commissioning forms in connection with the equipment or systems have been structured in 3 parts: product identification, installation/operational check list and performance verification. All available commissioning forms are included in Division 1. Make those forms project specific and develop new ones where not available. Structure any new forms in 3 parts as described and provide all details to capture all requirements. The contractor shall utilize and follow procedures for testing as outlined in the NETA 2001 standard for acceptance testing and in addition as described in various electrical sections.

- .7 Load Balance:
 - .1 Measure phase current to panelboards with normal loads (lighting) operating at time of acceptance; adjust branch circuit connections as required to obtain best balance of current between phases and record changes.
 - .2 Measure phase voltages at loads and adjust transformer taps to within 2% of rated voltage of equipment.
 - .3 Provide upon completion of work, load balance report as directed in PART 1 - SUBMITTALS: phase and neutral currents on panelboards, dry-core transformers and motor control centres, operating under normal load, as well as hour and date on which each load was measured, and voltage at time of test.
- .8 Conduct:
 - .1 Power distribution system including phasing, voltage, grounding and load balancing.
 - .2 Circuits originating from branch distribution panels.
 - .3 Lighting and its control.
 - .4 Motors, heaters and associated control equipment including sequenced operation of systems where applicable.
 - .5 Systems: fire alarm and communications.
 - .6 Insulation resistance testing:
 - .1 Megger circuits, feeders and equipment up to 350 V with a 500 V instrument.
 - .2 Megger 350-600 V circuits, feeders and equipment with a 1000 V instrument.
 - .3 Check resistance to ground before energizing.
- .9 Advise Departmental representative, when testing to be performed.
- .10 Manufacturer's Field Services:
 - .1 Obtain written report from manufacturer verifying compliance of Work, in handling, installing, applying, protecting and cleaning of product and submit Manufacturer's Field Reports as described in PART 1 - ACTION AND INFORMATIONAL SUBMITTALS.
 - .2 Provide manufacturer's field services consisting of product use recommendations and periodic site visits for inspection of product installation, testing and commissioning in accordance with manufacturer's instructions.
- .11 Ten months after the building has been completed and occupied, and all load balancing and adjustments have been completed, carry out or engage and pay for a specialist to carry out an Infra Red Scan using AEGMA or equivalent instrument, on all major equipment and submit report complete with pictures and recommendations. Scanning time to be fully coordinated with the Departmental representative, at least two (2) weeks in advance, and shall meet all site operational requirements. Submit scanning plan to Departmental Representative and Engineer for review and approval.
 - .1 Major equipment shall include at least the following:

- .1 All Low Voltage Switchboards
- .2 All Distribution Panels, branch circuit Panels and disconnect switches.
- .3 All motor starters (including VFDs) and all motor connections.
- .4 Busway
- .5 Transformers
- .2 Submit to the Departmental Representative scan results within 48 hours of scanning. Adjust and modify the equipment as instructed by the Engineer. For equipment requiring adjustment or modification, rescan under load, until Engineer accepts results. Resubmit results for Engineer's review.
- .3 All work to be performed on weekends and after hours.

3.14 CLEANING

- .1 Clean and touch up surfaces of shop-painted equipment scratched or marred during shipment or installation, to match original paint.
- .2 Clean and prime exposed non-galvanized hangers, racks and fastenings to prevent rusting.

End of Section

1 General**1.1 SUMMARY**

.1 Section includes:

- .1 Labour, products, equipment and services necessary to complete the work of this Section.

1.2 RELATED SECTIONS

- .1 Section 26 05 01: Basic electrical requirements.
- .2 Section 26 05 54: Electrical identification.

1.3 REFERENCES

- .1 Conform to latest issues, amendments and supplements of following standards:
 - .1 Canadian General Standards Board (CGSB):
 - .1 CAN/CGSB-1.40-M - Primer, Structural Steel, Oil Alkyd Type
 - .2 Canadian Institute of Steel Construction (CISC/CPMA)
 - .1 CISC/CPMA 2.75 - Canadian Institute of Steel Construction/ Canadian Paint Manufacturers Association, A Quick Drying Primer For Use on Structural Steel
 - .3 Canadian Standards Association (CSA):
 - .1 CAN3-C21.1-M - Control Cable - 600V
 - .2 CAN3-C21.2-M - Control Cable for Low Energy Circuits 150V and 300V
 - .3 CAN/CSA C22.2 No. 18 - Outlet Boxes, Conduit Boxes, and Fittings
 - .4 CAN/C22.2 No. 26 - Wireways, Auxiliary Gutters and Associated Fittings
 - .5 CSA C22.2 No. 30-M - Explosion-Proof Enclosures for Use in Class I Hazardous Locations
 - .6 CSA C22.2 No. 38-M - Thermoset Insulated Wires and Cables
 - .7 CSA C22.2 No. 40-M - Cutout, Junction and Pull Boxes
 - .8 CSA C22.2 No. 42-M - General Use Receptacles, Attachment Plugs and Similar Wiring Devices
 - .9 CSA C22.2 No. 45-M - Rigid Metal Conduit
 - .10 CSA C22.2 No. 49 - Flexible Cords and Cables
 - .11 CAN/CSA C22.2 No. 51-M - Armoured Cables
 - .12 CSA C22.2 No. 52-M - Service-Entrance Cables
 - .13 CSA C22.2 No. 56 - Flexible Metal Conduit and Liquid-Tight Flexible Metal Conduit
 - .14 CSA C22.2 No. 62 - Surface Raceway Systems

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- .15 CSA C22.2 No. 65 - Wire Connectors
 - .16 CSA C22.2 No. 75-M - Thermoplastic Insulated Wires and Cables
 - .17 CSA C22.2 No. 76-M - Splitters
 - .18 CSA C22.2 No. 79 - Cellular Metal and Cellular Concrete Floor Raceways and Fittings
 - .19 CSA C22.2 No. 80 - Underfloor Raceways and Fittings
 - .20 CSA C22.2 No. 83-M - Electrical Metallic Tubing
 - .21 CAN/CSA-C22.2 No. 85-M - Rigid PVC Boxes and Fittings
 - .22 CAN/CSA C22.2 No. 94-M -Special Purpose Enclosures
 - .23 CSA C22.2 No. 123-M - Aluminum Sheathed Cables
 - .24 CSA C22.2 No. 124-M - Mineral-Insulated Cables
 - .25 CSA C22.2 No. 126-M - Cable Tray Systems
 - .26 CSA C22.2 No. 127 - Equipment Wires
 - .27 CAN/CSA-C22.2 No. 131-M - Type Teck 90 Cable
 - .28 CSA C22.2 No. 138-M - Heat Tracing Cable and Cable Sets for Use in Hazardous Locations
 - .29 CSA C22.2 No. 159-M - Attachment Plugs, Receptacles and Similar Wiring Devices for Use in Hazardous Locations: Class I, Groups A, B, C, and D; Class II, Group G, in Coal or Coke Dust, and in Gaseous Mines
 - .30 CSA C22.2 No. 174-M - Cable and Cable Glands for Use in Hazardous Locations
 - .31 CSA C22.2 No. 182.1 - Industrial Type, Special Use Attachment Plugs, Receptacles, and Connectors
 - .32 CSA C22.2 No. 182.2-M - Industrial Locking Type, Special Use Attachment Plugs, Receptacles, and Connectors
 - .33 CSA C22.2 No. 182.3-M - Special Use Attachment Plugs, Receptacles, and Connectors
 - .34 CSA C22.2 No. 208-M - Fire Alarm and Signal Cable
 - .35 CSA C22.2 No. 211.2-M - Rigid PVC (Unplasticized) Conduit
 - .36 CSA C22.2 No. 211.3 - Rigid Fiberglass Reinforced Epoxy (RE) Conduit and Associated Fittings
 - .37 CSA C22.2 No. 214-M - Communications Cables
 - .38 CSA C22.2 No. 222-M - Type FCC Under-Carpet Wiring System
 - .39 CSA C22.2 No. 227.1 - Electrical Nonmetallic Tubing
 - .40 CSA C22.2 No. 227.2 - Flexible Liquid-Tight Nonmetallic Conduit
 - .41 CSA C22.2 No. 227.3-M - Flexible Nonmetallic Tubing
 - .42 CSA C22.2 No. 230-M - Tray Cables

- .43 CSA C22.2 No. 232-M - Optical Fiber Cables
- .4 SSPC: Steel Structures Painting Council
 - .1 SSPC - Steel Structures Painting Council" Steel Structures Painting Manual, Vol. 2"

1.4 SUBMITTALS

- .1 Departmental Representative reserves the right to require Contractor to submit samples of any materials to be used in this project.
- .2 Dimensioned location drawings indicating required sleeves and/or openings in structural concrete or roofing or other locations affecting other trades work.
- .3 Proposed equipment nameplates and warning signs.
- .4 Detailed cable tray or J-Hook layouts.
- .5 Equipment/product factory testing reports.
- .6 Prior to application for Substantial Performance of the Work, submit the following to Departmental Representative for review:
 - .1 ESA inspection certificates.
 - .2 Fire alarm system pre-testing.
 - .3 Distribution system testing and coordination study performed.
 - .4 Structured network cabling system tested and verified.

2 Products

2.1 WIRE - LOW VOLTAGE UP TO 1000V SERVICE

- .1 Conductors
 - .1 ASTM Class B, soft drawn, electrolytic copper
 - .2 Stranded for # 10 AWG and larger.
- .2 Insulation
 - .1 CSA type RW90 XLPE (-40°C)
 - .1 Heat and moisture resistant
 - .2 Low temperature, chemically cross-linked thermosetting polyethylene material
 - .3 600V or 1000V rated
 - .4 For maximum 90°C conductor temperature
 - .5 For installation at minimum -40°C temperature
 - .6 To CSA C22.2 No. 38
 - .2 CSA type RWU90 XLPE (-40°C):

- .1 Heat and moisture resistant
- .2 Low temperature, chemically cross-linked thermosetting polyethylene material
- .3 1000V rated
- .4 For maximum 90°C conductor temperature
- .5 For installation at minimum -40°C
- .6 To CSA C22.2 No. 38
- .3 CSA type T90 NYLON (-10°C):
 - .1 Heat resistant
 - .2 Flame retardant
 - .3 Thermoplastic PVC material with extruded nylon cover
 - .4 600V rated
 - .5 For maximum 90°C conductor temperature dry and 75°C in wet locations
 - .6 For installation at minimum -10°C
 - .7 To CSA C22.2 No. 75-M
- .4 CSA type TEW:
 - .1 Heat resistant
 - .2 600V rated
 - .3 For maximum 105°C conductor temperature
 - .4 To CSA C22.2 No. 127
- .5 CSA type SEW-2
 - .1 Heat resistant
 - .2 600V rated
 - .3 For maximum 200°C conductor temperature
 - .4 To CSA C22.2 No. 127

2.2 CABLE - LOW VOLTAGE UP TO 1000V SERVICE

- .1 CSA Type AC90 XLPE (-40°C)
 - .1 Conductors
 - .1 ASTM Class B, soft drawn, electrolytic copper
 - .2 Solid for sizes #10 AWG and smaller
 - .3 Stranded for sizes #8 AWG and larger
 - .2 Insulation
 - .1 Heat and moisture resistant

- .2 Low temperature, chemically cross-linked thermosetting polyethylene material
 - .3 600V rated for sizes #10 AWG and smaller
 - .4 1000V rated for sizes #8 AWG and larger
 - .5 For maximum 90°C conductor temperature
 - .6 For installation at minimum -40°C temperature
 - .7 To CSA C22.2 No. 38
 - .3 Construction
 - .1 2, 3 or 4 insulated conductors
 - .2 Bare ground conductor
 - .3 Overall interlocking aluminium armour
 - .4 To CSA C22.2 No. 51
- .2 CSA Type TECK90 (-40°C)
 - .1 Conductors
 - .1 ASTM Class B, soft drawn, electrolytic copper
 - .2 Stranded
 - .2 Insulation
 - .1 Heat and moisture resistant
 - .2 Low temperature, chemically cross-linked thermosetting polyethylene material
 - .3 600V or 1000V rated
 - .4 For maximum 90°C conductor temperature
 - .5 For installation at minimum -40°C temperature
 - .6 CSA type RW90 XLPE
 - .7 To CSA C22.2 No. 38
 - .3 Construction
 - .1 1 or more insulated conductors
 - .2 Bare, stranded, copper ground conductor for multi-conductor cables
 - .3 Bare, solid, served copper ground conductors for single conductor cables
 - .4 Fillers with binder tape to produce a circular cross-section for multi-conductor cables
 - .5 Power cables
 - .1 1, 2, 3 or 4 conductors
 - .2 Conductors 1000V rated

- .6 Composite cables
 - .1 3 power conductors
 - .2 3 #14 AWG control conductors
 - .3 Conductors 600V rated
- .7 Extruded PVC inner jacket over conductor assembly
- .8 Interlocking aluminium armour over inner jacket
- .9 Extruded PVC overall jacket over armour
 - .1 FT4 flame test rated
 - .2 Colour black unless otherwise indicated
- .10 Cable assembly for installation at minimum -40°C temperature
- .11 To CSA C22.2 No. 131 and CSA C22.2 No. 174
- .3 CSA Type NMD90 (Romex):
 - .1 Non-metallic Sheathed Cable
 - .2 300V rated
- .4 CSA Type MI
 - .1 Conductors
 - .1 ASTM Class B, soft drawn, electrolytic copper
 - .2 Solid
 - .2 Insulation
 - .1 Powdered magnesium oxide
 - .2 600V rated for feeders on 208/120V system or control wiring
 - .3 1000V rated for feeders on 600/347V systems
 - .3 Construction
 - .1 Solid conductor
 - .2 Insulation around the conductor compressed to form a solid, homogeneous mass between the conductor and the metal sheath throughout the entire length of cable
 - .3 Soft annealed seamless copper sheath over insulation
 - .4 Extruded PVC overall jacket over sheath
 - .1 FT4 flame test rated
 - .2 Colour black unless otherwise indicated
 - .5 Two (2) hour fire rated where indicated on drawings.
 - .6 Connectors: watertight, field installed approved for MI cable.
 - .7 Termination kits: field installed approved for MI cable

- .8 To CSA C22.1 No. 124-M
- .4 Acceptable Manufacturer
 - .1 As a minimum performance standard the cabling shall meet the performance specifications as indicated above and as manufactured by Pyrotenax or equivalent.

2.3 CONTROL CABLES

- .1 Type: LVT: 2 soft annealed copper conductors, sized as indicated:
 - .1 Insulation: thermoplastic.
 - .2 Sheath: thermoplastic jacket.
- .2 Type: low energy 300 V control cable: solid annealed copper conductors sized as indicated:
 - .1 Insulation: TW 40 degrees C.
 - .2 Shielding: tape coated with diamagnetic material over each conductor.
 - .3 Overall covering: PVC jackets.
- .3 Type: 600 V stranded annealed copper conductors, sizes as indicated:
 - .1 Insulation: RW90 (x-link).
 - .2 Shielding: non-magnetic tape over each pair of conductors.
 - .3 Overall covering: PVC.

2.4 CABLE CONNECTORS

- .1 Connectors for Type AC90 Cable
 - .1 Steel or malleable iron
 - .2 Insulated throat
 - .3 As a minimal standard of performance the electrical device shall meet the or exceed the construction standards as provided be the following manufacturers
 - .1 Efcor 1000B series
 - .2 Elliott 65200 series
 - .3 Thomas & Betts 3110 series
- .2 Connectors for Type TECK90 Cable
 - .1 Copper free aluminium body
 - .2 Steel or copper free aluminium fittings and locknut
 - .3 Certified for use in hazardous locations Classes I, II, and III
 - .4 Class I hazardous location sealing fitting
 - .5 As a minimal standard of performance the electrical device shall meet the or exceed the construction standards as provided be the following manufacturers
 - .1 Thomas & Betts "STE" series

- .2 Crouse-Hinds type TMC
- .3 Commander/Iberville type TEK

2.5 WIRE AND CABLE CONNECTORS

- .1 Copper compression type wire and cable terminations for #8 AWG and larger conductors, colour keyed, sized to suit. Long barrel NEMA 2 hole lugs for sizes #1/0 AWG and larger.
 - .1 As a minimal standard of performance the electrical device shall meet the or exceed the construction standards as provided be the following manufacturers
 - .1 Thomas & Betts series 54000
 - .2 Ideal Powr-Connect
 - .3 Burndy Hylug
 - .2 Twist type splicing connectors, copper, sized to suit, with nylon or plastic shroud for tee connections in #10 AWG and smaller conductors.
 - .1 As a minimal standard of performance the electrical device shall meet the or exceed the construction standards as provided be the following manufacturers
 - .1 Thomas & Betts spring type
 - .2 Ideal Twister
 - .3 Marr Marrette
 - .3 Conductor compression splice for #10 AWG or smaller.
 - .1 As a minimal standard of performance the electrical device shall meet the or exceed the construction standards as provided be the following manufacturers
 - .1 Thomas & Betts STA-Kon series
 - .2 Ideal Splices
 - .3 Burndy

2.6 WIRE PULLING LUBRICANT

- .1 Wire pulling lubricant to be "Ideal Industries", Yellow 77 Plus Wire pulling Lubricant or approved equivalent.

2.7 HEAT SHRINKABLE TUBING INSULATION, HEAVY WALL

- .1 As a minimal standard of performance the electrical device shall meet the or exceed the construction standards as provided be the following manufacturers
- .2 Thomas & Betts, Shrink-Kon series
- .3 Ideal Thermo-Shrink, TS-46
- .4 Raychem tubing WCSM
- .5 3M cable sleeve ITCSN

2.8 MOTOR LEAD CONNECTION KITS, 600 VOLT

- .1 Connection kits for low voltage motors.

