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**END OF DOCUMENT**

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## **PART 1      GENERAL**

### **1.1      WORK COVERED BY CONTRACT DOCUMENTS**

- .1      The work consists of the installation of a new washroom building and associated infrastructure, as well as general site restoration within the Castle Mountain Campground Area; this includes the entirety of the washroom building construction, related water (plumbing, fixtures, well connection water distribution lines), wastewater (plumbing, fixtures, septic tank, sanitary lines), electrical and communications infrastructure. These works will be required to begin immediately with activities continuing through winter conditions to allow for completion in early 2023. Work of the contract includes, but is not limited to the total performance of the work (labour, materials, and equipment).
- .2      The scope of work includes:
  - .1      Water Network:
    1.      Supply/install new pitless well adapter on existing well, piping to facility and related appurtenances.
    2.      Supply/install new underground water distribution lines from the new washroom building and the boundaries of the project area.
  - .2      Septic System:
    1.      Supply/install of septic tank and piping to the washroom building.
    2.      Supply/install new sanitary force main between the septic tank and the boundary of the project area.
  - .3      Electrical System:
    1.      Install a new Fortis transformer pad and supply/install grounding grid, and conduit connections to new washroom building and limit of the project area.
    2.      Supply/install new conduit and supporting infrastructure from the new washroom building to various areas throughout the project area, including to the septic tank, to the existing kitchen shelter, to the new pitless adapter, to newly supplied/installed wooden posts and to the project boundary.
    3.      Supply/install new electrical service from the new washroom building to the existing kitchen shelter.
  - .4      Washroom Facility:
    1.      Supply and installation of a new washroom building including but not limited to the underground building services/mechanical systems, the building foundation, and all structural, architectural, mechanical, and electrical works, including temporary service connections. Work includes supplying and installing all materials to leave the building in a completed stage unless otherwise noted to be supplied by Parks Canada; materials to be supplied by Parks Canada are to be installed by the Contractor.

.5 Site Restoration

1. Re-grading of the area surrounding the new washroom area to according to the site development plan.
2. Supply/installation of a new retaining wall, concrete stairs, concrete pathway and gravel trails/roadway area within the new washroom area, as well as the installation of two Parks Canada supplied food locker units.
3. Supply/installation of a new wooden fence and gates around the new septic tank.
4. Construction of a new campsite, including the supply/install of all surface covering material and installation of Parks Canada supplied fixtures.
5. Supply/installation of tree/shrub/grass plugs, topsoil placement, seeding and hydro-mulching and fencing of restoration areas.
6. Restoration of all affected roadway and vegetated areas to original condition or better according to contract.
7. Non-native vegetation control and landscape maintenance of all restoration areas.

.6 Other

1. Clearing and grubbing and excavation of proposed septic field area and reuse of material within other project areas.
2. Locate and verify all existing underground utilities and coordinate all trenching to prevent damage to utilities to remain in place as well as to limit service disruptions to allowances noted in contract.
3. All trenching and backfill required to support underground utility installations noted above. Shared trenches are to be used wherever possible to minimize disturbance footprint.
4. Upon completion of work, provide the Departmental Representative with detailed redline drawings and Operating and Maintenance Manual.
5. Commissioning of all systems, operation and maintenance details and training of Parks Canada staff is included in the contract prior to hand over.
6. Provide all snow clearing and surface maintenance required to allow work to safely proceed as required to meet the terms of the contract.

.3 The drawings and the specification sections more completely describe the full scope of work and material requirements.

.4 Construct Work under a Unit Price Contract.

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## **1.2 WORK BY OTHERS**

- .1 Co-operate with other contractors in carrying out their respective works and carry out instructions from Departmental Representative.
- .2 Co-ordinate work with that of other contractors. The Contractor is entirely responsible for coordinating directly with the respective utility providers to complete the items identified in the contract documents as required to be completed by those providers or their assigned contractors.
- .3 Co-ordinate work of Phase 2 (this contract) with the departmental representative to allow for the successful completion of Phase 3 (future) of the project. Any changes made by the Contractor in Phase 2 may have monetary or schedule impacts in Phase 3 that the Phase 2 Contractor may be responsible for.
- .4 Parks Canada will not be responsible for any project delays caused by Fortis. The contractor is responsible to appropriately coordinate with those utility providers to meet the outlined contract schedule.
- .5 If any part of work under this Contract depends for its proper execution or result upon work of another contractor, report promptly to Departmental Representative, in writing, any defects which may interfere with proper execution of Work.
- .6 The contractor is to act as prime contractor for all work to be completed on site in support of this contract scope; this will include those supporting tasks to be completed by Telus, and Fortis or their assigned contractor.