- .1 As a minimal standard of performance the electrical device shall meet the or exceed the construction standards as provided be the following manufacturers
- .2 3M, motor lead splice kit, pigtail, 5300 series
- .3 Raychem, motor connection kit, MCK, type V

2.9 CONDUIT AND FITTINGS

- .1 Rigid Steel Conduit
 - .1 To CSA C22.2 No. 45-M
 - .2 Rigid thick wall galvanized steel threaded conduit
- .2 Coated Steel Conduit
 - .1 Corrosive resistant coated rigid thickwall steel threaded conduit, CSA approved.
 - .2 As a minimal standard of performance the electrical device shall meet the or exceed the construction standards as provided be the following manufacturers
 - .1 Rob Roy Plastibond PVC coated
 - .2 Columbex Green Guard II epoxy polyester coated
- .3 Rigid PVC Conduit
 - .1 To CSA C22.2 No. 211.2-M
 - .2 Rigid PVC conduit
- .4 Flexible Steel Conduit
 - .1 To CSA 22.2 No. 56
 - .2 Liquid-tight flexible steel conduit with PVC cover
- .5 Non-Metallic Flexible Conduit
 - .1 Non-metallic extra flexible PVC conduit
 - .2 As a minimal standard of performance the electrical device shall meet the or exceed the construction standards as provided be the following manufacturers
 - .1 Carlon, Carflex X-Flex
 - .2 Hubbell, Polytuff Black
- .6 Rigid Steel Conduit Fittings
 - .1 To CAN/CSA C22.2 No. 18
 - .2 Galvanized or polymer coated cast steel fittings
 - .3 Expansion fittings, watertight with integral bonding jumper suitable for linear expansion and 19 mm deflection in all directions
 - .4 Sealing condulets for hazardous areas
 - .5 Corrosive resistant coated cast steel fittings for corrosive resistant conduit
- .7 Rigid PVC Conduit Fittings

- .1 To CSA C22.2 No. 85-M
- .2 Rigid PVC fittings of same manufacture as rigid PVC conduit
- .8 Liquid Tight Flexible Steel Conduit Fittings
 - .1 Watertight connectors with nylon insulated throat
 - .2 As a minimal standard of performance the electrical device shall meet the or exceed the construction standards as provided be the following manufacturers
 - .1 T & B Series 5331 with Sealing O-ring Series 5262
 - .2 Commander/Iberville Series 6300-IT with nitrile O-ring

2.10 EMT AND FITTINGS

- .1 EMT
 - .1 To CSA C22.2 No. 83-M
 - .2 EMT galvanized cold rolled steel tubing
- .2 EMT Fittings
 - .1 Compression type, steel
 - .1 Gland compression connectors with insulated throats
 - .2 Compression couplings
 - .2 As a minimal standard of performance the electrical device shall meet the or exceed the construction standards as provided be the following manufacturers
 - .1 :
 - .1 T & B Series 5123 & 5120
 - .2 O-Z/Gedney type ZTC series
 - .3 Commander/Iberville Series 5600-IT and 5700
 - .3 Set screw type, steel, concrete-tight
 - .1 Connectors with insulated throats
 - .2 Couplings
 - .4 As a minimal standard of performance the electrical device shall meet the or exceed the construction standards as provided be the following manufacturers
 - .1 Commander/Iberville Series 5400 and 5500

2.11 CABLE TRAY

- .1 Cable Trays and Fittings
 - .1 To EEMAC F5-1
 - .2 To CAN/CSA C22.2 No. 126-M
- .2 Ladder Type
 - .1 Class C1

- .2 Steel, hot dip galvanized after fabrication
- .3 Side height, 100 mm
- .4 Rung spacing, 300 mm
- .5 Width as indicated on drawings.
- .3 Basket Type
 - .1 Class C1
 - .2 Powder coated with average paint thickness of 30 microns to 75 microns.
 - .3 50 mm x 50 mm grid
 - .4 Side height: 100 mm minimum.
 - .5 Width as indicated on drawings.
- .4 As a minimal standard of performance the electrical device shall meet the or exceed the construction standards as provided be the following manufacturers
 - .1 Legrand Cablofil
 - .2 Cooper B-Line
 - .3 Canadian Electrical Raceways

2.12 WIREWAY

- .1 To CSA C22.1 No. 94-M.
- .2 Steel with hinged cover to give uninterrupted access.
- .3 Elbows, tees, couplings and hanger fittings manufactured as accessories for wireway supplied.
- .4 As a minimal standard of performance the electrical device shall meet the or exceed the construction standards as provided be the following manufacturers
 - .1 Amalgamated Electric
 - .2 Canadian Electrical Raceways
 - .3 Schneider Square D
 - .4 Pilgrim
 - .5 Pursley

2.13 SURFACE RACEWAY

- .1 Surface Raceway to be Legrand Wiremold Model No. 'DS4000 Designer Series'.
- .2 Surface metal raceway, single or complete with snap-in divider to form 2 compartments for power and data, with removable cover. Width to suit application while keeping Code and Telecommunication standard filling ratios.

- .3 Elbows, couplings, end caps, device brackets and faceplates for power, data and voice, and fittings manufactured as accessories for wireway supplied. 120V power receptacles and mounting only for voice/data.
- .4 Finish: Designer Grey
- .5 As a minimal standard of performance the electrical device shall meet the or exceed the construction standards as provided be the following manufacturers
 - .1 Legrand/Wiremold or approved equivalent.

2.14 FASTENINGS, SUPPORTS AND SLEEVES

- .1 Fastenings
 - .1 Galvanized steel straps, beam clamps and threaded rods for structural steel
 - .2 Concrete inserts, Crane Canada No.4-M for concrete work for single or double conduit cable tray.
 - .3 Unistrut multiple type inserts for runs of three or more conduits.
 - .4 Concrete fastener type "WEJ-IT" anchors
 - .5 Drywall, plaster or ceiling, 2-wing spring toggles
 - .6 40mm width, galvanized steel channels complete with accessories for metal framing channels.
 - .1 Unistrut
 - .2 Thomas & Betts
 - .7 Metal "J" hooks cable supports systems for communication systems cabling in accessible ceiling spaces where conduit or cable tray is not being provided.
 - .8 Velcro tie wraps for bundling and securing telecommunication cabling
- .2 Sleeves
 - .1 Schedule 40 steel pipe, minimum I.D. 13 mm larger than O.D. of conduit or cable passing through.
- .3 Strut
 - .1 Continuous slotted channel
 - .2 12 gauge pre-galvanized steel
 - .3 41.2 mm x 41.2 mm minimum
 - .4 As a minimal standard of performance the electrical device shall meet the or exceed the construction standards as provided be the following manufacturers
 - .1 B-Line
 - .2 Pilgrim
 - .3 Pursley
 - .4 Unistrut

2.15 ACCESS DOORS

- .1 Access doors to Section 10 00 00, manufactured Specialties.

2.16 SPLITTER BOXES

- .1 Code gauge galvanized sheet steel enclosure EEMAC Type 4 or 12, welded corners and formed hinged cover suitable for locking in closed position.
- .2 Cast steel enclosure EEMAC 7 or 9 with gasketed bolt on cover for and to suit the designated hazardous locations.
- .3 Copper main and branch lugs to match required size and number of incoming and outgoing conductors.
- .4 At least 3 spare terminals on each set of lugs in splitters less than 400 A.

2.17 JUNCTION BOXES

- .1 Galvanized steel EEMAC Type 1, 4, 12, size as required by code for number and size of conduits, conductors and devices, complete with covers, corrosion resistant screws, terminal blocks and mounting rails.
- .2 Screw-on sheet steel covers to match enclosure for surface mounting boxes.
- .3 Covers with 25 mm minimum extension around for flush-mounted junction boxes.
- .4 Galvanized steel barriers as required.

2.18 TERMINAL BLOCKS - SURGE PROTECTION

- .1 Terminal blocks, rail mounted, with surge voltage protection, rated for circuit voltage.
- .2 Acceptable Manufacturers
 - .1 Phoenix Contact Termitrab SLKK5 (Termitrab SLKK5-F) (TT-SLKK5-S).

2.19 PULL BOXES

- .1 Galvanized sheet steel welded construction, EEMAC Type 4 or 12.
- .2 Screw-on galvanized sheet steel covers for surface mounting boxes.
- .3 Covers with 25 mm minimum extension around, for flush mounted pull boxes.
- .4 Galvanized steel barriers as required.

2.20 METER CABINET

- .1 Sheet steel CSA Type 2 sprinkler-proof enclosure with meter backplate, to accommodate meters, test terminal block and associated equipment, factory installed and wired.
- .2 Utility metering cabinet to conform with Utilities specifications.

2.21 CONDUIT BOXES - GENERAL

- .1 Boxes for EMT

- .1 Galvanized pressed steel
- .2 Boxes for Rigid Steel Conduit
 - .1 Galvanized cast iron alloy FS boxes with mounting feet for surface mounted switches and receptacles
 - .2 Gasketed cover plate for exterior location
 - .3 For corrosive resistant coated conduit: cast boxes with same finish as conduit
- .3 Boxes for Rigid PVC Conduit
 - .1 PVC boxes

2.22 OUTLET BOXES - SHEET STEEL

- .1 Pressed steel single and multi-gang flush device boxes, minimum size 100 mm x 50 mm x 38 mm. 100 mm square outlet boxes where more than 1 conduit enters 1 side, with extension rings as required.
- .2 100 mm square or octagonal outlet boxes.
- .3 119 mm square outlet boxes with extension and plaster rings as necessary for flush mounting devices in gypsum board, plaster or panelled walls.

2.23 MASONRY BOXES

- .1 Pressed steel masonry single and multi-gang boxes for devices flush mounted in exposed masonry walls with extension and plaster rings as required.

2.24 CONCRETE BOXES

- .1 Pressed steel concrete type boxes for flush mount in concrete with extension and plaster rings as required.

2.25 OUTLET BOXES - FITTINGS

- .1 Bushings and connectors with nylon insulated throats.
- .2 Knock-out fillers to prevent entry of foreign materials.
- .3 Double locknuts and insulated bushings for sheet steel metal boxes.

2.26 WIRING DEVICES - SWITCHES

- .1 Specification grade, general purpose AC switches, manual toggle operated, white and brown colour, 15A, 20A, 120-277V, 347V, single pole, double pole, three-way, four-way switches as required.
- .2 Acceptable manufacturers:
 - .1 Hubbell - HBL1201 Series: HBL1221 Series: HBL18201 Series: HBL 18221 Series
 - .2 P & S - 15AC Series: 20AC Series: 370000 Series
 - .3 Arrow Hart - 1891 Series: 1991 Series: 18201 Series: 18221 Series

- .3 Specification grade, general purpose AC switches, manual rocker operated, white colour, 15A, 20A, 120-277V, 347V, single pole, double pole, 3 way, 4 way switches as required.
- .4 Acceptable Manufacturers
 - .1 Bryant, 120-277V, Fashion Series 9000
 - .2 Hubbell, 120-277V, Style Line 2100 Series
 - .3 Leviton, 120-277V and 347V, Decora Plus 5600 Series
 - .4 Pass & Seymour, 120-277V and 347V, Sierraplex Decorator, 2600 and 2600000 Series

2.27 WIRING DEVICES – OCCUPANCY SENSORS

- .1 Occupancy Sensor, WattStopper, Model No. EW-205 or equivalent:
 - .1 The passive infrared sensor shall be capable of detecting presence in the control area by detecting changes in infrared energy.
 - .2 Sensor shall be sealed and gasketed and shall be moisture and dust proof.
 - .3 Sensor shall function in a temperature range of -40°F (-40°C) to +95°F (+35°C).
 - .4 Sensor shall utilize a temperature compensated, dual element sensor and a multi-element Fresnel lens.
 - .5 Fresnel lens shall be a Poly IR 4 based material (for standard and Long Range lens) to offer superior performance in the infrared wavelengths and filter short wavelength infrared, such as those emitted by the sun and other visible light sources. The lens shall have grooves facing in to avoid dust and residue build up which affects IR reception. Aisleway lenses shall be a poly IR 2 based material.
 - .6 Sensor shall provide 270° coverage with the Standard Lens, up to 50 linear feet with the Long Range Lens.
 - .7 Sensor shall have a DIP switch controlled digital time delay setting, adjustable from 15 seconds to 10 minutes approximately.
 - .8 Sensor shall have DIP switch sensitivity setting adjustable from minimum to maximum.
 - .9 Adjustments and mounting hardware shall be concealed under a removable cover to prevent tampering of adjustments and hardware.
 - .10 Sensors shall be capable of being wired in parallel to allow coverage of large areas.
 - .11 To ensure quality and reliability, sensor shall be manufactured by and ISO9002 certified manufacturing facility and shall have a defect rate of less than 1/3 of 1%.
 - .12 Sensor shall have a standard 5 year warranty.
 - .13 Sensor shall be UL and CUL listed.
- .2 Light Switch Type 'B' - Dual Technology Dual Relay Wall Switch Sensor, WattStopper, Model No. DW-200 or equivalent:
 - .1 Sensor shall be capable of detecting presence in the control area by detecting shifts in transmitted ultrasound and passive infrared heat changes.

- .2 Sensor shall utilize ultrasonic and PIR technologies to reduce likelihood of false operations
- .3 Sensor shall feature a trigger mode where the end-user can choose which technology will activate the sensor from Off mode (initial), the type of detection that will reset the time delay (maintain), and the type of detection that will cause the sensor to be turned back On immediately after lights turned Off due to lack of motion (re-trigger). Selection of technologies for initial, maintain, and re-trigger shall be done with DIP switches.
- .4 Sensor shall have its trigger mode factory preset to allow for quick installation in most applications. In this default setting, both technologies must occur in order to initially activate lighting systems. Detection by either technology shall maintain lighting on, and detection by either technology shall turn lights back on after lights were turned off for 5 seconds or less in automatic mode and 30 seconds or less in manual mode.
- .5 Sensor shall have 4 occupancy logic options for customized control to meet application needs.
- .6 Robotic test method as referred in the NEMA WD 7 guide shall be utilized for minor motion coverage verification.
- .7 Automatically adjusts the detection threshold dynamically to compensate for constantly changing levels of activity and air flow throughout controlled space.
- .8 Sensor shall utilize two relays capable of simultaneously controlling independent lighting loads or circuits. The secondary relay is isolated, allowing for two-circuit control.
- .9 Sensor shall have no minimum load requirement and shall be capable of switching from 0 to 800 Watt incandescent; 0 to 800 Watt fluorescent or 1/6 hp @ 120 VAC, 60Hz; and 0 to 1200 Watt fluorescent @ 277 VAC, 60Hz.
- .10 Sensor shall feature a walk-through mode, where lights turn off 3 minutes after the area is initially occupied if no motion is detected after the first 30 seconds, set by a DIP switch.
- .11 To avoid false ON activations, the sensor shall examine the frequency, duration, and amplitude of a signal, to respond only to those signals caused by human motion.
- .12 Sensor shall cover up to 1,000 sq. ft. for walking motion, with a field view of 180 degree
- .13 Sensor shall have automatic-ON or manual-ON operation on both relays adjustable with DIP switch.
- .14 Sensor shall have a time delay that is adjusted automatically or shall have a fixed time delay of 5 to 30 minutes, set by DIP switches.
- .15 In automatic mode, sensor shall be capable to automatically return to Automatic-ON after lights are turned off manually.
- .16 Each sensing technology shall have a LED indicator that remains active at all times in order to verify detection within the area to be controlled.

- .17 Sensor shall have a service switch to allow end-users to operate the sensor in the unlikely event of a failure; set by a trim pot.
- .18 Sensor shall be able to control electronic low voltage, and fluorescent loads.
- .19 Sensor shall have a built-in light level featuring simple, one-step daylighting setup that works from 8 to 180 foot candles.
- .20 Switching mechanism shall be a relay(s). Triac and other harmonic generating devices shall not be allowed. Sensor shall have ground wire and grounded strap for safety.
- .21 The Dual Technology wall switch sensor shall be a completely self contained control system that replaces a standard toggle switch
- .22 Sensor shall have standard 5 year warranty and shall be UL and CUL listed
- .3 Light Switch Type 'OS' – as type 'B' except single relay switch.

2.28 WIRING DEVICES - RECEPTACLES FOR GENERAL SERVICE

- .1 Receptacles: specification grade suitable for back and side wiring, complete with grounding terminal, white colour for straight blade devices and black colour for twistlock devices.
- .2 All receptacles shall be from one manufacturer.
- .3 Acceptable Manufacturers:
 - .1 15A, 125V, (5-15R) Single Straight Blade
 - .1 Arrow Hart 5261
 - .2 Leviton 5261
 - .3 Hubbell 5261
 - .4 Pass & Seymour 5261
 - .2 15A, 125V, (5-15R) Duplex Straight Blade
 - .1 Arrow Hart 5262
 - .2 Leviton 5262
 - .3 Hubbell 5262
 - .4 Pass & Seymour 5262
 - .3 20A, 125V, (5-20R) Single Straight Blade
 - .1 Arrow Hart 5361
 - .2 Leviton 5361
 - .3 Hubbell 6331
 - .4 Pass & Seymour 5361
 - .4 20A, 125V, (5-20R) Duplex Straight Blade
 - .1 Arrow Hart 5392
 - .2 Leviton 5362

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- .3 Hubbell 5392
 - .4 Pass & Seymour 5362
 - .5 15A, 125V, (5-15R) Duplex GFCI, Straight Blade
 - .1 Arrow Hart GF5242AH
 - .2 Leviton 6599-W
 - .3 Hubbell GF-5252
 - .4 Pass & Seymour 1591
 - .6 15A, 125V, (5-15R) Duplex Isolated Ground Straight Blade
 - .1 Arrow Hart IG5262AH
 - .2 Leviton 5262-IG
 - .3 Hubbell IG-5262
 - .4 Pass & Seymour IG6200
 - .7 20A, 125V, (L5-20R) Single locking, 2 pole, 3 wire grounding
 - .1 Arrow Hart 6200
 - .2 Leviton 2310
 - .3 Hubbell 2310ACN
 - .4 Pass & Seymour L520-RCN
 - .8 20A, 250V, (L6-20R) Single locking, 2 pole, 3 wire, grounding
 - .1 Arrow Hart 6210
 - .2 Leviton 2320
 - .3 Hubbell 2320ACN
 - .4 Pass & Seymour L620-RCN
 - .9 30A, 250V, (L6-30R) Single locking, 2 pole, 3 wire, grounding
 - .1 Arrow Hart 6340
 - .2 Leviton 70630-FR
 - .3 Hubbell 2620CAN
 - .4 Pass & Seymour L630RCN
 - .10 30A, 250V, (L15-30R) Single locking, 3 pole, 4 wire, phase, grounding
 - .1 Arrow Hart 6520
 - .2 Leviton 2720
 - .3 Hubbell 2720ACN
 - .4 Pass & Seymour L1530-RCN
 - .11 20A, 347V (L24-20R) Single locking, 2 pole, 3 wire grounding
 - .1 Leviton 3721

- .2 Pass & Seymour L3720-RCN
- .12 15A, 125V (5-15R) Quad straight blade, 2 pole, 3 wire grounding
 - .1 Bryant 1254
 - .2 Hubbell 415 series
 - .3 Pass & Seymour 1254
- .13 15A, 347V, (24-15R) Quad straight blade, 2 pole, 3 wire grounding
 - .1 Bryant 3474W
 - .2 Hubbell 415347WC
 - .3 Pass & Seymour 3474W
- .14 15A, 125V, (5-15R) Duplex straight blade
 - .1 Arrow Hart 26262
 - .2 Leviton Decora Plus
 - .3 Hubbell 2152 series
 - .4 Pass & Seymour 885
- .15 15A, 125V (5-15R) Duplex straight blade, 2 pole, 3 wire grounding, surge suppression indicator light, blue (ivory) colour
 - .1 Arrow Hart 5250
 - .2 Hubbell 5260
- .16 15A, 125V (5-15R) Duplex straight blade, 2 pole, 3 wire grounding, isolated ground surge suppression indicator light, blue (ivory) colour
 - .1 Arrow Hart IG5250
 - .2 Hubbell IG5262,

2.29 WIRING DEVICES - RECEPTACLES FOR PATIENT CARE AREAS

- .1 Receptacles: CSA Approved, ULC Listed, specification Hospital grade with green dot symbol, suitable for back and side wiring, flush, complete with grounding terminal, thermoplastic polyester face/body construction, 2-pole, 3-wire grounding receptacles complete with one piece nickel-plated brass mounting strip with integral grounding clips, ground retention clips, nickel-plated brass wiring clamps with nickel-plated brass screws, front circuit identification area and reinforced thermoplastic brass colour as required for type of area for straight blade devices.
- .2 Receptacles of one manufacturer.
- .3 Acceptable Manufacturers:
 - .1 15A, 125V, (5-15R) duplex Straight Blade
 - .1 Leviton: 16262-HG
 - .2 Hubbell: HBL 8200
 - .3 Pass & Seymour: 26262HG

- .2 20A, 125V, (5-20R) duplex Straight Blade
 - .1 Leviton: 16362-HG
 - .2 Hubbell: HBL 8300
 - .3 Pass & Seymour: 26362HG
- .3 15A, 125V, (5-15R) duplex Straight Blade, ULC Class A, GFCI
 - .1 Leviton: 7599-HG
 - .2 Hubbell: GF8200H
 - .3 Pass & Seymour: 1595HG
- .4 20A, 125V, (5-20R) duplex Straight Blade, ULC Class A, GFCI
 - .1 Leviton: 7899-HG
 - .2 Hubbell: GF8300H
 - .3 Pass & Seymour: 2095HG

2.30 WIRING DEVICES - COVER PLATES

- .1 Stainless steel Type 302 alloy, vertically brushed, 0.8 mm thick cover plates.
- .2 Nylon, smooth, high impact strength.
- .3 Pressed steel, galvanized.
- .4 Cast covers for cast boxes with gaskets.
- .5 Outdoors:
 - .1 Marine grade outlet box hood
 - .2 Weather proof die cast alloy 360 copper free aluminum
 - .3 Nema 3R rating for in-use protection
 - .4 Gaskets are closed-cell foam
 - .5 Latching covers hold securely
 - .6 Large cord openings
 - .7 Holes for padlocks are 6.4 mm diameter
 - .8 Acceptable manufacturers:
 - .1 Hubbell No. WP7D Series or equivalent.
- .6 Cover plates of same manufacture as devices.

2.31 WELDING RECEPTACLES

- .1 Circuit Breaking Receptacle
 - .1 Receptacle and back box assembly, 600 volt, 60 amp, 3 wire, 4 pole, weatherproof, aluminum housing.
 - .2 Acceptable Manufacturers

- .1 Appleton Powertite, AJA mounting box and spring door
 - .2 Crouse-Hinds, Arktite AREA 6000 series, AJ back box, angle adaptor and spring door
 - .3 Russellstoll, type JRFA, 20 degree angle adaptor and spring door
- .2 Interlocked Receptacle and Switch
 - .1 Receptacle interlocked with unfused disconnect switch, 600 volt, 60 amp, 3 wire, 4 pole. Receptacle with aluminum housing and spring door. Disconnect switch with NEMA 12 sheet steel enclosure.
 - .2 Acceptable Manufacturers
 - .1 Appleton WSRD interlocked receptacle
 - .2 Crouse-Hinds Arktite receptacle with WSRD disconnect switch
 - .3 Schneider Square D with Crouse-Hinds Arktite receptacle and class 3110 disconnect switch
- .3 Compact Interlocked Receptacle and Switch
 - .1 Compact unit, receptacle interlocked with unfused disconnect switch, 600 volt, 60 amp, 3 wire, 4 pole, watertight, NEMA 4X non-metallic enclosure.
 - .2 Acceptable Manufacturers
 - .1 Bryant, 460SM series
 - .2 Crouse-Hinds, Arktite CSR Series
 - .3 Hubbell, Circuit-Lock

2.32 FUSES

- .1 Form I, Class "J" HRC for continuous loads
- .2 Form II, Class "C" HRC for cycling loads
- .3 Acceptable manufacturers:
 - .1 Ferraz-Shawmut
 - .2 Cooper Bussmann

2.33 PUSHBUTTONS OPERATORS

- .1 Rockwell Automation, 800T Series
- .2 Exact type and rating to suit application
- .3 Acceptable manufacturers:
 - .1 Rockwell Automation
 - .2 Eaton Cutler-Hammer
 - .3 SquareD
 - .4 GE

.5 Schneider Electric

2.34 ROOFTOP CONDUIT SUPPORT SYSTEM

- .1 Cooper B-Line "Dura – Blok" series rooftop support systems

2.35 PLYWOOD BACKBOARDS

- .1 Plywood backboards, good one side, 4' x 8' x $\frac{3}{4}$ " (1220mm x 2440mm x 19mm) unless indicated otherwise. Treat with primer and two coats of fire retardant paint.
- .2 Mount plywood on vertical strapping, on 40 mm centres to provide 10 mm clearance between wall and rear of plywood. Treat strapping similar to plywood.

2.36 ELCU EMERGENCY LIGHTING CONTROL UNIT

- .1 Provides all required functionality to allow any standard lighting control device to control emergency lighting in conjunction with normal lighting in any area within a building.
- .2 Self-contained and provide integral one half inch pip nipple mount with snap in locking feature for mounting into a standard junction box KO.
- .3 Normally closed dry contacts capable of switching 20 amp emergency ballast loads @ 120-277 VAC, 60 Hz, or 10 amp tungsten loads @ 120 VAC, 60 Hz.
- .4 Universal rated voltage inputs provided for normal power sense and normal switched power at 120-277 VAC, 60 Hz.
- .5 Integral momentary test switch. Pressing and holding this switch shall instantly force the unit into emergency mode and turn on emergency lighting. Releasing the test switch shall immediately return the unit to normal operation.
- .6 Dedicated leads and 24 VDC source for connection to remote test switch, fire alarm system, or other external system capable of providing a normally closed dry contact closure. Breaking contact between the terminals shall force and hold the emergency lighting on until the terminals are again closed. An integral LED indicator shall indicate the unit's current remote activation status.
- .7 Separate LEDs to indicate the presence of normal and emergency power sources. The LEDs shall indicate the unit's current operational mode (normal or emergency).
- .8 Automatically switches emergency lighting on and off as normal lighting is switched. When normal power is not available, the unit shall force and hold emergency lighting on regardless of the state of any external control device until normal power is restored.
- .9 Zero crossing circuitry to protect relay contacts from the damaging effects of inrush current generated by switching electronic ballast loads.
- .10 UL94 V-O plenum rated and equipped with compression flying leads.
- .11 UL and cUL listed and labeled for connection to both normal and emergency lighting power sources.
- .12 Acceptable manufacturer: WattStopper Model No. ELCU-200

2.37 FINISH

- .1 Equipment enclosure finish: baked grey enamel, ANSI 49 or ANSI 61.

3 Execution**3.1 WIRE AND CABLE**

- .1 Install wiring in raceways unless noted otherwise.
- .2 Install separate and dedicated neutral wires for each circuit fed from:
 - .1 Harmonic mitigation transformers/panelboards (e.g. RP-Hxx)
 - .2 UPS panelboards (e.g. RP-Uxx)
 - .3 Lighting panelboards (e.g. LP-Lxx)
- .3 Provide 600 V rated cable for up to 208 V application; 1000V rated cable for up to 600 V application.
- .4 Wiring in walls: typically drop or loop vertically from above to better facilitate future renovations. Generally wiring from below and horizontal wiring in walls to be avoided unless indicated.
- .5 Minimum wire sizes:
 - .1 Power and lighting No. 12 AWG
 - .2 Control No. 14 AWG
 - .3 Fire alarm No.: to Section 28 31 00 Fire Detection and Alarm Systems
- .6 Wire and cable application and type:

Application	Type
Lighting branch circuits	T90 nylon for conditioned spaces RW90 for unconditioned spaces/areas
Receptacle branch circuits	T90 nylon for conditioned spaces RW90 for unconditioned spaces/areas
Ceiling boxes to luminaires in suspended ACT	T90 nylon or AC90 cable (max. length as noted below)
Ceiling boxes to luminaires in non-accessible ceilings.	T90 nylon or AC90 cable (max. length as noted below)
Ceiling boxes to receptacles	T90 nylon for conditioned spaces RW90 for unconditioned spaces/areas
Wiring inside high temperature equipment (including final connection)	TEW or SEW-2

Underground and under slab raceways, duct banks, direct burial	RWU90
All distribution feeders and equipment feeders	RW90 or Mineral Insulated
Life safety feeders and equipment feeders	Mineral insulated – 2 hr rated.
Hazardous locations	RW90 or mineral insulated (as per OESC Class 1 zone 2.

- .7 Type AC90 cable length limitations:
 - .1 Ceiling box to luminaire:
 - .1 2 m maximum in non-accessible ceilings;
 - .2 3 m in accessible ceilings
 - .2 Junction box to outlet:
 - .1 4 m maximum
- .8 Load current limitations:
 - .1 Conductors rated for more than 90°C:
 - .1 75°C code ampacity rating
 - .2 90°C code ampacity rating if terminating device and/or equipment maximum conductor termination temperature is 90°C rated.
 - .2 Motor connection:
 - .1 75°C code ampacity rating
- .9 Use wire lubricant when pulling wires into conduit. Wires shall be kept straight and not twisted.

3.2 CONNECTORS

- .1 Install compression terminations and splices in accordance with manufacturer's written instructions.
- .2 Make splices in junction boxes.
- .3 Make connections in lighting circuits with twist type splicing connectors.
- .4 Terminate and splice conductors No. 8 and larger at terminal blocks in junction boxes.
- .5 Seal terminations and splices exposed to moisture, corrosive conditions or mechanical abrasions with heavy wall heat shrinkable insulation.
- .6 Install fixture type connectors and tighten. Replace insulating cap.

3.3 MOTOR LEAD CONNECTION KITS, 600 VOLT

- .1 Install motor lead connection kits for low voltage motors.

3.4 CONDUIT AND EMT - GENERAL

- .1 Run parallel or perpendicular to building lines.
- .2 Group raceways wherever possible. Support on channels.
- .3 Install expansion joints as required.
- .4 Run raceways in web portion of structural steel columns and beams.
- .5 Do not drill structural members to pass through.
- .6 Locate raceways behind infrared or unit heaters with 1500 mm clearance.
- .7 Locate raceways not less than 125 mm clear where parallel to steam or hot water lines with a minimum of 75 mm at crossovers.
- .8 Do not install horizontal runs in masonry walls.
- .9 Use metallic raceway where temperatures exceed 75°C or where enclosed in thermal insulation.
- .10 EMT and non-metallic conduits to contain insulated green ground wire.
- .11 Install 6 mm diameter nylon pull cord in empty raceways.
- .12 Conduits may be surface mounted (exposed) in mechanical and electrical rooms and spaces; and concealed elsewhere.

3.5 CONDUIT AND FITTINGS

- .1 Minimum conduit sizes:
 - .1 Surface installation: 21 mm trade size conduit
 - .2 Embedded in concrete: 27 mm trade size conduit
 - .3 Directly buried: 53 mm trade size conduit
- .2 Conduit application and type:

Application	Type
Corrosive areas	rigid steel corrosion resistant coated
Hazardous areas	rigid steel
Outdoor areas	rigid steel hot dip-galvanized
Embedded in concrete	rigid PVC
In or below grade slab	Rigid PVC
Exposed in unfinished areas up to 3 m above finished floor. Use EMT above 3m	rigid steel
Connection to motors and equipment subject to vibration	liquid tight flexible steel conduit

Final connection to dry type transformer	flexible steel conduit
Whip connection to modular furniture - power	Furniture whip provided by furniture system manufacturer or flexible EMT
Whip connection to modular furniture - others	non-metallic extra flexible PVC
Unheated parking garage area	Rigid steel

- .3 Use field threads on rigid conduit of sufficient length to draw conduits up tight.
- .4 Do not bend coated steel conduit. Use elbows for deflections.
- .5 Do not install conduit under slab on grade.
- .6 Do not install conduit in slab, unless indicated otherwise on drawings.
- .7 Use factory "ells" where 90° bends are required for 27 trade size and larger conduits.
- .8 Bend conduit offsets cold. Do not install crushed or deformed conduits and avoid trapped runs in damp or wet locations. Prevent the entrance of water and lodging of concrete, plaster, dirt, or trash in conduit, boxes, fittings, and equipment during course of construction.
- .9 Where conduit joints occur in damp or wet locations, make joints watertight by applying an approved compound on the entire thread area before assembling. Draw up all conduit joints as tightly as possible.
- .10 Cap exposed empty conduits which do not terminate in outlets, panels, cabinets, etc., with standard galvanized plumber's pipe caps.
- .11 Plug empty conduits which terminate flush with floors or walls with flush coupling and brass plug.
- .12 Install conduit sleeves for all exposed conduits and cables passing through walls, ceilings, or floors, and fill void between sleeve and conduit with caulking. If fire-rated caulking is required by code, use same class as walls, ceilings or floors.
- .13 Terminate conduit stubbed up through concrete floor for connection to free standing equipment with a coupling flush with finish floor, and extend rigid conduit to equipment, except where required, use flexible conduit from a point 150 mm above floor.
- .14 Install double locknuts and bushings on all rigid conduit terminations into threadless openings. Increase length of conduit threads at terminations sufficiently to permit bushing to be fully seated against end of conduit.
- .15 Mechanically bend steel conduit.
- .16 Install sealing condulets in conduits at hazardous area boundaries.
- .17 Conduits in Poured Concrete
 - .1 Locate to suit reinforcing steel. Secure firmly to prevent movement during pour.

- .2 Clear each conduit with mandrel and brush before concrete sets.
- .3 Protect conduits from damage where they stub out of concrete.
- .4 Install sleeves where conduits pass through slab or wall.
- .5 Provide oversized sleeve before membrane is installed where conduits pass through waterproof membrane. Use cold mastic between sleeve and conduit.
- .6 Encase conduits completely in concrete; provide 50 mm minimum concrete cover.
- .7 Replace with exposed conduit, any conduit run found to be obstructed after concrete sets.

3.6 EMT AND FITTINGS

- .1 Minimum EMT size: 21 mm trade size conduit.
- .2 EMT Application
 - .1 Exposed in unfinished areas, above truss level and for drops in column web to 3 m above finished floor. Use rigid steel conduit below 3 m.
 - .2 In block walls and stud partitions.

3.7 CABLE TRAY

- .1 Install cable tray systems.
- .2 Provide barriers where required by Code.
- .3 Support cable trays from structural members. Support cable tray on both sides or on cantilever brackets to provide continuous open access to one side of the tray as required. Coordinate support locations and weight per support with building structure. Provide any additional support fastenings required.
- .4 Provide the following minimum clearances:
 - .1 300 mm vertical between top of tray and equipment or structure above.
 - .2 300 mm vertical between trays (between bottom of the upper tray to top of lower tray).
 - .3 600 mm horizontal on access side of tray.
- .5 Ensure that sharp burrs or projections are removed to prevent damage to cables and injury to personnel.
- .6 Install cables individually.
- .7 Lay cables into cable tray. Use rollers where necessary, to pull cables.
- .8 For maintained spacing, secure cables in cable tray at 3 m centers for horizontal runs with black coloured tie wraps and at 1500 mm centres for vertical runs with aluminum clamps supplied by tray manufacturer.
- .9 Maintain power cables greater than one diameter minimum spacing unless shown otherwise.

.10 Firestop Fire Barriers (refer to Section 26 05 01).

- .1 Penetration of fire rated walls with cable trays is not allowed. Provide instead metallic sleeves to match cable tray capacity to allow for transitioning of cabling. Pack, seal and firestop around and inside in accordance with Section 07 84 00 Fire Stopping and Smoke Seals.

3.8 WIREWAYS

- .1 Install per manufacturer's recommendations.
- .2 Keep number of elbows, offsets and connections to a minimum.
- .3 Install barriers where required by Code.
- .4 Install gutters to full length of equipment.

3.9 SURFACE RACEWAYS

- .1 Install per manufacturer's recommendations.

3.10 FASTENINGS AND SUPPORTS

- .1 Provide supports and fastenings for the Work of this Division. Do not use supports or equipment provided by other Trades.
- .2 Equipment fastenings and supports shall conform to manufacturers recommendations.
- .3 Do not attach to, or suspend any electrical product or service from the roof deck, mechanical ductwork or piping.
- .4 Do not use wire lashing or perforated strap to support or secure raceways or cable.
- .5 Support rods for any suspended item must not be attached to or extended through steel pan type roofs or through concrete slab roofs.
- .6 For surface mounting of two or more raceways or cables use channels.
- .7 Where there is no wall support for raceways and cables dropped vertically to equipment, provide channel properly secured to floor and structure.
- .8 Hang supports from structural members. Where location does not permit direct support from structure provide necessary brackets, frames, channels secured to structural members.
- .9 Fasten exposed conduit and cables to building construction or support systems using straps. Use beam clamps on exposed steelwork.
- .10 Masonry, tile and plaster surfaces: use lead anchors.
- .11 Poured concrete: use expandable inserts. Low velocity powder activated fastenings may be used only in poured concrete.
- .12 Steel structures: use clips, spring loaded bolts, cable clamps, designed as accessories to basic channel members.
- .13 Do not use powder activated fasteners in, tile, precast concrete or steel structure.

- .14 Do not install conduits or cables on the bottom chord of joists or trusses.
- .15 Use beam clamps of the 2-bolt design and of such type that the rod load is transmitted only concentrically to the beam web centreline. The use of "C" and "I" beam side clamps will not be allowed.
- .16 Where the roof or floor framing consists of open web or long span steel joists and/or trusses, ensure that hangers are located at or within 150 mm of the joist or truss top or bottom chord panel points, otherwise provide additional structural steel as required where hanger spacing does not coincide with joist or truss spacing. Design suspension assembly such that the hanger load is transmitted only concentrically to the supporting joist or truss. The use of "C" and "I" beam clamps, brackets, etc., will not be allowed.
- .17 Locate secondary structural steel members between joists or trusses at or within 150 mm of top or bottom chord panel points. Where the secondary structural steel member cannot be located at or near a joist or truss panel point, provide additional diagonal structural steel web member/members designed for the applicable load to the nearest panel point in the opposite chord member. Diagonal hangers which will induce lateral stresses in the chord members of the joist will not be permitted. Submit shop drawings of the suspension assembly indicating the location of suspension or support points, the maximum load at each suspension point, location and size of hangers, brackets and intermediate framing members when required, and also details of connection to building structure.

3.11 ACCESS DOORS

- .1 Provide an access door and arrange for its installation by the Division in whose work it occurs, whenever any electrical item equipment requiring accessibility, maintenance or adjustment is concealed.

3.12 SPLITTER BOXES

- .1 Install splitters as indicated and mount plumb, true and square to the building lines.
- .2 Extend splitters full length of equipment arrangement.

3.13 JUNCTION BOXES

- .1 Install junction boxes in inconspicuous but accessible locations. Secure to structure.
- .2 Install terminal blocks on mounting rails, for termination of each wire and cable regardless of size.
- .3 Only one voltage source is permitted in a junction box.
- .4 Install barriers to separate different auxiliary systems.
- .5 In areas with hard ceilings (e.g. gypsum board), install junction boxes in an accessible area. Extend conduit to junction or pull boxes.
- .6 If an accessible area is not within reasonable reach, group all junction boxes for all systems in one area of the room and advise the Design Architect/Departmental Representative of the need of an access door. Do not proceed with work until approval for access panel is received from the Design Architect.

3.14 TERMINAL BLOCKS - SURGE SUPPRESSION

- .1 Install surge suppression terminal blocks.

3.15 PULL BOXES

- .1 Install pull boxes in inconspicuous but accessible locations. Secure to structure.
- .2 Install pull boxes so as not to exceed 30 m of conduit run between pull boxes.
- .3 Only one voltage source is permitted in a pull box.
- .4 Install barriers to separate different auxiliary systems.
- .5 In areas with hard ceilings (e.g. gypsum board), install pull boxes in an accessible area. Extend conduit to junction or pull boxes.
- .6 If an accessible area is not within reasonable reach, group all pull boxes for all systems in one area of the room and advise the Design Architect/Departmental Representative of the need of an access door. Do not proceed with work until approval for access panel is received from the Design Architect.

3.16 OUTLET AND CONDUIT BOXES

- .1 Install conduit outlet boxes for conduit up to 32 mm and pull boxes for larger conduits.
- .2 Support boxes independently of connecting conduits.
- .3 Seal boxes during construction to prevent entry of debris, dust and dirt.
- .4 For flush installations mount plaster rings to box, flush with wall surface to permit wall finish to come within 6 mm of opening.
- .5 Provide correct size of openings in boxes for conduit, armoured cable connections. Reducing washers will not be acceptable.
- .6 Install switches and other controls close to door lock or latch jambs and other openings, maintaining a minimum of 100 mm from trims of doors (except where installed in door frames of metal partitions) check door swings.
- .7 Install 100 mm square or octagonal outlet boxes for lighting fixture outlets.

3.17 METER CABINET

- .1 Install meter cabinet as close as feasible to service entrance switchboard.
- .2 For utility meters install cabinets with all local utility requirements.

3.18 MASONRY BOXES

- .1 In block walls use deep boxes to provide clear space around knockout for AC90 cable entry.