## **1.3 CONTRACTOR USE OF PREMISES**

- .1 Limit use of premises for Work, for storage, and for access, to allow:
  - .1 Departmental Representative occupancy according to Canadian Environmental Assessment Act (CEAA).
  - .2 Departmental Representative usage.
  - .3 Park & campground access by public and government agencies.
  - .4 Ongoing Parks Canada campground operations as necessary.
  - .5 Work by other contractors.
- .2 Co-ordinate use of premises under direction of the Departmental Representative.
- .3 Remove or alter existing work to prevent injury or damage to portions of existing work which remain.
- .4 Repair or replace portions of existing work which have been altered during construction operations to match existing or adjoining work, as directed by the Departmental Representative.
- .5 At completion of operations condition of existing work: to make good any work disturbed during construction to that of its original state.
- .6 Follow all site access restrictions noted under Work Restrictions section of specifications.

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- .7 Limit staging, equipment or material storage, and all other activities outside of project work areas to pavement surfaces only unless otherwise approved in writing by the Departmental Representative.
  - .8 Maintain the site in a safe condition for visitors and wildlife at all times when work is not actively taking place in an area. This includes all necessary security or other measures necessary to prevent access to hazards on site resulting from the work.

#### **1.4 DEPARTMENTAL REPRESENTATIVE OCCUPANCY**

- .1 The Departmental Representative will have access to the premises during entire construction period for execution of normal operations.
- .2 Co-operate with the Departmental Representative in scheduling operations to minimize conflict with the institution and to facilitate the Departmental Representative's usage.
- .3 Co-ordinate Progress Schedule and co-ordinate with the Departmental Representative during construction.
- .4 Maintain fire access/control to the work site at all times.

#### **1.5 ALTERATIONS, ADDITIONS OR REPAIRS**

- .1 Execute work with least possible interference or disturbance to visitor operations, occupants, staff and normal use of premises. Arrange with the Departmental Representative to facilitate execution of work.
- .2 Execute work according to CEAA and National Parks Act.

#### **1.6 EXISTING SERVICES**

- .1 Notify the Departmental Representative and utility companies of intended interruption of services and obtain required permission. The contractor is to provide:
  - Written notice to the Departmental Representative five business days in advance of any service disruptions.
  - Verbal confirmation to the Departmental Representative 24 hours in advance of any service disruption that it is still to go ahead as previously communicated in writing
- .2 Minimize duration of interruptions. Carry out work at times as directed by governing authorities with minimum disturbance to campground operations, occupants, staff and normal use of premises.
- .3 Contractor shall inform Departmental Representative 24 – 48 hours, depending on building, in advance of requiring access to any buildings.
- .4 Contractor is to receive approval from Departmental Representative prior to any shutdowns.
- .5 Where work involves underground services, the Contractor must inform and obtain approval from the Departmental Representative before any excavation may commence.

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- .6 Provide alternative safe routes for personnel and vehicular traffic through construction area.
  - .7 Provide flagging, barricades and traffic controls at all times during work.
  - .8 Maintain continuous pedestrian and vehicle access to the site as noted in the Work Restrictions section of the specifications.
  - .9 Establish location and extent of service lines in area of work before starting Work. Notify the Departmental Representative of findings.
  - .10 Submit schedule to and obtain approval from the Departmental Representative for any shut-down or closure of active service or facility including power services or roadways. Adhere to approved schedule and provide notice to affected parties.
  - .11 Provide adequate bridging over trenches which cross sidewalks or roads to permit normal traffic where required. Normal traffic includes buses and large trailers
  - .12 Where unknown services are encountered, immediately advise the Departmental Representative and confirm findings in writing.
  - .13 Protect, relocate or maintain existing active services. When inactive services are encountered, cap off in manner approved by authorities having jurisdiction.
  - .14 Record locations of maintained, re-routed and abandoned service lines.
  - .15 Construct barriers in accordance with Section 01 56 00 - Temporary Barriers and Enclosures.