3.19 WIRING DEVICES - SWITCHES

- .1 In all front of house areas and public areas, all switches are to be Decora/Decorator style.

- .2 Install single throw switches with handle in UP position when switch is closed.
- .3 Install switches in gang type outlet box when more than one switch is required in a location.
- .4 Mount toggle switches at height indicated.
- .5 Install switch colours as follows:

Area	Colour
Gypsum board, plaster or paneled	White
Office	White
Service	Brown
Patient Care Areas	White
Feature wood panels	Black

3.20 WIRING DEVICES - OCCUPANCY SENSORS

- .1 Install each occupancy sensor at locations indicated.
- .2 Mount occupancy sensor/switches at height indicated.

3.21 WIRING DEVICES - RECEPTACLES

- .1 Generally, install receptacles vertically with ground pins up.
- .2 In patient care areas, 15A/20A straight blade receptacles to be hospital grade.
- .3 In all front of house areas and public areas, all receptacles are to be Decora/Decorator style.
- .4 Comply with requirements of CSA Standard Z32, with regards to identifying the circuit number and supplying panelboard, permanently identified at the outlets. Identify this information in the areas on the front of each receptacle.
- .5 Install receptacles vertically, use gang type outlet box where more than one receptacle is required in a location.
- .6 Where split receptacle has a portion switched, mount vertically and switch upper portion.
- .7 Coordinate with architectural and interior design drawings for final positioning and mounting heights of power and voice/data receptacles. Where there is disagreement between electrical and architectural drawings, take the architectural drawings as correct.
- .8 Maintain clearances between receptacle outlet boxes and millwork as stipulated on the drawings.
- .9 Align and evenly space outlet boxes that are mounted as a group.
- .10 Install receptacle colours as follows:

Area	Colour
------	--------

Gypsum board, plaster or panelled	White
Office	White
Service, exterior	gray
Patient Care Areas	White
Feature wood panels	Black

3.22 WIRING DEVICES - COVER PLATES

- .1 Protect stainless steel cover plate finish with paper or plastic film until painting and other work is finished.
- .2 Install suitable common cover plates where wiring devices are grouped.
- .3 Do not use cover plates designed for flush outlet boxes on surface-mounted boxes.
- .4 Provide plaster ring where necessary.
- .5 Install cover plates as follows:

Area	Cover Plate Type
Gypsum board, plaster or panelled	stainless steel (nylon)
Offices	Nylon
Service	galvanized steel
Exterior	Lockable weather proof
Patient Care Areas	Stainless Steel
Feature wood panels	Black

3.23 WELDING RECEPTACLES

- .1 Install welding receptacles.
- .2 Ensure that phase rotation is similar for all receptacles.

3.24 CONTROL DEVICES

- .1 Install as indicated.

3.25 PLYWOOD BACKBOARDS

- .1 Install G1S plywood backboards where indicated on drawings.
- .2 Backboards shall be installed to 8' high from floor.
- .3 Backboards shall be painted with intumescent grey paint.

3.26 FIELD FABRICATED METAL WORK

- .1 Clean and prime paint field fabricated metal work.

- .2 After fabrication deburr, scrape, grind smooth, wire brush with power brush and degrease metal work.
- .3 Prime paint steel with 1 coat of CISC/CPMA 2.75 oil alkyd primer.
- .4 Prime paint aluminum as follows: wash with detergent solution and wipe down with SSPC-SP1 solvent. Apply Glidden #Y-5229 primer to 1.5 mils DFT.
- .5 For brass and bronze alloy materials, prepare as for aluminum but apply 1 coat of CAN/CGSB-1.40-M zinc chromate primer.

END OF SECTION

1 General**1.1 SUMMARY**

- .1 Section includes:
Labour, products, equipment and services necessary to complete the work of this Section.
- .2 Refer to grounding riser diagram on drawings for additional information.

2 Products**2.1 GROUND CONDUCTORS**

- .1 Copper conductors, soft drawn, ASTM Class B stranded.
- .2 Insulated or bare conductors. Insulation colour green.
- .3 Acceptable Manufacturers:
Erico
Approved equal manufacturer

2.2 BURIED CONNECTIONS - EXOTHERMIC TYPE CONNECTION

- .1 Cable to rod / cable to pipe / cable to cable.
- .2 Moulds, weld metal and accessories.
- .3 Acceptable Manufacturers:
Erico
Burndy
Approved equal manufacturer

2.3 CONNECTIONS TO STEEL STRUCTURES

- .1 Exothermic connection (for underground connections) or compression ground connector (for above ground connections).
- .2 Bi-metallic washers shall be used in the case of steel-copper compression connection.
- .3 Acceptable Manufacturers:
Erico
Burndy
Approved equal manufacturer

2.4 MISCELLANEOUS HARDWARE

- .1 Galvanized steel ground studs, bolts, washers, nuts and accessories necessary for grounding system, including but not limited to:
Grounding and bonding bushings
Bolt type conductor connectors

Bonding jumpers, straps

Pressure type wire connectors

- .2 Acceptable Manufacturers:

Erico

Burndy

T & B Blackburn

2.5 GROUND RODS

- .1 Copper-clad steel, minimum 19 mm diameter, 3 m long, two 1.5m sections which are connected via grounding coupling.

- .2 At manholes provide screw down lugs on ground rods.

- .3 Acceptable Manufacturers:

Erico

Hydel

T & B Blackburn

Approved equal manufacturer

2.6 GROUND ELECTRODE INSPECTION BOX

- .1 Inspection box, hot dip galvanized steel or hard PVC, with flush cover and ground lug, minimum 245mm dia., 300 mm deep, lockable door.

- .2 Acceptable Manufacturers:

Erico

Burndy

Lacal

Hydel

Approved equal manufacturer

2.7 GROUND BUS

- .1 Ground bus: copper, 50 mm x 6 mm thick complete with insulated supports, fastenings, connectors, length as indicated.

- .2 Telecommunication Main Grounding Busbar (TMGB): copper, 100mm x 6 mm thick complete with insulated supports, fastenings, connector, and length as indicated.

The TMGB shall be predrilled with holes for use with standard sized lugs.

The TMGB shall be UL listed and meet the requirements of ANSI-J-STD-607-A

The TMGB shall be sized as above or lengthen to meet the requirements of the immediate application with consideration for future growth.

- .3 Telecommunication Grounding Busbar (TGB): copper, 50mm x 6 mm thick complete with insulated supports, fastenings, connector, and length as indicated.

The TGB shall be predrilled with holes for use with standard sized lugs.

The TGB shall be UL listed and meet the requirements of ANSI-J-STD-607-A

The TGB shall be sized as above or lengthen to meet the requirements of the immediate application with consideration for future growth.

- .4 Acceptable manufacturers:

Erico

Burndy

Harger

Approved equal manufacturer

2.8 ALUMINUM STRUCTURES AND EQUIPMENT

- .1 Use tin or silver plated connectors for grounding connections to aluminum structures and equipment.

- .2 Acceptable Manufacturers:

Erico

Burndy

Thomas & Betts

Approved equal manufacturer

3 Execution

3.1 GENERAL

- .1 Clean all paint, rust and dirt from all surfaces to which ground lugs are bolted.

- .2 Protect exposed grounding conductors from mechanical damage.

- .3 Ensure that moulds, for exothermic type connections, are not used for more than 50 connections.

- .4 All panels, junction and terminal boxes, shall be bonded to grounding conductors.

- .5 Primary grounding:

Install continuous grounding system including, electrodes, conductors, connectors and accessories as indicated and to requirements of ESA (Electrical Safety Authority) and Horizon Utilities.

Install connectors and cadweld in accordance with manufacturer's instructions.

Protect exposed grounding conductors during and after construction.

Make buried connections, and connections to electrodes, structural steel work, using copper welding by thermite process.

Use mechanical connectors for grounding connections to equipment provided with lugs.

Use tinned copper conductors for aluminium structures, in all connection of two different metals, bimetallic washers shall be used.

Do not use bare copper conductors near unjacketed lead sheath cables.

.6 Secondary grounding:

Install complete permanent, continuous grounding system including, electrodes, conductors, connectors, accessories.

Where EMT or rigid steel is used, run separate and dedicated ground wire for each circuit within.

Install connectors in accordance with manufacturer's instructions.

Protect exposed grounding conductors from mechanical injury.

Make buried connections, and connections to conductive water main, electrodes, using copper welding by thermite process.

Use mechanical connectors for grounding connections to equipment provided with lugs.

Soldered joints are not permitted.

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.

Install flexible ground straps for bus duct enclosure joints, where such bonding is not inherently provided with equipment.

Make grounding connections in radial configuration only, with connections terminating at single grounding point. Avoid loop connections.

Bond single conductor, metallic armoured cables to cabinet at supply end, and provide non-metallic entry plate at both ends.

Make ground connections to continuously conductive underground water pipe on street side of water meter.

Install water meter shunt.

3.2 EQUIPMENT GROUNDING

.1 Install grounding connections as indicated to typical station equipment including: metallic water main, line sky wire, neutral, gradient control mats. Non current carrying parts of: transformers, generators, motors, circuit breakers, reclosers, current transformers, frames of gang-operated switches and fuse cutout bases. Cable sheaths, raceways, pipe work, screen guards, switchboards, potential transformers. Meter and relay cases. Any exposed building metal, within or forming part of station enclosure. Sub-station fences, pothead bodies. Outdoor lighting.

.2 Ground hinged doors to main frame of electrical equipment enclosure with flexible jumper.

.3 Connect metallic piping (water, oil, air, etc.) inside station to main ground bus at several locations, including each service location within station.[Make connections to metallic water pipes outside station to assist in reduction of station ground resistance value].

3.3 BURIED GROUNDING LOOP

- .1 For buried grounding connected only exothermic connection types are permitted.
- .2 Install ground rods 300 mm below finished grade.
- .3 Install ground loop around transformer foundation 300 mm below finished grade. Refer and comply with Horizon Utilities ground requirements for pad mounted transformers.

3.4 DUCT BANKS

- .1 Bond metal raceway within duct banks to system ground each 10 m distance (at least from two points).
- .2 Connect grounding conductor in duct banks to ground bus or ground rods in electrical rooms, substations, manholes, etc.

3.5 MANHOLES

- .1 Provide ground rod(s) in each manhole and connect to metalwork such as, ladder, cable racks, manhole metal frame.
- .2 Install ground rod with top projecting through floor slab and install a screw down lug for connection of portable appliances etc.
- .3 Where more than one compartment is provided, install ground rod in each compartment.

3.6 STRUCTURAL STEEL AND BUILDING GROUNDING

- .1 Ground building structural steel columns to buried perimeter grounding conductor. Ensure perimeter cable is slack to avoid stressing the connections.
- .2 Install grounding jumpers across building expansion joints.
- .3 Install ground rods close to column foundations and drive top of rod 300 mm below grade or finished floor level of slab on grade.
- .4 Install inspection boxes.

3.7 ELECTRICAL ROOMS

- .1 Install ground buses as indicated on plans.
- .2 Connect electrical panels and equipment ground buses and lugs to electrical room perimeter or bar ground bus. Make connections to bus with cable lugs, bolted through the copper bus with shakeproof lockwashers and nuts. Use minimum No. 2/0 AWG or as shown on drawings, bared copper conductor to bond ground bus to grounding system.

3.8 LIGHTING POLES

- .1 Lighting poles shall be connected to the grounding system via the grounding conductor inside the lighting cable (fifth core in 5-core cables or third-core in 3-core cables)

3.9 PAD MOUNTED TRANSFORMERS

- .1 Main transformer (utility transformer) body shall be connected to the ground grid around it from at least two points.

- .2 Main transformer neutral point shall be connected directly to the ground grid with minimum 4/0 AWG size grounding conductor.
- .3 Also, transformer neutral points shall be interconnected via interconnection cables (Neutral core of the connecting cable).

3.10 POLE MOUNTED TRANSFORMER GROUNDING

- .1 Drive ground rods at base of each pole on which transformers are mounted and interconnect transformer, system neutral, lightning arresters and ground rods.

3.11 NEUTRAL GROUNDING

- .1 Connect transformer neutral and distribution neutral together using 1000 V insulated conductor to one side of ground test link, the other side of the test link being connected directly to main station ground. Ensure distribution neutral and neutrals of potential transformers and service banks are bonded directly to transformer neutral and not to main station ground.
- .2 Interconnect electrodes and neutrals at each grounding installation.
- .3 Connect neutral of station service transformer to main neutral bus with tap of same size as secondary neutral.
- .4 Ground transformer tank with continuous conductor from tank ground lug through connector on ground bus to primary neutral. Connect neutral bushing at transformer to primary neutral in same manner.

3.12 LOW VOLTAGE PANELS

- .1 All electrical panels' body shall be connected to the panel ground bus from two points. Panel ground busbar shall be connected to the grounding busbar in electrical room from two different points.

3.13 CONDUCTORS

- .1 Conductors: bare, stranded, soft annealed copper wire, size No. 4/0 AWG and 2/0 AWG for ground bus, electrode interconnections, metal structures, gradient control mats, transformers, switchgear, motors, ground connections.
- .2 Conductors: bare or PVC insulated coloured green, stranded [un] [tinned] soft annealed copper wire, size No. 4 AWG for grounding cable sheaths, raceways, pipe work, screen guards, switchboards, potential transformers.
- .3 Conductors: pvc insulated coloured green, stranded soft annealed copper wire No. 10 AWG for grounding meter and relay cases.
- .4 Conductors: No. 3/0 AWG extra flexible (425 strands) copper conductor for connection of switch mechanism operating rod to gradient control mat, fence gates, vault doors.

3.14 RACEWAYS

- .1 On raceways, lock-up tight all couplers and connections to boxes and enclosures. Install bonding jumpers at expansion joints, and where necessary. Maintain ground continuity throughout run of raceway.

-
- .2 Install bonding jumpers on both ends of flexible conduit. Use grounding bushing, solderless lug, clamp or cup washer and screw connection. Install grounding conductor inside flexible conduit.
 - .3 EMT and non-metallic raceways: install insulated grounding conductor in raceway.
 - .4 Branch and feeder circuits in rigid conduit: use raceway as bonding conductor.
 - .5 Cable trays: provide a bare No. 2/0 AWG ground conductor along inside of tray run bonded to tray at 15 m intervals. Where multiple cable trays are supported on a common structure bond all trays to one common grounding conductor at 15 m intervals. Keep grounding continuity when cable trays transition to conduit. Provide conduit bonding lugs as required.

3.15 TELECOMMUNICATIONS ROOMS

- .1 Bond metallic raceways to building ground
- .2 Provide telecommunications ground bus TMGB or TGB as designated on drawings, on one wall of telecommunications room (as indicated). Mounted TMGB and TGB on stand-off brackets to clear adjacent obstructions.
- .3 Provide No. 6 AWG insulated grounding conductor from TGB to ground bus to telecommunications room power distribution panel.
- .4 Maintain isolation between building ground and all components within the telecommunications room connected to the TMGB or TGB.
- .5 Provide isolated ground receptacles in telecommunications rooms. Provide a separate ground conductor from each receptacle to the ground bus in the power distribution panel.
- .6 Connection to the TMGB and TGB shall be made by exothermic welding or by listed two-hole compression lugs.
- .7 Provide No. 6 AWG insulated grounding conductor to bond TMGB to ground bus in main electrical room
- .8 All metal conduits or raceways for telecommunications cabling located within the same room or space as the TMGB or TGB shall be bonded to TMGB or TGB.

Metal conduits 27mm diameter and larger shall be bonded using electro thin plated pipe clamps.

Metal conduits 21mm diameter and smaller shall be bonded using electro thin plated conduit bonding clamps.

Metal cable trays shall be bonded using electro-tinplated cable tray bonding clamps.

Bonding surface areas shall be cleaned to bare metal removing all paint, etc. The contact area shall be protected from corrosion using antioxidant joint compound.

- .9 Where an electrical panelboard for telecommunication equipment is located in the same room or space as the TGB or TMGB, the panelboard ground bus or panelboard enclosure shall be bonded to the TMGB or TGB.
- .10 The TMGB or TGB shall be located in an area that is accessible to telecommunications personnel.

- .11 Provide individual No. 6 AWG insulated grounding conductors from each telecommunications cabinet or frame to the TGB
- .12 Provide #12AWG insulated green conductor from static dissipative tile (SDT) to TGB.

3.16 TESTING

- .1 Test the primary grounding loop resistance to ground, before bonding to others loops or devices (e.g. lightning protection loops) the connection is made to link them together.
- .2 For resistance to ground measurements use a ground resistance test set with an accuracy of 10 milliohms.
- .3 For measuring resistance to ground use the fall of potential method as outlined in IEEE Standard No. 81. After selecting the distance for the current probe take resistance measurements at a minimum of six voltage probe locations. Ensure that three of the voltage probe locations have resistance values such that the difference between any two is 0.5 ohm or less. If this is not the case repeat and retest with a larger distance for the current probe until this condition is satisfied.
- .4 Perform testing under average weather conditions; allow three days after the last rain before conducting test. Do not test resistance to ground under frozen soil conditions unless specifically approved by Consultant.
- .5 Test the integrity of the connections between the various components of the total grounding system. Test separately the continuity of the building perimeter loop (if used) and the connections between the primary grounding grid and the building grounding system.
- .6 For continuity measurements use a bridge or similar type test meter designed for the purpose with an accuracy of 1 milliohm.
- .7 Where readings are not acceptable to Electrical Inspection and Consultant provide additional ground conductors, ground rods, connections, as necessary to satisfy the requirements of both.
- .8 Prepare and submit a Test Report, signed by the Test Engineer, and where witnessed, by Consultant. Include record of tests performed, methods of calculation, date and time of test, ambient conditions, and names of testing company, test engineer, witnesses, also calibration record of all test instruments used together with manufacturers name, serial number and model number. Calibration record shall include percentage error, correction factors, if any. Submit 3 copies.

END OF SECTION

- 1 General
 - 1.1 **SUMMARY**
 - .1 Section includes:
 - .1 Labour, products, equipment and services necessary to complete the work of this Section.
 - 1.2 **APPROVALS**
 - .1 Identification subject to prior approval of Departmental Representative.
- 2 Products
 - 2.1 **WIRE AND CABLE MARKERS**
 - .1 Wire and Cable Diameter Less Than 13 mm
 - .1 Acceptable manufacturer
 - .1 Wieland Z type
 - .2 Cable Diameter 13 mm and Larger
 - .1 Acceptable manufacturer
 - .1 Wieland K type
 - .3 Non-Circular Wire
 - .1 Acceptable manufacturer
 - .1 Raychem Shrinkmark sleeves
 - 2.2 **CONDUIT AND ELECTRICAL METALLIC TUBING MARKERS**
 - .1 Stick-On Marker
 - .1 Raceway Size Minimum Character Height
 - .1 ¾" - 1 ¼ " 15 mm
 - .2 1½" - 2" 19 mm
 - .3 Over 2" 32 mm
 - .2 Acceptable Manufacturers
 - .1 Brady, vinyl cloth, black on orange, type B-500
 - .2 Panduit, vinyl cloth, black on yellow, type PCL
 - .3 Wieland, mylar, black on yellow, type NL
 - 2.3 **CABLE TRAY MARKERS**
 - .1 Stick-On Marker each 15m
 - .1 Acceptable Manufacturers

- .1 Brady, vinyl cloth, black on orange, 48 mm character height, type B-500
- .2 Safety Supply Canada, conduit and voltage markers, style A, 48 mm character height
- .3 Panduit, vinyl indoor/outdoor, black on yellow, 50 mm character height, type PVL
- .4 Wieland, black on yellow, 50 mm character height, Electrocode NL

2.4 BUSWAY MARKERS

- .1 Stick-On Marker
 - .1 Acceptable Manufacturers
 - .1 Brady, vinyl cloth, black on orange, 48 mm character height, type B-500
 - .2 Safety Supply Canada, conduit and voltage markers, style A, 48 mm character height
 - .3 Panduit, vinyl indoor/outdoor, black on yellow, 50 mm character height, type PVL
 - .4 Wieland, black on yellow, 50 mm character height, Electrocode NL
 - .2 Laminated plastic, black letters on white background, 75 mm character height.
 - .3 Suspended sign, rigid vinyl, black on yellow, 75 mm character height.
 - .1 Acceptable Manufacturers
 - .1 Panduit
 - .2 Safety Supply Canada
 - .4 Typical Identification: "347/600 V, 800A, 3-ph, 4W" "FED from MSB".

2.5 PANELBOARD IDENTIFICATION

- .1 Engraved laminated plastic, black lettering on white background, 6 mm character height.
- .2 Typical 2-line identification for lighting panel:

"LP-L2A, 120/208V, 3ph, 4W" "FED from TX2C"
- .3 Directories: Typewritten identification of breaker number, ampere rating and connected equipment.

2.6 SWITCHBOARD IDENTIFICATION

- .1 Engraved laminated plastic, black lettering on white background, 15 mm minimum character height.
- .2 Typical Identification: "Switchboard AAA, 347/600V, 3 ph, 4 w".

2.7 MOTOR STARTER, CONTACTOR AND DISCONNECT SWITCH IDENTIFICATION

- .1 Engraved laminated plastic, black lettering on white background, 6 mm character height.

- .2 Typical Identification: "Pump S4, 600V, 3 ph". "FED from DP-MBA"

2.8 MAGLOCK/FIRE ALARM PULL STATIONS IDENTIFICATION

- .1 Engraved laminated plastic, red lettering on white background, 25 mm character height.
- .2 Identification: "EMERGENCY EXIT UNLOCKED BY FIRE ALARM OR BY SECURITY SYSTEM".

2.9 WARNING SIGNS

- .1 Outdoor - metal, porcelain enamel finish. Indoor - rigid vinyl.
- .2 Typical Identification: "Danger - High Voltage".
- .3 Acceptable Manufacturers
- .1 Outdoor: Safety Supply Canada
- .2 Indoor: Safety Supply Canada, Panduit

2.10 MARKER TAPE, SERVICE AND PHASE IDENTIFICATION

- .1 As a minimal standard of performance the electrical device shall meet the or exceed the construction standards as provided by the following manufacturers
- .1 3M, Scotch Code Tape, type STD with SDR colour refills or 3M Scotch 35 colour tape.

3 Execution

3.1 SYSTEMS IDENTIFICATION

- .1 Identify outlet boxes for various systems with distinctive paint colour. Apply a small area of paint to inside of outlet, junction and pull boxes and panels. In suspended ceiling areas, apply paint to inside and outside of junction boxes. System colours:

System	Normal	Emergency	UPS
120/208 volt	black	black/red	black/blue
347/600 volt	orange	orange/red	orange/blue
Fire alarm	red		
Intercom	brown		
Low voltage control	black		
Security	light green		

3.2 POWER COMPANY SERVICE IDENTIFICATION

- .1 Identify service conductors with coloured marker tape as follows:
- .1 Phase A red
- .2 Phase B black
- .3 Phase C blue
- .4 Neutral white
- .5 Ground green

3.3 WIRE AND CABLE IDENTIFICATION

- .1 Identify power, control, lighting and receptacle wires with continuous coloring as follows:
 - .1 Phase A red
 - .2 Phase B black
 - .3 Phase C blue
 - .4 Neutral white
 - .5 Ground green
 - .6 Isolating ground green and yellow
 - .7 Control red
 - .8 Interlock yellow
 - .9 D.C. blue
- .2 For larger wire sizes available only in black, install colored wire marker tape in accordance with above coding.
- .3 Cables Bearing Identification Numbers on the Drawings
 - .1 Install identification markers at each end of cable run.
- .4 Control/Indication Conductors
 - .1 Install conductor identification markers at switchgear, motor control centres and motor starter terminal blocks and at remote devices.
 - .2 Identification in accordance with the Drawings and reviewed shop drawings.
- .5 Lighting and Receptacle Branch Circuits
 - .1 Install conductor identification markers at panel, outlet box connections to lighting fixtures and device outlet boxes.
 - .2 Typical identification if fixture or device is connected to panel RP-H2B, circuit 5: H2B-5.
- .6 Low Voltage Lighting Control
 - .1 Install conductor identification marker at relay phase conductors. Typical identification if connected to panel LP-L2A, circuit 5: L2A-5.
 - .2 Install conductor identification marker on conductors between control locations and relay panels. Identify in accordance with reviewed shop drawings.
- .7 Data, Voice and Fibre Optic Cables
 - .1 Label horizontally distributed cabling at the following locations:
 - .1 Both ends of cable run
 - .2 Entrance and exit of cable pathway (i.e. cable trays, zone conduits, etc.)
 - .2 Label riser/backbone distribution cables at the following locations:

- .1 Both ends of cable run
- .2 Entrance and exit of cable pathway (ie. cable trays, zone conduits, etc.)
- .3 1.5 m above finished floor in communication closets and equipment rooms
- .4 At entrance and exit of a sleeve or slot in communication closets and equipment rooms
- .3 Use the following color codes for labels:

Function	Color
Auxiliary and miscellaneous circuits	Yellow
Common equipment	Purple
Customer side of network interface	Green
First level backbone	White
Horizontal cabling to workstations	Blue
Inter-building backbone	Brown
Key telephone systems	Red
Network side of network interface	Orange
Second level backbone	Gray

Note: Common equipment refers to PBX equipment, host computer, LANs and multiplexer. Miscellaneous refers to maintenance alarms, security, paging systems, and other system and circuits not an integral part of common equipment. Color codes to ANSI/TIA/EIA-606.

- .8 Fire Alarm and Miscellaneous Systems
 - .1 Install identification on conductors at panels, remote devices and system connections. Identify in accordance with reviewed shop drawings.
 - .2 Install maglock/fire alarm pull station identification adjacent to each door equipped with a maglock.

3.4 CONDUIT AND ELECTRICAL METALLIC TUBING (EMT) IDENTIFICATION

- .1 Where Drawings indicate conduit and EMT identification numbers/letters, install identification markers at each end of run and at pull box locations.

3.5 CABLE TRAY IDENTIFICATION

- .1 Install markers indicating system, voltage, or voltages for trays with barriers, and identification number at intervals of 20 m maximum, at branches and termination locations.

3.6 BUSWAY IDENTIFICATION

- .1 Install stick-on markers indicating busway identification number and rating at cable tap boxes and thereafter at intervals of 30 m maximum.
- .2 Install suspended identification signs at start of run and at intervals of 30 m maximum.

3.7 PANELBOARD IDENTIFICATION

.1 Install identification plates, using adhesive, on outside of panel.

.2 Install directory.

.3 Identify main bus as follows:

- | | | |
|----|---------|-------|
| .1 | Phase A | red |
| .2 | Phase B | black |
| .3 | Phase C | blue |
| .4 | Neutral | white |
| .5 | Ground | green |

3.8 SWITCHBOARD IDENTIFICATION

.1 Install identification plates for panel and branch feeders.

3.9 MOTOR STARTER, CONTACTOR AND DISCONNECT SWITCH IDENTIFICATION

.1 Install identification plates using self-tapping screws.

3.10 IDENTIFICATION AFTER FINISH PAINTING

.1 Behind access doors at shaft plenums: identify busways, feeder cables and feeder conduits.

3.11 EQUIPMENT WARNING SIGNS

.1 Install "Danger - High Voltage" signs.

.2 When equipment is supplied from more than one source install red warning signs to this effect.

3.12 PATCH PANEL AND FACEPLATE IDENTIFICATION

.1 Identify each jack at each wall or furniture outlet with a label supplied by the faceplate manufacturer. Each jack identification designation to match the respective cable identification designation.

.2 Identify each jack at each patch panel jack with labels, front and back, supplied by the patch panel manufacturer. Each jack identification designation to match the respective cable identification designation.

.3 In addition to an alphanumeric label use manufacturer's matching colour coded icons, which conform to ANSI/TIA/EIA-606, to identify individual jacks on faceplate and patch panels.

End of Section

1 General**1.1 SUMMARY**

.1 Section includes:

- .1 Labour, products, equipment and services necessary to complete the work of this Section.

1.2 RELATED SECTIONS

- .1 Section 26 05 01: Basic electrical requirements.
- .2 Section 26 05 54: Electrical identification.

1.3 REFERENCES

- .1 Conform to latest issues, amendments and supplements of following standards:
 - .1 CSA C22.2 No.29-11, Panelboards and enclosed Panelboards.
 - .2 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 NMJ-J-266-ANCE).

1.4 SYSTEM DESCRIPTION

- .1 Panelboards – Power Switching Circuit Breaker Type

2 Products**2.1 PANELBOARDS - CIRCUIT BREAKER TYPE**

- .1 All of Panelboards to be product of one manufacturer.
- .2 Enclosures: Steel, NEMA 2, sprinklerproof.
- .3 Bus: Copper, ground bar, isolated ground bar and full capacity neutral bar, braced for interrupting capacity as indicated on drawings or schedules.
- .4 A minimum of 10% spares.
- .5 Breakers
 - .1 Moulded-case circuit breakers, circuit breakers and ground-fault circuit-interrupters to CSA C22.2 No. 5.
 - .2 Bolt-on moulded case circuit breaker: quick- make, quick-break type, for manual and automatic operation with temperature compensation for 40 degrees C ambient.
 - .3 Common-trip breakers: with single handle for multi-pole applications.
 - .4 Circuit breakers to have minimum symmetrical rms interrupting capacity rating as required in the single line diagrams.
 - .5 Breakers with thermal and magnetic tripping in panelboards except as indicated otherwise.

- .6 Ground Fault Interrupter Breakers – Class A:
 - .1 Single or two pole ground fault circuit interrupter c/w test and reset facilities.
 - .2 30mA trip sensitivity.
- .7 Ground Fault Equipment Protector Breakers – Class B:
 - .1 Single or two pole ground fault circuit interrupter c/w test and reset facilities.
 - .2 30 mA trip sensitivity.
- .8 Main breaker:
 - .1 Separately mounted in vertical position on top or bottom of panel to suit cable entry. When mounted vertically, down position should open breaker.
- .9 Provide RED colour breakers with lock-on devices for breakers serving fire alarm devices.
- .10 Lock-on devices for all security, life safety and asset integrity circuits as identified.
- .11 Breaker Arrangement: Locate breakers at specific circuit number locations shown on panelboard schedule sheet.
- .12 Lock-on Devices: For circuits supplying continuously operating equipment. Minimum quantity 10% of 15A, 20A and 30A rated breakers.
- .6 Door: Hinged lockable door.
- .7 Keys: 2 keys per panelboard; key panelboards alike.
- .8 In addition to CSA requirements, manufacturer's nameplate to indicate panel withstand fault current.
- .9 Spaces: Fully bussed for future breakers with removable filler plates.
- .10 Acceptable Manufacturers
 - .1 Cutler-Hammer
 - .2 Schneider Electric / Square D
 - .3 GE Canada
 - .4 Siemens Canada

2.2 PANELBOARDS – POWER SWITCHING CIRCUIT BREAKER TYPE

- .1 The Power Switching Panelboard is an Eaton Cutler Hammer, “Pow-R-Command 750” or approved equivalent.
- .2 Acceptable Manufacturers:
 - .1 Eaton Cutler Hammer
 - .2 Schneider Electric / Square D
 - .3 Siemens Canada

- .3 Enclosures:
 - .1 Steel, NEMA 2, sprinklerproof.
 - .2 Interiors shall be capable of housing a control module and sized to allow easy access and replacement of the control modules.
 - .3 Interiors shall provide a Class 2 separation for the control module with an internal Class 2, 120/277 VAC power supply with secondary thermal magnetic ON/OFF protection to provide power to the panelboard control module. Power supply shall be fed from panelboard bus.
 - .4 Provide dead front cover for access to control module
 - .5 Control module shall be provided with local ON/OFF switch and programming/diagnostic port.
- .4 Bus: Copper, ground bar and full capacity neutral bar, braced for interrupting capacity as indicated on drawings or schedules.
- .5 A minimum of 10% spares.
- .6 Integral programmable plug and play lighting control module that provides ON/OFF control for low voltage switchable circuit breakers.
- .7 Pre-wired and factory assembled.
- .8 Switching 'Smart' Breakers
 - .1 Low voltage controlled thermal magnetic circuit breaker in a standard panelboard enclosure.
 - .2 Branch circuit breakers shall have bolt-on type bus connectors. Plug-in type circuit breakers are not acceptable.
 - .3 Circuit breakers shall have an overcenter toggle mechanism, which will provide quick-make, quick-break contact action. Circuit breakers shall have thermal and magnetic trip elements in each pole. Two- pole circuit breakers shall have common tripping of all poles.
 - .4 Circuit breaker trip target shall be provided. In addition, the circuit breaker handle shall move to center of travel on breaker trip.
 - .5 Circuit breakers marked "Remotely Controlled" on drawings shall respond to a remote low voltage Class 2 signal for Open or Closed contact positioning. Circuit breaker power contacts shall remain Open when the breaker handle is in the OFF or tripped position, regardless of the remote close command. Remote control shall only be possible when the breaker handle is in the ON position. Circuit breakers may be manually controlled by operating the breaker handle in the event of a control module failure. Control power for circuit breakers shall be derived from the control module.
- .9 Standard Breakers
 - .1 Moulded-case circuit breakers, circuit breakers and ground-fault circuit-interrupters to CSA C22.2 No. 5.

- .2 Bolt-on moulded case circuit breaker: quick-make, quick-break type, for manual and automatic operation with temperature compensation for 40 degrees C ambient.
- .3 Common-trip breakers: with single handle for multi-pole applications.
- .4 Circuit breakers to have symmetrical rms interrupting capacity rating as specified in the single line diagram.
- .5 Breakers with thermal and magnetic tripping in panelboards except as indicated otherwise.
- .6 Ground Fault Interrupter Breakers – Class A:
 - .1 Single or two pole ground fault circuit interrupter c/w test and reset facilities.
 - .2 30mA trip sensitivity.
- .7 Ground Fault Equipment Protector Breakers – Class B:
 - .1 Single or two pole ground fault circuit interrupter c/w test and reset facilities.
 - .2 30 mA trip sensitivity.
- .8 Main breaker:
 - .1 Separately mounted in vertical position on top or bottom of panel to suit cable entry. When mounted vertically, down position should open breaker.
- .9 Provide RED colour breakers with lock-on devices for breakers serving fire alarm devices.
- .10 Lock-on devices for all security, life safety and asset integrity circuits as identified.
- .11 Breaker Arrangement: Locate breakers at specific circuit number locations shown on panelboard schedule sheet.
- .12 Lock-on Devices: For circuits supplying continuously operating equipment. Minimum quantity 10% of 15A, 20A and 30A rated breakers.
- .10 Door: Hinged lockable door.
- .11 Keys: 2 keys per panelboard; key panelboards alike.
- .12 In addition to CSA requirements, manufacturer's nameplate to indicate panel withstand fault current.
- .13 Spaces: Fully bussed for future breakers with removable filler plates.

3 Execution

3.1 GENERAL

- .1 Protect equipment from dust, debris, moisture, and physical damage, with sealed envelope of plastic or other impervious material until building is enclosed and cleaned and equipment is energized.
- .2 Protect from condensation by maintaining at suitable temperature above 0°C.

- .3 Finish equipment enclosures to ANSI 49 or ANSI 61, baked grey enamel.

3.2 PANELBOARDS

- .1 Locate panelboards, secure, plumb true and square to structure.
- .2 Mounting Methods
 - .1 Exterior walls and interior combustible walls: mount on continuous slotted channel strut with 75 mm clear between back of panel and wall. Where practical, group panelboards on common frame.
 - .2 Interior non-combustible walls: mount against wall.
 - .3 Provide plywood backboards behind all wall mounted panelboards. Plywood to G1S and painted with Intumescent grey paint.
- .3 Where panelboards are flush mounted, provide 3 – 25 mm spare empty conduits from each panelboard into ceiling space above.
- .4 Identify load circuits on panel directory complete with name and location.
- .5 Where panelboards are equipped with fused switches, install fuses immediately prior to energize. Record fuse rating on breaker or switch cover.
- .6 Training
 - .1 Provide a training session for the Departmental Representatives for normal workdays at a jobsite location determined by the Departmental representative.
 - .2 The training session shall be conducted by a manufacturer's qualified representative. Training program shall include review of all system components and their function and operation instructions.
 - .3 Factory Testing
 - .1 The factory service shall provide adequate testing of the supplied equipment to ensure that the system performs as intended by the specification. Building engineering personnel shall be trained on all aspects of operating and maintaining the system. Care shall be taken to ensure that the system load connections are to the electrical drawing and that the control scenarios are operating properly.
 - .4 Field Quality Control
 - .1 Provide the services of a qualified factory-trained manufacturer's representative to assist the Contractor in starting-up the system for a period of working days. The manufacturer's representative shall be factory-trained and shall have a thorough knowledge of the system and functions:
 - .1 Check installation of all smart panelboards, expansion cabinets and the central operator's station

- .2 Test operation of all remote-controlled loads
- .3 Repair or replace any defective component
- .4 Test operation of complete lighting control system
- .5 Conduct system point-by-point walk through
- .5 The Contractor shall provide three (3) copies of the manufacturer's field startup.

3.3 DELIVERY, STORAGE AND HANDLING

- .1 Do not ship equipment to site prior to completion of factory testing and acceptance of test results by Departmental representative.

3.4 WARRANTY

- .1 Warranty requirements shall be as indicated in Division 01 except for this equipment the duration of warranty period shall be 12 months from the date the equipment is placed in service or 18 months from the date the equipment is accepted at site, whichever shall occur first.

END OF SECTION

1 General**1.1 SUMMARY**

- .1 Section includes:
 - .1 Labour, products, equipment and services necessary to complete the work of this Section including, but not limited to, the following:
 - .1 Lighting equipment as per the luminaire schedule and as specified herein.
- .2 Refer to Electrical lighting plan for exact location of luminaires.
- .3 Check latest ceiling finish schedule in areas where recessed luminaires are specified to ensure that luminaires have suitable ceiling trim for particular ceiling finish.
- .4 Refer to Luminaire Schedule located on drawings for specific light fixture information.

1.2 SUBMITTALS

- .1 Submit shop drawings in accordance with Division 01.
- .2 Submit certified copies of photometric test data, for each luminaire type, prepared by independent testing laboratory. Photometric data to include total input watts, candlepower summary, candlepower distribution, zonal lumen summary, luminaire efficiency, coefficient of utilization table, lamp type, ballast type and manufacturer, and lumen rating in accordance with IESNA testing procedures.
- .3 Submit samples as directed by Departmental Representative for the following luminaire types:

1.3 REFERENCES

- .1 CSA C22.2 No. 9-M1988 Luminaires
- .2 CSA C22.2 No. 34-M1987 Electrode Receptacles, Fittings, and Connectors for Gas Tubes
- .3 CSA C22.2 No. 43-M1984 Lampholders
- .4 CSA C22.2 No. 66-1988 Specialty Transformers
- .5 CSA C22.2 No. 74-92 Equipment for Use with Electric Discharge Lamps
- .6 CSA C22.2 No. 141-M1985 Unit Equipment for Emergency Lighting
- .7 ANSI/IEEE C62.41 Guide for Surge Voltages in Low Voltage AC Power Circuits

1.4 CODES AND STANDARDS

- .1 All wiring to be in accordance with the Alberta Electrical Safety Code.
- .2 Provide only equipment bearing a label acceptable to the Electrical Safety Authority (ESA) to indicate that the equipment has been tested to applicable CSA standards.

2 Products

2.1 LUMINAIRES**.1 General**

- .1 Furnish luminaires in accordance with CSA C22.2 No. 9.
- .2 Luminaire finishes shall resist chipping, crazing, and discolouration.
- .3 Luminaires to contain no asbestos.
- .4 Furnish luminaires with flanges and gaskets to eliminate light leaks.

.2 Fluorescent Luminaires

- .1 Fabricate steel luminaires from minimum 22 gauge mild sheet steel with joints securely fastened.
- .2 Do not use pre-painted steel.
- .3 Remove sharp edges.
- .4 Phosphate dip, prime and paint luminaire body, hardware and accessories with 2 coats of baked enamel, or other finish where indicated, after fabrication.
- .5 Interior baked enamel finish to have a minimum 88% reflectance and a minimum thickness of 1.2 mils.
- .6 Where 2 level switching is indicated, furnish 2 ballasts, separately switched, with one ballast connected to the outer lamps and the other ballast connected to the inner lamp(s).
- .7 Acrylic lens, 100% virgin acrylic, 0.125" nominal thickness, extruded aluminum hinged frame.

.3 Exit Light Luminaires

- .1 150 mm high red letters.
- .2 Universal ceiling, end-to-wall, surface back-to-wall mounting or recessed mounting if indicated.
- .3 Connection for emergency 12V source where indicated.
- .4 Refer to luminaire schedule.

2.2 BALLASTS – NON-DIMMABLE**.1 Fluorescent**

- .1 To CSA C22.2 No. 74.
- .2 Electronic, to operate 1 or 2 lamps, integrally mounted in luminaire unless otherwise indicated.
- .3 Rapid start type for normal output lamps unless otherwise indicated.
- .4 Instant start type for high output lamps.
- .5 Programmed start type for applications with occupancy/vacancy sensors.
- .6 Type as indicated in luminaire type appendix.
- .7 Totally enclosed containing no polychlorinated biphenyls.

- .8 Rated 60 Hz, voltage as indicated.
- .9 Rated for operation over an ambient temperature range of 10°C to 40°C.
- .10 Maximum case temperature not greater than 25°C above ambient temperature.
- .11 Operate at in a frequency range of 25 kHz to 40 kHz.
- .12 Produce no visible flicker.
- .13 Minimum sound rating of Class A.
- .14 Minimum ballast factor of 0.9.
- .15 Minimum power factor of 0.95.
- .16 Maximum crest factor of 1.5.
- .17 Maximum input current total harmonic distortion of 10% measured at rated output.
- .18 To withstand line transients as defined by ANSI/IEEE C62.41, Category A.
- .19 Acceptable manufacturers:
 - .1 Lutron
 - .2 Philips Advance
 - .3 Osram Sylvania
 - .4 GE Motorola
- .2 LED Drivers
 - .1 Dims continuously from 100% to 1% lighting level (if applicable)
 - .2 Rated for a 50,000 hour lifetime
 - .3 Constant current reduction (CCR) or pulse width modulation (PWM) dimming for constant current drivers selection
 - .4 Works with Forward Phase controls (neutral wire required), 3-wire fluorescent controls and network lighting management controls
 - .5 Constant Current model: 200 mA to 2.1 A (in 10 mA steps), 5 W to 40 W
 - .6 Constant Voltage model: 10 Volts to 40 Volts (in 0.5 V steps), 5 W to 40 W
 - .7 Universal input voltage
 - .8 Full range of UL Class 2 products operating at low DC voltage
 - .9 Operational down to -30° C for use in outdoor and cold areas
 - .10 Integrated short circuit protection
 - .11 Acceptable manufacturers:
 - .1 Lutron
 - .2 Philips Advance
 - .3 Osram Sylvania
 - .4 GE Motorola

- .3 Compact Fluorescent
 - .1 Ballasts shall be CSA and/or UL listed, Class P thermally protected and meet ANSI C62.41 (IEEE 587, Category A) for surge protection.
 - .2 Light level output shall be continuous, smooth and flicker free over the entire dimming range.
 - .3 Ballast shall have:
 - .1 Power factor greater than .95 and it should be self-compensated
 - .2 Total harmonic distortion less than 10%
 - .4 Ballast shall have an ambient noise level of 27dB or less throughout the dimming range.
 - .5 Ballasts must comply with FCC part 18 regulations and shall not interfere with other electrical or electronic equipment
 - .6 Ballasts shall have a minimum starting temperature of 10 deg C.
 - .7 Ballasts shall have protected control wire input which is not damaged by miswire.
 - .8 Ballasts current inrush shall not exceed three amps at 120 volts to avoid nuisance circuit breaker trips and control contact malfunctions.
 - .9 Lead length from ballast to lamp socket shall not exceed 1M (3ft.)
 - .10 Acceptable manufacturers:
 - .1 Lutron
 - .2 Philips Advance
 - .3 Osram Sylvania
 - .4 GE Motorola
- .4 Metal halide ballast:
 - .1 Rating: [voltage as indicated] 120 V, 60 Hz, for use with 1-400W metal halide lamp. Provide circuitry for quartz re-strike standby light where indicated.
 - .2 Totally encased and designed for 40 degrees Celsius ambient temperature.
 - .3 Power factor: minimum 95 % with 95% of rated lamp lumens.
 - .4 Input voltage range: plus or minus 10% of nominal.
 - .5 Minimum starting temperature: minus 30 degrees Celsius at 90% line voltage.
 - .6 Mounting: as per drawings.
 - .7 Current crest factor: 1.7 maximum current.
- .5 High pressure sodium ballast: to ANSI C82.4 design.
 - .1 Rating: 120 V, 60Hz, for use with 1-400W high pressure sodium lamp.
 - .2 Totally encased and designed for 40 degrees Celsius ambient temperature.
 - .3 Power factor: minimum 95 % with 95% of rated lamp lumens.

- .4 Type: as recommended by manufacturer.
- .5 Input voltage range: plus 10% to minus 10% of nominal.
- .6 Minimum starting temperature: minus 40 degrees Celsius at 90% line voltage.
- .7 Mounting: As per drawings..
- .8 Current crest factor: 1.7 maximum current.
- .6 Low pressure sodium ballast:
 - .1 Rating: 120 V, 60 Hz, for use with 1-35W low pressure sodium lamp.
 - .2 Totally encased and designed for 40 degrees Celsius ambient temperature.
 - .3 Power factor: minimum 95% with 95% of rated lamp lumens.
 - .4 Input voltage range: plus or minus 20% of nominal.
 - .5 Minimum starting temperature: minus 34 degrees Celsius at 90% line voltage.
 - .6 Mounting: as per drawings.

2.3 BALLASTS – DIMMABLE

- .1 Fluorescent
 - .1 Ten-year operational life while operating with a case temperature range of 10 degrees C (50 degrees F) to 75 degrees C (167 degrees F) and 90 percent non-condensing relative humidity.
 - .2 Designed and tested to withstand electrostatic discharges up to 15,000 V without impairment per IEC 801-2.
 - .3 Electrolytic capacitors to operate at least 20 degrees C below the capacitor's maximum temperature rating when the ballast is under fully-loaded conditions and case temperature is 75 degrees C (167 degrees F).
 - .4 Programmed Rapid Start Type.
 - .5 Current crest factor (CCF) less than 1.7.
 - .6 Meet ANSI C82.11 High frequency ballast standard.
 - .7 Will not interfere with infrared devices operating at frequencies between 38 kHz and 42 kHz.
 - .8 Withstand up to a 4,000 volt surge without impairment of performance as defined by ANSI C62.41 Category A.
 - .9 Manufactured in a facility that employ ESD reduction practices in compliance with ANSI/ESD S20.20.
 - .10 Inaudible in a 27 dBA ambient.
 - .11 No visible change in light output with a variation of +/- 10 percent line voltage input.
 - .12 Total Harmonic Distortion less than 10 percent and meet ANSI C82.11 maximum allowable THD requirements
 - .13 Actively prevent overheating in T5-HO linear fluorescent lamp applications.

- .14 Ballasts to track evenly across:
 - .1 Multiple lamp lengths.
 - .2 All light levels.
- .15 Dimming range of ballast shall be from 1% to 100% illuminance level.
- .16 Acceptable manufacturers:
 - .1 Lutron
 - .2 Philips Advance
 - .3 Osram Sylvania
 - .4 GE Motorola
- .2 Compact Fluorescent
 - .1 Continuous dimming from 100 percent to 5 percent relative light output for T4 compact and T5 twin tube lamps.
 - .2 Generate digital communication commands to distribute ballast data on the digital bus.
 - .3 Monitor and report lamp and ballast status.
 - .4 Lights automatically return to the setting prior to power interruption.
 - .5 Each ballast responds independently to:
 - .1 Up to 32 occupant sensors.
 - .2 Up to 64 personal control inputs.
 - .3 Up to 2 daylight sensors.
 - .6 Unique internal reference number visibly displayed on ballast cover.
 - .7 Averages 2 independent daylight harvesting inputs internally.
 - .8 Responds to digital load shed command.
 - .1 Sets high end trim.
 - .2 Automatically scales light output proportional to load shed command.
 - .1 Example: If light output is at 30 percent and a load shed command of 10 percent is received, the ballast automatically sets the maximum light output at 90 percent and lowers current light output by 3 percent to 27 percent.
 - .9 Maximum inrush current of 7 amperes for 120V ballasts and 3 amperes for 277V ballasts.
 - .10 Acceptable manufacturers:
 - .1 Lutron
 - .2 Philips Advance
 - .3 Osram Sylvania

- .4 GE Motorola
- .3 Light Emitting Diodes (LEDs)
 - .1 Continuous dimming from 100 percent to 1 percent relative light output.
 - .2 Ability to operate with installed or specified building control system.
 - .3 Lights automatically return to the setting prior to power interruption.
 - .4 Each driver responds independently to:
 - .1 Up to 32 occupant sensors.
 - .2 Up to 16 daylight sensors.
 - .5 Responds to digital load shed command.
 - .6 Sets high end trim.
 - .7 Automatically scales light output proportional to load shed command.
 - .1 Example: If light output is at 30 percent and a load shed command of 10 percent is received, the driver automatically sets the maximum light output at 90 percent (of the 30 percent light level) and lowers current light output by 3 percent to 27 percent.
 - .8 Acceptable manufacturers:
 - .1 Lutron
 - .2 Philips Advance
 - .3 Osram Sylvania
 - .4 GE Motorola

2.4 LAMPS

- .1 Fluorescent Lamps are as per project luminaire schedule and lighting plan drawings.
- .2 Incandescent lamps to be - clear, A19, 100 Watt with 1000 hour lamp life, rough-service rated; or as indicated..
- .3 Tungsten halogen lamps to be - clear, T-3, 300 Watt, RSC base, 2000 hour lamp life, 5000 lumens; or as indicated.
- .4 Fluorescent lamps to be - T8, 32 Watt, medium bi-pin, rapid-start, 4100 K, 30,000 hour lamp life, 2950 initial lumens, CRI [80]; or as indicated.
- .5 Metal halide lamps to be - clear, BT37, 400 Watt, mogul base, horizontal burn, 4100 K, 15,000 hour lamp life, 36,000 initial lumens, CRI[65], open or enclosed type to suit the luminaire; or as indicated.
- .6 Low pressure sodium lamps to be - clear, T21, 135 Watt, BY22d base, horizontal burn, 16,000 hour lamp life, 22,000 initial lumens; or as indicated.

- .7 High pressure sodium lamps to be - clear, ED18, 400 Watt, mogul base, 30,000 hour lamp life, 54,000 initial lumens; or as indicated.
- .8 Compact fluorescent lamps to be - 18 Watt, G24q-2 base, 12,000 hour lamp life, 12,000 initial lumens, 4100 K, CRI [80]; or as indicated.
- .9 Light emitting diodes (LEDs):
 - .1 Provide the most technically proven, advanced and successfully tested LED technology at time of installation.
 - .2 Colour temperature range to be from 2800 K to 4000 K as shown on luminaire schedule
 - .3 Minimum CRI of: 80
 - .4 Rated life: at least 50,000 hours based on 70% lumen depreciation level
 - .5 Heat sinks to adequately remove heat from bottom of semiconductor

2.5 LIGHTING POLES

- .1 Design poles and arms to withstand wind loading of 160 km/h and gusts of 1.3, without deformation, with designated luminaires installed.
- .2 Furnish poles round, aluminum, finish and colour as shown, designed for mounting on concrete base, height as indicated, complete with base bolt covers, grounding lug, handhole and flush weatherproof cover at base housing fuses and terminal strip.
- .3 Fuseholder, in-line, waterproof, breakaway type with 10A fuse.
 - .1 Acceptable manufacturers:
 - .1 Bussman, Tron fuseholder, HEB series with insulation boot
 - .2 Buchanan/Elastimold, Style 65
 - .3 Gould Shawmut, GEB series with insulating boots

2.6 EMERGENCY BATTERY UNITS

- .1 Supply voltage 120 V AC, 1PH, 60Hz.
- .2 Output voltage 12 V DC.
- .3 Batteries: sealed lead acid calcium alloy grid type sized to operate the lamp load to 91% of initial voltage for 30 minutes.
- .4 Battery charger: solid state, multi-rate, voltage/current regulated, sized to restore battery to full charge in 12 hours.
- .5 Low voltage disconnect: solid state, modular, operates at 80% battery voltage.
- .6 EEMAC 2 code gauge steel housing.
- .7 Auxiliary equipment:
 - .1 "AC Power ON"

- .2 "Fast charge" pilot light
- .3 Voltmeter
- .4 Test switch
- .5 5 minute time delay relay
- .6 Cord and plug
- .8 Lamp heads: mounted as indicated, 360° horizontal and 180° vertical adjustment, (12W) (20W) (55W) (micro quartz) (quartz halogen composite) lamps.
- .9 Acceptable Manufacturers:
 - .1 –Refer to Luminaire Schedule.

3 Execution

3.1 INSTALLATION - GENERAL

- .1 Provide supports for luminaires. For continuous row fluorescent type, provide support for each end plus at least one for each channel section, or additional as required. Swivel mount stems. Provide concrete inserts at points of luminaire support in unfinished areas where a concrete slab serves as ceiling. Provide support from concrete floor and roof steel above ceiling as applicable.
- .2 Align luminaires in rows, maintain required heights, and install luminaires clear of other work.
- .3 Keep luminaires covered and protected from construction dust and debris until building is broom clean and free of suspended dust clouds.
- .4 Do not lamp luminaires until ready for testing and use. Obtain Departmental Representative's approval before lamping. Install lamps in lampholders.
- .5 When installation is complete, demonstrate operation to satisfaction of Departmental Representative.
- .6 Standard octagonal boxes may be supplied where conduits feeding luminaires in finished areas are exposed on ceiling if hanger canopies entirely cover outlet boxes and are neatly notched for conduit. Otherwise, provide cast conduit outlet boxes with a diameter larger than canopies.
- .7 Attach boxes or hickey directly to poured concrete with 6 mm minimum diameter bolts and lead expansion anchors where luminaires are suspended directly from concrete slabs. Use 8 mm minimum bolts through precast slabs, welded to 100 mm x 100 mm minimum, 3.5 mm plate above slabs.
- .8 Do not mount luminaires above pipes, ducts or equipment. In event of unavoidable tight locations, provide hangers to clear obstructions. Check layouts of other trades on job and plan cooperatively. Luminaires in any room shall hang at one height. Obtain approval before any changes are made to layouts shown.

- .9 Provide continuous 12 mm x 38 mm channel above ceiling, where luminaires are suspended or mounted on furred ceilings. Fasten luminaires to channel with two 6 mm minimum diameter studs with minimum 1220 mm on centre.
- .10 Where two 4'-0" surface or suspended fluorescent luminaires occur in tandem, an 8'-0" body may be used. Where two single lamp luminaires occur in tandem, a common lamp ballast may be used.
- .11 Verify catalogue number of luminaires with description prior to ordering, and check for final ceiling finish in areas where recessed luminaires are called for in order to provide ceiling trim, flanges and mounting brackets to suit particular construction used where luminaires are installed.
- .12 Support luminaires in an approved manner to comply with the Ontario Electrical Safety Code and the Ontario Building Code.
- .13 Provide steel luminaire studs, brackets and hangers. Where luminaires are hung on chain hangers, provide chain of closed link type capable of supporting ten times luminaire weight. Use U-bolts for chain ends; S-hooks are not acceptable.

3.2 INSTALLATION - EMERGENCY AND EXIT LIGHTS

- .1 Exit sign installation shall meet all requirements of the authorities having jurisdiction.
- .2 Install emergency battery units where shown. Support on brackets supplied by manufacturer.
- .3 Aim heads to properly illuminate exit path.

3.3 INSTALLATION - CEILINGS

- .1 Suspend luminaires mounted from or in a suspended T-bar ceiling directly from building structure, independent of the T-bar system, to ULC, Local Fire Marshal's Office, Alberta Building Code, Electrical Safety Authority (ESA) and Departmental Representative's approval.
- .2 In non-accessible ceilings wire with not more than 1200 mm of AC90 or RW90 XLPE wire in flexible conduit to adjacent outlet boxes placed above finished ceiling within reach of the luminaire openings.
- .3 In accessible ceilings wire with not more than 1800 mm of AC90 or RW90 XLPE wire in flexible conduit to adjacent outlet boxes, locations as shown on the Drawings.
- .4 Provide suitable trim for all luminaires installed in drywall ceilings or within lay-in or snap-in tiles.

3.4 INSTALLATION - POLES

- .1 Wire down inside of lighting poles with No. 10 AWG RW90 plus No. 10 AWG insulated ground wire and secure to clips. Provide strain relief at the top of the pole so that the weight of the wiring down to the bottom of the pole does not place a strain on the wiring terminations. Install fuse holders and fuses.
- .2 Assemble arms and luminaires securely to pole. Provide lamps in lampholders.

- .3 Erect pole plumb and true on base. Along roadways, orient pole handhole on the side opposite the roadway unless otherwise indicated.
- .4 Connect underground ground wire and pole ground wire at ground lug in pole.
- .5 Leave slack in wires to allow connector and ground wire to be pulled out of handhole 150 mm clear of pole without disconnecting.

END OF SECTION

1 General

1.1 SUMMARY

- .1 Section includes:
 - .1 Labour, products, equipment and services necessary to complete the work of this Section.

1.2 DIMENSIONS AND QUANTITIES

- .1 Dimensions shown on Drawings are approximate. Verify dimensions by reference to shop drawings and field measurement.
- .2 Quantities or lengths indicated in any of the Contract Documents are approximate only and are not to gauge or limit the Work.
- .3 Make necessary changes to routing of cables and the like to accommodate structural, mechanical, electrical and architectural conditions. Coordinate with other trades and make allowance for conditions that will arise from work in progress under separate contract.

1.3 WORKING DRAWINGS AND DOCUMENTS

- .1 Where the word "HOLD" appears on Drawings and other Contract Documents, the Work is included in the Contract. Execute such Work only after verification of dimensions and materials and obtaining Departmental Representative's written permission to proceed.

1.4 OPERATING AND MAINTENANCE MANUALS

- .1 Submit Operating and Maintenance Manuals.

1.5 "AS BUILT" RECORD DRAWINGS

- .1 Where wiring is underground or underfloor, furnish field dimension with respect to building column lines and inverts with respect to finished floor levels or grades.
- .2 Record deviations from cable numbers shown on the Contract Drawings.
- .3 Prepare records of interconnecting and cross-connecting wiring between items of equipment including equipment supplied by Departmental Representative and under other Specification Sections. Provide the records loaded into a data base. Select the data base by mutual agreement with the Departmental Representative.
- .4 Approved data base products:
 - .1 Microsoft Access
 - .2 Microsoft Excel
- .5 Prepare drawings clearly identifying routes taken by cable where the cable is not supported along its length by either conduit or raceway.
- .6 Include all test reports as part of the "As-built" submittals.

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- .7 Provide all test data and numeric as-built information in a format approved by the Departmental Representative selected from the following alternatives:

- .1 CD-ROM (write once, read many)
- .2 DVD-ROM (write once, read many)

1.6 MANUFACTURER'S ATTENDANCE

- .1 Provide manufacturer's representatives to verify installation practices for each part of the Work as may be relevant to all components including wiring and terminations.

1.7 FIELD INSPECTION

- .1 Provide field engineer for inspection and certification of equipment during installation, testing and commissioning as required.

1.8 QUALITY ASSURANCE

- .1 These Specifications supplement the Electrical and Electronic Manufacturers Association of Canada, Canadian Standards Association Standards, Electronic Industries Association, Telecommunications Industries Association standards and recommendations. Conditions of the EEMAC, CSA, EIA, TIA and ISO/IEC standards and recommendations apply unless superseded or modified by this Specification.
- .2 Where requirements of the specifications exceed referenced standards, the specifications apply. Where standards differ between authorities, the most rigid applies.
- .3 Requirements of the specifications that are substandard to referenced standards should be brought to the attention of Departmental Representative during bidding period in sufficient time to allow suitable action to be taken and addenda issued as necessary.
- .4 Equipment must be acceptable to electrical inspection authorities.
- .5 Where any part of the Work fails tests, repair the fault in a manner to prevent recurrence and re-test.
- .6 Where any part of the Work fails tests and that Work is to be built without physical discontinuity, remove the offending material and install new without increase in cost to the Contract.

1.9 AREA CLASSIFICATION

- .1 No area in the Work is classified as Hazardous.

2 Products**2.1 MANUFACTURERS**

- .1 Cable Support Hardware
 - .1 Cable supports of open hook construction with curved cable bearing surface. Do not exceed minimum bending radius restriction.
 - .2 Flexible corrugated non-metallic conduit to be available in colours:

- .1 Orange
- .3 Flexible corrugated non-metallic conduit to be available in the following nominal sizes:
 - .1 25 mm inside diameter
 - .2 32 mm inside diameter
- .4 Flexible corrugated non-metallic conduit to be available in the following fire ratings:
 - .1 FT4
 - .2 FT6 - plenum rated

2.2 WLAN INFRASTRUCTURE

- .1 The entire building is to have 100% wireless LAN (WLAN) coverage. Category 5E horizontal network cabling drops are shown on drawings as provisions to enable the deployment the WLAN access points (AP) throughout the facility.
- .2 This contractor is to:
 - .1 Site Signal Survey:
 - .1 Perform a coverage site signal survey/audit and confirm if additional Cat. 5E cabling drops are required or locations of the ones on drawings need to be adjusted.
 - .2 Site survey is to be performed immediately after all interior partitions are in place.
 - .3 Submit a copy of survey/audit to the Engineer for review.
 - .2 Coordinate and install active AP equipment supplied by the Departmental Representative.
 - .1 Make recommendation to the Departmental Representative of type of AP to be provided (e.g. Directional, omnidirectional) for each particular location.
- .3 Location criteria:
 - .1 Minimum threshold coverage: -65 dBm
 - .2 User density:
 - .1 Second floor: high density user area (teaching rooms, multipurpose room)
 - .2 Remaining floors: standard density user areas.
 - .3 Above accessible ceilings or on underside of slab in no-ceiling areas
 - .4 In service areas/rooms adjacent to public areas
 - .5 In accessible light coves hiding antennas from view
 - .6 Near an access panel if in hard ceilings.

3 Execution**3.1 GENERAL**

- .1 All cables and cable pathways to run parallel or perpendicular to building lines.
- .2 Proposed installation drawings to be submitted to the Engineer or Departmental Representative prior to installation.

3.2 DUCT DISTRIBUTION

- .1 Clean out each section of duct by pulling a steel wire brush and mandrel of the correct size through the duct before pulling cables.
- .2 When cleaning ducts, if obstructions are encountered which cannot be removed, advise the Departmental Representative of the problems encountered.
- .3 Cable entry and exit from ducts to be protected by flexible corrugated non-metallic conduit or plastic bushings attached to the end of the conduit.
- .4 Pull cables in underground duct-bank in continuous length. Splicing of any kind will not be permitted.
- .5 Pull cable in bottom ducts first, leaving top ducts for future.
- .6 Apply manufacturer recommended lubricant to cables to reduce friction between the cable and the duct.
- .7 Cable grip to be attached to the sheath and its strength members so that no direct force is applied to the conductors/fibres. The cable grip shall have a ball bearing swivel to prevent the cable from twisting during pulling.
- .8 Station personnel at each access point (i.e. manhole/handhole) to observe and lubricate the cables during pull.
- .9 Cable passing through manholes to have sufficient slack for expansion and contraction and to be mounted with clips to prevent sagging.
- .10 Submit tension pulling calculation for installation of cables to Engineer.
- .11 The fibre optic cables maximum tensile rating shall not be exceeded during installation. Tension of cable to be monitored during installation.
- .12 Minimum bend radius to be as per manufacturer's recommendations or 10 times the cable outside diameter which ever is the greater.
- .13 Where cable must be pulled through a distance of greater than 30 m or through a pathway containing more than one 90° bend, use a dynamometer to record installation tension and a tension limiting device to be used to prevent exceeding the maximum pulling tension specification during installation. The tension limit shall be set at or below the manufacturer's maximum limit. The cable to be taken up at intermediate pulling points with an intermediate cable take-up device as approved by the Departmental Representative, to prevent over tension on the cable.

- .14 Make cable pulls continuous and steady between pull points and not to interrupt the pull unless necessitated by excessive tension on the cable.
- .15 Following the installation of the cables, all duct entrance into buildings to be sealed with duct sealing compound to prevent the ingress of moisture, foreign materials and rodents.
- .16 Exposed cable ends shall be protected from moisture ingress.
- .17 For underground non-metallic conduit run-empty/spare or with fiber optic cables, provide a metal tracing cable through their entire length within the conduit conveying such cable. The tracing cable will be a minimum size # 12 AWG wire to be terminated at each end so that tracer can be attached. All underground buried conduits will also be marked with plastic caution tape, within a layer of backfill just above the conduit as a warning for future excavation.

3.3 GROUNDING

- .1 All grounding bonding to comply with CSA C22.1 standard or after applicable codes.
- .2 Install grounding cables between all equipment frames and enclosures and connect to grounding bus.
- .3 Support grounding cables in the non-metallic conduits or cable trays provided.

3.4 WARRANTY

- .1 Test complete structural cabling system to meet manufacturer's best warranty.
- .2 Submit all necessary test results, drawings, and any other documents required to receive manufacturer's warranty certificate to manufacturer's representative.

END OF SECTION

- 1 General
 - 1.1 **SUMMARY**
 - .1 Section includes:
 - .1 Labour, products, equipment and services necessary to complete the work of this Section.
 - 1.2 **SHOP (VENDOR) DRAWINGS AND PARTS LISTS**
 - .1 Submit for review, manufacturer's or vendor's drawings and specifications for all products being furnished. Include rating, performance, specification sheets, descriptive literature, schematic and wiring diagrams, dimensional layouts and weights of components as well as complete assemblies.
 - 1.3 **AREA CLASSIFICATION**
 - .1 No area in the Work is classified as Hazardous.
- 2 Products
 - 2.1 **MANUFACTURERS**
 - .1 Copper Cable Labels
 - .1 All cables to be labelled using self-adhesive, self-laminating material.
 - .1 Label to be installed 100 mm from each end of cable termination.
 - .2 All grounding conductors to be labelled with materials in compliance with CSA-T528 or ANSI/TIA/EIA-606 specification.
 - .2 Identification Labels
 - .1 All faceplate and icons labels to suit selected faceplate.
 - .2 All patch panels and termination strips to be labelled with materials to suit selected patch panel or termination strip.
 - .3 All pullboxes, cabinet, racks to have 75 mm high (minimum) lamacoid labels at the top of unit.
 - .4 Colour code labels in accordance with EIA/TIA-606A or as Instructed by the Engineer.
 - .3 Fibre Labels
 - .1 Provide fibre labels along the length of the fibre cable or fibre conduit in interval of 3 meters.
 - .2 Provide labels at junction and pull boxes.
 - .3 Provide labels at each end of the fibre cables within 150 mm of the termination.
 - .4 Provide labels at fibre optic patch panels.
 - .4 Provide 15% additional labels in each room for future use.

3 Execution

3.1 **INSTALLATION GENERAL**

- .1 Submit shop drawings and sample of all proposed labels and obtain approval before printing of any labels.
- .2 Clearly identify all cables according to the administration system shown on the Contract Drawings.
- .3 Use only approved cable marking materials.
- .4 Clearly identify all outlets, patch-panels, patch-cords, cables, racks, enclosures, spaces, closets, conduit, and raceways according to the administration system shown on the contract drawings.
- .5 Use only machine printed labelling for outlets.
- .6 Use only engraved plastic plates for the labelling of enclosures and racks.
- .7 For each termination panel port affix and secure two (2) corresponding unique Identification labels on the termination panel front and back surfaces.

3.2 **LABELLING**

- .1 Provide horizontal cabling labelling in accordance with McMaster Standards. Labelling shall have the following format at both ends of the cable:
 - .1 Label each drop with the room number and jack number. The jack number is determined by the patch panel. Using a 48 port patch panel:
 - .1 Patch Panel #1
 - .1 room#-1 Room#-24
 - .2 room#-25 Room#-48
 - .2 Patch Panel #2
 - .1 room#-49 Room#-72
 - .2 room#-73 Room#-96
 - .3 Example: Room 110, the label will read: "110-53"

END OF SECTION

1 General

1.1 SUMMARY

.1 Section includes:

.1 Labour, products, equipment and services necessary to complete the work of this Section.

.2 Include all test reports as part of the "As-built" submittals.

.3 Provide all test data and numeric as-built information in a format approved by the Departmental Representative selected from the following alternatives:

.1 CD-ROM (write once, read many)

.2 DVD-ROM (write once, read many)

1.2 TEST REPORTS

.1 For each check and test performed prepare and submit a Test Report, signed by the Test engineer, and where witnessed, by the Departmental Representative.

.2 Test Reports to include a record of all tests performed, methods of calculation, date and time of test, ambient conditions, names of testing company, test engineer, witnesses, also calibration record of all test instruments used together with manufacturers name, serial number and model number.

.3 Calibration record to include percentage error and applicable correction factors.

.4 Tests performed with instruments that have not been calibrated or certified as Fit for Purpose within 12 months preceding the date of use will not be accepted.

.5 Submit a Certified Test Report from each manufacturer, signed by the certifying inspector, confirming correct installation and operation of each product and part of Work. Include name of certifying inspector, date and times of inspection, ambient conditions.

.6 Submit evidence from each third party warranting performance guarantees of any part of the cabling system of their agreement that testing and site inspection procedures are fit for the purpose of upholding the warranty.

.7 Undertake either full or sample testing daily and have reports available for inspection by the Departmental Representative as an assurance that standards of working practices are being maintained.

.8 Complete test records and certification of such records prior to project cutover.

1.3 MANUFACTURER'S ATTENDANCE

.1 Provide manufacturer's representatives to verify installation practices for each part of the Work as may be relevant to all components including wiring and terminations.

1.4 FIELD INSPECTION

- .1 Provide field engineer for inspection and certification of equipment during installation, testing and commissioning as required.

1.5 QUALITY ASSURANCE

- .1 These Specifications supplement the Electrical and Electronic Manufacturers Association of Canada, Canadian Standards Association Standards, Electronic Industries Association, Telecommunications Industries Association standards and recommendations. Conditions of the EEMAC, CSA, EIA, TIA and ISO/IEC standards and recommendations apply unless superseded or modified by this Specification.
- .2 Where requirements of the specifications exceed referenced standards, the specifications apply. Where standards differ between authorities, the most rigid applies.
- .3 Requirements of the specifications that are substandard to referenced standards should be brought to the attention of Departmental Representative during bidding period in sufficient time to allow suitable action to be taken and addenda issued as necessary.
- .4 Equipment must be acceptable to electrical inspection authorities.
- .5 Where any part of the Work fails tests, repair the fault in a manner to prevent recurrence and re-test.
- .6 Where any part of the Work fails tests and that Work is to be built without physical discontinuity, remove the offending material and install new without increase in cost to the Contract.

2 Products

3 Execution

3.1 TESTING AND ACCEPTANCE

- .1 Horizontal cabling testing to be completed according to the following test criteria.
 - .1 All terminated cabling runs shall be 100% tested for defects in installation and to verify cabling system performance under installed conditions according to the requirements found in the TIA/EIA-568-C series of standards. All pairs in each installed cable shall be verified prior to system acceptance. Any defect in the cabling system installation, including (but not limited to) cables, connectors, patch panels, and cordage shall be repaired or replaced in order to ensure 100% usability of all installed runs.
 - .2 All balanced twisted-pair cable links shall be tested for basic for:
 - .1 Wire map, including shield connection if present
 - .2 Insertion loss
 - .3 Cable length;
 - .4 Attenuation;
 - .5 NEXT loss, pair-to-pair, measured from local end
 - .6 NEXT loss, pair-to-pair, measured from far-end

- .7 NEXT loss, power sum, measured from local end
- .8 NEXT loss, power sum, measured from far-end
- .9 ELFEXT, pair-to-pair
- .10 ELFEXT, power sum
- .11 Return loss, measured from local end
- .12 Return loss, measured from far-end
- .13 Propagation delay
- .14 Delay skew
- .15 ACR;
- .16 Power sum ACR;
- .17 End to end continuity;
- .18 Opens or shorts;
- .19 Pair polarity.
- .3 Provide full bandwidth graphical results for all cables.
- .4 Category 6 performance testing shall be done according to the published standards.
- .2 Fibre optic cabling testing to be completed according to the following test criteria.
 - .1 The backbone optical fibre cabling link segment shall be tested in at least one direction at both operating wavelengths to account for attenuation deltas associated with wavelength.
 - .1 Singlemode backbone links should be tested at 1310 nm and 1550 nm in accordance with ANSI/TIA/EIA-526-7, Method A.1, One Reference Jumper.
 - .2 Multimode backbone links shall be tested at 850 nm and 1300 nm in accordance with ANSI/EIA/TIA-526-14A, Method B, One Reference Jumper.
 - .3 Because backbone length and the potential number of splices vary depending upon site conditions, the link attenuation equation should be used to determine acceptance values based upon this Standard's component requirement at each of the applicable wavelengths.
 - .2 Test every fibre of each cable with an Optical Time Domain Reflectometer for length and attenuation. Include a hard copy chart recording with the test documentation.
 - .3 Tabulate and include test results with the test documentation.
- .3 Correct all cable faults. Splicing of any cable will not be permitted, for any reason, unless prior authorization is received in writing by the Departmental Representative.

- .4 All installed cables and terminations must meet and exceed the minimum performance specifications as outline by the cable manufacturer. Marginal passes are NOT acceptable and must be corrected prior to test results submission.
- .5 All defects and deficiencies which become evident during the warranty period are to be repaired or replaced within a time frame that is acceptable to the Departmental Representative and at no extra cost.
- .6 Submit complete test results in hard and soft format.
- .7 Submit letter of system certification within 3 weeks of substantial completion. Include:
 - .1 Notification of systems installed (Category 6)
 - .2 Verification of performance of the system
 - .3 Manufacturer certificate number
 - .4 Copy warranties

End of Section

-
- 1 General
- 1.1 **SUMMARY**
- .1 Section includes:
- .1 Labour, products, equipment and services necessary to complete the work of this Section.
- 1.2 **SHOP (VENDOR) DRAWINGS AND PARTS LISTS**
- .1 Submit for review, manufacturer's or vendor's drawings and specifications for all products being furnished. Include rating, performance, specification sheets, descriptive literature, schematic and wiring diagrams, dimensional layouts and weights of components as well as complete assemblies.
- 2 Products
- 2.1 **MANUFACTURERS**
- .1 Horizontal (Distribution) UTP Cables
- .1 The copper backbone cables shall be Belden "IBDN DataTwist 2400 UTP, Category 5E".
- .2 Horizontal UTP cables to be of characteristic impedance 100Ω and comply with ANSI/EIA/TIA 568A specification for Category 5E UTP cables except where indicated otherwise on the Contract Drawings.
- .3 Bandwidth: 250 MHz
- .4 Horizontal UTP cable to be 4 pair 23 AWG solid conductor.
- .5 Exposed cable in air space between underside of ceiling and underside of overhead slab to be FT6 Plenum rating (CMP).
- .6 Cable routed through the air space between underside of ceiling and underside of overhead slab and fully contained in metallic conduit or electrical metallic tubing to be FT4 rated (CMG).
- 3 Execution
- 3.1 **GENERAL**
- .1 All cables and cable pathways to run parallel or perpendicular to building lines.
- .2 The following minimum clearances from electrical and heat sources are to be maintained when routing cables.
- | | | |
|----|---|-------|
| .1 | Unit substations | 10 m |
| .2 | Power transformers (greater than 30KVA) | 10 m |
| .3 | Transformers | 1.2 m |
| .4 | Motors | 1.2 m |
| .5 | Switch gear (greater than 600V) | 10 m |

- | | | |
|-----|---|--------|
| .6 | Feeder cables (600V and above) | 1 m |
| .7 | Distribution cables (less than 600V) | 750 mm |
| .8 | Conduit (Enclosing 30A branch circuits) | 300 mm |
| .9 | Conduit (Enclosing 20A branch circuits) | 75 mm |
| .10 | Conduit (Enclosing 15A branch circuits) | 65 mm |
| .11 | Fluorescent luminaires | 120 mm |
| .12 | Pipes (gas, oil, water, etc.) | 300 mm |
| .13 | HVAC (equipment, ducts, etc.) | 150 mm |
- .3 Any deviation from cable routing shown on drawings to be approved by Engineer and documented on as-built drawings.
- .4 Avoid scraping, denting, crushing, twisting, kinking or otherwise damaging cables, before, during or after installation. Damaged cables to be replaced by the Contractor without additional compensation.
- .5 Patch-panels and cable management panels to be mounted with clearance between equipment enclosure doors and patch cables.
- .6 Proposed installation drawings to be submitted to the Engineer or Departmental Representative prior to installation.

3.2 CABLING - GENERAL

- .1 Pull all UTP cables in a continuous run. Cable splices will not be permitted.
- .2 Install all cables in accordance with manufacturer's specifications ensuring that proper installation techniques are observed and that the cable maximum pull-force and minimum bend radius specifications are adhered to.
- .3 Utilize all indicated and available cable pathways such as slots, sleeves, conduits, cable trays, ducts, raceways and furniture system channels except where otherwise noted to route cable vertically and horizontally through the building. Exercise caution when pulling cables in such pathways to avoid damage to any existing cables and follow manufacturer's maximum pull-force and minimum bend radii.
- .4 Where cables are exposed to risk of being damaged by sharp edges of furniture, cable tray, raceway etc. protect cables by feeding them through a length of flexible plastic conduit.
- .5 Where cables exit the cable tray and are exposed to sharp bends, reduce the bending stress by covering the cable tray with protective flexible plastic conduit.
- .6 Neatly bundle, secure and tie-wrap all cables. Ensure cable ties do not deform the cable jacket.
- .7 Where cables are terminated on a patch panel, bundle and dress cables in groups of 12 or 24, each group consisting of cables from a single 12 or 24 port patch panel.
- .8 Where cables are terminated on a cross-connect field, bundle and dress cables in groups of 12 or 24, each group consisting of cables from a single cross-connect panel.

- .9 Where voice and data cables are separately identified on the Contract Drawings, separate voice and data cable into distinct bundles.
- .10 Do not maintain bundles for distances greater than 1m in cable trays.
- .11 For cables being terminated on a backboard mounted cross-connect field, pass all cables behind backboard in bundles and pass them through holes positioned in the center of the termination mount.
- .12 When bundling Category 5E cable bundles, comply with manufacturer's recommended bundling practices for Category 5E installations. Ensure that no cable bundling puts excess pressure on the cable at any point which may result in compression or deformation of the cable jacket and internal pair/conductor geometry.
- .13 Follow proper installation and termination practices for Category 5E UTP cabling. Do not kink or exceed manufacturer's restrictions on the UTP cable minimum bend radius.
- .14 For UTP cables, maintain a minimum bending radius of 4 times cable diameter or 25 mm whichever is the greater.
- .15 When terminating UTP cables to IDC blocks or outlet connections, observe the manufacturer's recommendations on stripping back insulation and the extent that pairs may be untwisted. Do not untwisted pairs for more than 13 mm.
- .16 When terminating UTP cables follow manufacturer's installation instructions. Unless directed by the manufacturer's instructions otherwise, remove cable jacket only enough to perform termination and untwist pairs no more than 13 mm for Category 5E cable.
- .17 Secure UTP distribution cables at rear of patch panels. Ensure cable approach to the patch panel is normal to the panel and stress is not transmitted to the termination.
- .18 Ground all metallic strength members integral to cables and components to manufacturer's specifications and standard practices
- .19 Do not strap cables to, or lay cables on, any length of conduit, pipe, ventilation duct or other building element not expressly installed for the purpose of cable support.
- .20 When determining a cable routing pathway, give priority to air handling ducts, fire sprinkler pipes and electrical conduits.
- .21 Except for spare cables, terminate all pairs of UTP cable at both ends.
- .22 Terminate all pairs of spare UTP cable in telecommunication closet and store workstation end in ceiling space by coiling neatly and suspending. Do not rest cables on ceilings or air handling ducts.
- .23 Spare cables to be of sufficient length to permit reaching any point in the room to which they apply.

3.3 HORIZONTAL DISTRIBUTION

- .1 Where practicable and where the maximum allowable cable length is not exceeded, provide 3 m of slack UTP cable at the workstation end of each distribution cable to permit outlet relocation after installation. Neatly coil slack in ceiling space and store suspended.

- .2 Secure and support cables every 1.2 m when running in free space. Bundle and tie-wrap all suspended cables so that droop between supports is minimized.
- .3 Attach cable supports only to the building structure or to support wires installed expressly for cable suspension. Do not attach cable supports to ceiling support wires.
- .4 Where the telecommunications outlet is mounted on a wall box or floor box or system furniture, provide working slack allowance for UTP cable of 300 mm. Coil neatly and secure.
- .5 Where the telecommunications outlet is mounted on furniture, do not crimp or trap the cable between the outlet receptacle and furniture structure.
- .6 Select least obstructed pathway through modular or system furniture. Where available, use eye-level pathways in preference to base-level pathways.
- .7 Install blank filler plates for all unused modular jack positions on faceplates.
- .8 Install blank cover plates for all unused or abandoned outlet boxes.
- .9 Inform Departmental Representative immediately of any horizontal cable runs exceeding 90 m in length.

END OF SECTION

Part 1. General**1.1. SUMMARY**

1. This Section includes the following:
 1. Excavating and backfilling for site demolition and preparation
 2. Excavating and backfilling for utility trenches
 3. Excavation and backfilling for structures
 4. Excavating and backfilling trenches for buried mechanical and electrical utilities and pits for buried utility structures

1.2. REFERENCES

1. American Society for Testing and Materials (ASTM):
 1. ASTM D69800ae1 Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ftlb/ft³ (600 kNm/m³))
 2. ASTM C11704 Test Method for Material Finer Than: 0.075 mm Sieve in Mineral Aggregates by Washing.
 3. ASTM C13604 Method for Sieve Analysis of Fine and Coarse Aggregates
 4. ASTM D155702e1 Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ftlb/ft³(2,700 kNm/m³))
2. Canadian General Standards Board (CGSB):
 1. CAN/CGSB 8.188 Sieves Testing, Woven Wire, Inch Series
 2. CAN/CGSB 8.2M88 Sieves, Testing, Woven Wire, Metric
3. Canadian Standards Association (CSA):
 1. CSAA23.1/A23.200 Concrete Materials and Methods of Concrete Construction/Methods of Tests for Concrete

1.3. DEFINITIONS

1. Backfill: Soil material or controlled low strength material used to fill an excavation
 1. Initial Backfill: Backfill placed beside and over pipe in a trench, including haunches to support sides of pipe
 2. Final Backfill: Backfill placed over initial backfill to fill a trench
2. Bedding Course: Course placed over the excavated subgrade in a trench before laying pipe
3. Borrow Soil: Satisfactory soil imported from off site for use as fill or backfill
4. Excavation: Removal of material encountered above subgrade elevations and to lines and dimensions indicated
5. Authorized Additional Excavation:
 1. Excavation below subgrade elevations or beyond indicated lines and dimensions as directed by geotechnical Departmental Representative
 2. Authorized additional excavation and replacement material will be paid for according to Contract provisions for changes in the Work

6. Unauthorized Excavation:
 1. Excavation below subgrade elevations or beyond indicated lines and dimensions without direction by geotechnical Departmental Representative
 2. Unauthorized excavation, as well as remedial work directed by geotechnical Departmental Representative, shall be without additional compensation
7. Common Excavation: Excavation of materials of whatever nature, which can be ripped and excavated with heavy construction equipment
8. Rock Excavation: Excavation of material from solid masses of igneous, sedimentary or metamorphic rock which, prior to its removal, was integral with its parent mass, and boulders or rock fragments having individual volume in excess of 1 m³
9. Fill: Soil materials used to raise existing grades
10. Structures: Buildings, footings, foundations, retaining walls, slabs, tanks, curbs, mechanical and electrical appurtenances, or other man made stationary features constructed above or below the ground surface
11. Subgrade: Surface or elevation remaining after completing excavation, or top surface of a fill or backfill
12. Topsoil: Material capable of supporting good vegetative growth and suitable for use in top dressing, landscaping and seeding
13. Utilities: On site underground pipes, conduits, ducts, and cables, as well as underground services within buildings

1.4. SUBMITTALS

1. Comply with requirements of Section 01 00 15.
2. Submit drawings indicating all required shoring and related work. Drawings must bear the seal of the Professional Engineer responsible for the shoring design.
3. Submit a drawing indicating required underpinning, construction methods and sequences. The drawing must bear the seal of a Professional Engineer responsible for the underpinning design.
4. Submit soil density test results and soil engineer reports before placing footings or slab on grade.
5. Samples: At least 2 weeks prior to commencing work, inform Departmental Representative of proposed source of fill materials and provide access for sampling; provide testing agency with 70 kg samples of type of fill specified.

1.5. QUALITY ASSURANCE

1. Refer to Section 31 24 19 for materials testing and quality control.

1.6. PROJECT CONDITIONS

1. A geotechnical report will be prepared for this Project and made available for viewing under the following conditions:
 1. The opinions expressed in this report are those of geotechnical engineer and represent interpretations of subsoil conditions, tests, and results of analyses conducted by geotechnical engineer.

2. Departmental Representative will not be responsible for interpretations or conclusions drawn from the report.
3. Departmental Representative has used the information for their own design purposes, and will not be responsible for further interpretations or conclusions drawn from the report.
4. Make additional test borings and conduct other exploratory operations necessary for excavation support and protection.
2. Do not interrupt utilities serving facilities occupied by Departmental Representative or others unless permitted in writing by Departmental Representative and then only after arranging to provide temporary utility services according to requirements indicated.
3. Size, depth and location of existing utilities and structures as indicated are for guidance only. Completeness and accuracy are not guaranteed.
4. Prior to commencing any excavation work, notify Departmental Representative, establish location and state of use of buried utilities including existing communication and security lines and structures. Clearly mark such locations to prevent disturbance during work. Immediate restoration and replacement of any damaged equipment or lines will be imposed at the Contractor's expense.
5. Confirm locations to buried utilities by careful test excavations.
6. When directed, reroute existing lines in area of excavation. Pay costs for such work.
7. Record location of maintained, rerouted and abandoned underground lines.
8. Conduct, with Departmental Representative, condition survey of existing buildings, trees and other plants, lawns, fencing, service poles, wires, rail tracts and paving, survey benchmarks and monuments which may be affected by work.
9. Protect existing buildings and surface features which may be affected by work from damage while work is in progress and repair damage resulting from work.
10. Where the excavation necessitates root or branch cutting, do so only as approved by Departmental Representative.

1.7. WARRANTY

1. The Contractor will be responsible for all reinstatement of surface paving, slabs, etc. due to settlement for 2 years from date of Substantial Performance.

Part 2. Products

2.1. SOIL MATERIALS

1. General:
 1. Provide borrow soil materials when sufficient satisfactory soil materials are not available from excavations.
 2. Coordinate with geotechnical Departmental Representative for types of fill materials required for the Project.
2. SiteExcavated Material:
 1. Site excavated soil, where approved as backfill and fill material, is to be free of debris, organic matter, snow and ice. Do not use frozen soil for fill.

2. Site excavated soil is to include only site material removed by required excavation and grading.
3. Granular Backfill and Fill Material:
 1. Where backfill or fill material is required to be pitrun gravel, crushed gravel, or sand, it is to be a clean natural stone. Do not exceed 2% organic content; gradation is to be within the specified limits.
4. PitRun Gravel A:

<u>Sieve Size (mm)</u>	Percent Passing	
	<u>By Weight</u>	
100	100	
75	60 100	Total Sample
25	60 80	
2.36	25 45	Material Passing
1.18	16 25	75 mm Sieve
0.60	8 18	
0.150	4 10	
0.075	2 6	

5. PitRun Gravel B:

<u>Sieve Size (mm)</u>	Percent Passing	
	<u>By Weight</u>	
80	100	
50	55 100	
25	38 100	
16	32 85	
5	20 65	
0.35	6 30	
0.080	2 15	

6. Crushed Gravel A:

<u>Sieve Size (mm)</u>	Percent Passing
	<u>By Weight</u>
25	100
20	95 100
10	60 80
4.75	40 60
2.36	28 48
0.60	13 29
0.15	6 15
0.075	4 10

7. Crushed Gravel B:

<u>Sieve Size (mm)</u>	Percent Passing
	<u>By Weight</u>
25	100
20	100
12.5	60 92
5	37 62
2	26 44
0.40	12 27
0.16	7 18
0.08	2 8

8. Coarse Gravel:

<u>Sieve Size (mm)</u>	Percent Passing
	<u>By Weight</u>
50	100
40	90 100
20	35 70
10	10 30
4.75	0 5

9. Sand A:

<u>Sieve Size (mm)</u>	Percent Passing
	<u>By Weight</u>
10	100
4.75	95 100
1.18	50 85
0.60	25 60
0.30	10 30
0.15	2 10

10. Sand B:

<u>Sieve Size (mm)</u>	Percent Passing
	<u>By Weight</u>
10	65 100
5.0	50 90
2.0	35 75
0.4	10 45
0.15	0 20
0.080	0 10

Part 3. Execution**3.1. PREPARATION**

1. Protect structures, utilities, sidewalks, pavements, and other facilities from damage caused by settlement, lateral movement, undermining, washout, and other hazards created by earthwork operations.
2. Preparation of sub-grade for earthwork operations including removal of vegetation, topsoil, debris, obstructions, and deleterious materials from ground surface.
3. Protect and maintain erosion and sedimentation controls during earthwork operations.
4. Protect sub-grade from softening, undermining, washout, and damage by rain or water accumulation as follows:
 1. Reroute surface water runoff away from excavated areas
 2. Do not allow water to accumulate in excavations
 3. Do not use excavated trenches as temporary drainage ditches
 4. Maintain until dewatering until it is no longer required

3.2. GENERAL EXCAVATION

1. It is not expected that any unclassified excavated materials will be encountered during excavation operations:
 1. Unclassified excavated materials may include rock, soil materials not reported in geotechnical investigation, and sub-grade obstructions not indicated on drawings or in specifications.
2. Excavate to sub-grade elevations indicated on drawings including foundation elements and building obstructions resulting from demolition of existing building and site features to a tolerance of ± 25 mm (1").
3. Extend excavations a sufficient distance from structures for placing and removing concrete formwork, for installing services and other construction, and for inspections.

4. Support excavations having an angle of repose greater than that allowable for the soil types in accordance with requirements.

3.3. EXCAVATION FOR UTILITY TRENCHES

1. Excavate trenches to indicated gradients, lines, depths, and elevations.
2. Excavate trenches to allow installation of top of pipe below frost line, where they occur beyond building perimeter.
3. Excavate trenches to uniform widths to provide the following clearance on each side of pipe or conduit:
 1. Excavate trench walls vertically from trench bottom to 305 mm (12") higher than top of pipe or conduit
 2. Clearance: 305 mm (12") each side of pipe or conduit.
4. Trench Bottoms:
 1. Excavate and shape trench bottoms to provide uniform bearing and support of pipes and conduit.
 2. Shape sub-grade to provide continuous support for bells, joints, and barrels of pipes and for joints, fittings, and bodies of conduits.
 3. Remove projecting stones and sharp objects along trench sub-grade.
 4. Hand excavate trench bottoms for pipes and conduit, and flat bottomed and multiple duct conduit units < 150 mm (6") Ø nominal, and support pipe and conduit on an undisturbed sub-grade.
 5. Shape bottom of trench to support bottom 90 degrees of pipe circumference for pipes and conduit < 150 mm (6") Ø nominal and fill depressions with tamped sand backfill.

3.4. STRUCTURE EXCAVATION

1. Excavate to elevations and dimensions indicated on Drawings within a tolerance of ± 50 mm, and extending a sufficient distance from footings and foundation walls to permit placing and removal of concrete formwork, installation of services, other required construction, and for inspection.
2. In excavating for footings and foundations, take care not to disturb bottom of excavation. Excavate by hand to final grade just before concrete reinforcement is placed.
3. Protect bottom of excavations and soil around and beneath footings from frost and ingress of water.

3.5. SUB-GRADE INSPECTION

1. Notify Departmental Representative when excavations have reached required sub-grade.
2. Continue excavation and replace with compacted backfill or fill material as directed where geotechnical Departmental Representative determines that unsatisfactory soil is present.

3. Proof roll sub-grade below the building slabs and pavements with heavy pneumatic tired equipment to identify soft pockets and areas of excess yielding using equipment acceptable to the geotechnical Departmental Representative; do not proof roll wet or saturated sub-grade, and as follows:
 1. Proof roll in direction and speed as directed by geotechnical Departmental Representative.
 2. Excavate soft spots, unsatisfactory soils, and areas of excessive pumping or rutting, as determined by geotechnical Departmental Representative, and replace with compacted backfill or fill as directed.
4. Authorized additional excavation and replacement material will be paid for according to Contract provisions for changes in the Work.
5. Reconstruct sub-grade damaged by freezing temperatures, frost, rain, accumulated water, or construction activities, as directed by geotechnical Departmental Representative, without additional compensation.

3.6. UNAUTHORIZED EXCAVATION

1. Fill unauthorized excavation under foundations or wall footings by extending bottom elevation of concrete foundation or footing to excavation bottom, without altering top elevation or other method as directed by the geotechnical Departmental Representative.
2. Fill unauthorized excavations under other construction or utility pipe as directed by geotechnical Departmental Representative.

3.7. STORAGE OF SOIL MATERIALS

1. Stockpile topsoil and other acceptable fill materials in locations as directed by Departmental Representative.

3.8. UTILITY TRENCH BACKFILL

1. Place backfill on sub-grade free of mud, frost, snow, or ice.
2. Place and compact bedding course on trench bottoms and where indicated.
3. Shape bedding course to provide continuous support for bells, joints, and barrels of pipes and for joints, fittings, and bodies of conduits.
4. Backfill trenches excavated under footings and within 450 mm (18") of bottom of footings with satisfactory soil; fill with concrete to elevation of bottom of footings.
5. Provide 100 mm (4") thick, concrete base slab support for piping or conduit less than 762 mm (30") below surface of roadways, followed by complete enclosure of piping or conduit in a minimum of 100 mm (4") of concrete after installation and testing and before backfilling or placing roadway sub-base.
6. Place and compact initial backfill of satisfactory soil, free of particles larger than 25 mm (1") in any dimension, to a height of 305 mm (12") over the utility pipe or conduit, and as follows:
 1. Carefully compact initial backfill under pipe haunches and compact evenly up on both sides and along the full length of utility piping or conduit to avoid damage or displacement of piping or conduit.
 2. Coordinate backfilling with utilities testing.
7. Backfill voids with satisfactory soil while installing and removing shoring and bracing.

8. Place and compact final backfill of satisfactory soil to final sub-grade elevation.

3.9. SOIL MOISTURE CONTROL

1. Uniformly moisten or aerate sub-grade and each subsequent fill or backfill soil layer before compaction to within 2% of optimum moisture content, and as follows:
 1. Do not place backfill or fill soil material on surfaces that are muddy, frozen, or contain frost or ice.
 2. Remove and replace, or scarify and air dry otherwise satisfactory soil material that exceeds optimum moisture content by 2% and is too wet to compact to specified dry unit weight.

3.10. COMPACTION OF SOIL BACKFILLS AND FILLS

1. Place backfill and fill soil materials in layers not more than 203 mm (8") in loose depth for material compacted by heavy compaction equipment, and not more than 100 mm (4") in loose depth for material compacted by hand operated tampers.
2. Place backfill and fill soil materials evenly on all sides of structures to required elevations, and uniformly along the full length of each structure.
3. Compact soil materials to not less than the following percentages of maximum dry unit weight according to ASTM D698:
 1. Under structures, building slabs, steps, and pavements, scarify and recompact top 305 mm (12") of existing subgrade and each layer of backfill or fill soil material at 100%.
 2. Under walkways, scarify and recompact top 150 mm (6") below subgrade and compact each layer of backfill or fill soil material at 100%.
 3. Under lawn or unpaved areas, scarify and recompact top 150 mm (6") below subgrade and compact each layer of backfill or fill soil material at 95%.
 4. For utility trenches, compact each layer of initial and final backfill soil material at 98%.

3.11. GRADING

1. Uniformly grade areas to a smooth surface, free of irregular surface changes. Comply with compaction requirements and grade to cross sections, lines, and elevations indicated, and as follows:
 1. Provide a smooth transition between adjacent existing grades and new grades.
 2. Cut out soft spots, fill low spots, and trim high spots to comply with required surface tolerances.
2. Site Grading: Slope grades to direct water away from buildings and to prevent ponding. Finish subgrade to required elevations within the following tolerances:
 1. Lawn or Unpaved Areas: ± 25 mm (1")
 2. Walks: ± 25 mm (1")
 3. Pavements: ± 13 mm ($\frac{1}{2}$ ")
3. Grading inside Building Lines: Finish subgrade to a tolerance of 13 mm ($\frac{1}{2}$ ") when measured against a 3050 mm (10'0") straightedge.

3.12. DISPOSAL OF SURPLUS AND WASTE MATERIALS

1. Disposal: Remove surplus satisfactory soil and waste material, including unsatisfactory soil, trash, and debris, and legally dispose of it off Departmental Representative's property.

3.13. RESTORATION AND CLEAN UP

1. Upon completion of work, remove surplus materials and debris, trim slopes, and correct defects noted by Departmental Representative.
2. Replace topsoil as indicated.
3. Reinstall pavement, sidewalks, and landscaping to condition and elevation that existed before excavation.
4. Clean and reinstall areas affected by work as directed by Departmental Representative.

END OF SECTION