## **1.7 DOCUMENTS REQUIRED**

- .1 Maintain at job site, one copy each document as follows:
  - .1 Contract Drawings.
  - .2 Specifications.
  - .3 Addenda.
  - .4 Reviewed Shop Drawings.
  - .5 List of Outstanding Shop Drawings.
  - .6 Change Orders.
  - .7 Other Modifications to Contract.
  - .8 Field Test Reports.
  - .9 Copy of Approved Work Schedule.
  - .10 Health and Safety Plan and Other Safety Related Documents.
  - .11 Minutes of Safety Meetings
  - .12 Performance Bond
  - .13 Other documents as specified.

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## 1.8 WORK SEQUENCE

- .1 Work will be permitted to start once all necessary submittals have been approved by Parks Canada. There is no earliest start date for activities on site.
- .2 Project completion milestones are as follows. The contractor is permitted and encouraged to advance work prior to these milestone dates wherever possible.
  - .1 Work to be completed by November 15, 2022
    - .1 Underground water lines and well connection (pitless adapter),
    - .2 Underground sanitary lines and septic tank installation,
    - .3 New washroom building foundation and building floor slab,
    - .4 All utility trench backfill and rough grading within the new washroom restoration area,
    - .5 Partial restoration, including placement of topsoil in old washroom restoration area and new campsite construction.
  - .2 Work to be completed by February 15, 2023
    - .1 All remaining work on remaining washroom building.
  - .3 Work to be completed by June 15, 2023
    - .1 Retaining wall and concrete stairs,
    - .2 Concrete sidewalks, gravel pathways and driveways,
    - .3 All remaining topsoil placement, tree/shrub/plug plantings, seeding, fencing,
    - .4 All remaining work not otherwise noted with the exception of landscape maintenance.
    - .5 Contractor largely demobilized from site.
  - .4 Work to be completed by September 30, 2023
    - .1 All remaining landscape maintenance

**END OF SECTION**

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## **PART 1        GENERAL**

### **1.1            SITE ACCESS AND EGRESS**

- .1        Construction shall commence immediately upon approval of all pre-mobilization submittals and approval from the Departmental Representative. The area may be closed to public access, but must remain accessible to all Parks Canada staff and delivery vehicles supporting future phases of work throughout the duration of the project.
- .2        The Contractor is responsible for the development and supply of construction access to the Work as approved by the Departmental Representative.
- .3        Access to the site is to be by use of existing gravel and paved roadways only. Equipment is only to be in vegetated areas when immediately working in those specific areas.
- .4        The contractor is required to construct and maintain temporary "access to" and "egress from" work areas and all areas affected by construction activities.

### **1.2            CONTRACTOR BUILDING ACCESS**

- .1        General Note on Contractor Building Access:
  - .1        Contractors entering enclosed buildings, including the new washroom building must at a minimum follow the stricter of the Province of Alberta or Parks Canada's Covid-19 protocols in addition to those outlined in their own Covid-19 safe work protocol; Parks Canada's protocols will be reviewed with the contractor during the start up meeting and are subject to change.

### **1.3            USE OF SITE AND FACILITIES**

- .1        The Work Site specified in the Contract shall only be used for the purposes of the Work.
- .2        The Work Site 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        Execute work with least possible interference or disturbance to normal use of premises. Make arrangements with the Departmental Representative to facilitate work as stated. Maintain area access to Parks Canada staff at all times.
- .5        Office/tool trailer may also be set up within the approved project staging area but must not cause environmental or vegetation issues. See Section 01 35 43 – Environmental Procedures
- .6        Where security is reduced by work provide temporary means to maintain security.

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- .7 The Contractor will provide onsite sanitary facilities for use by Contractor's personnel. Keep facilities clean.
  - .8 Contractor shall provide and secure its own waste bins and shall dispose of domestic waste on a daily basis. Contractor shall not use existing public waste bins inside the campground or day use areas. All construction waste to be placed in Contractor supplied bins on site.
  - .9 Closures: protect work temporarily until permanent enclosures are completed.
  - .10 Pets shall not be brought to or maintained at the construction site. Any damage to the Work Site caused by the Contractor shall be repaired by the Contractor at their expense.
  - .11 The contractor shall coordinate their material deliveries and construction staging so that all construction staging can be accommodated within the designated staging or paved areas. No materials, stockpiles, or equipment is to be stored outside of these areas when not in immediate use.

#### 1.4 WORKING TIMES

- .1 Work in BNP is permitted between the following hours during the 2022 and 2023 seasons:

Month	Start	Finish
January	9:00 am	4:30 pm
February	8:30 am	5:00 pm
March	8:30 am	6:00 pm
April	7:30 am	8:00 pm
May	7:30 am	8:30 pm
June	7:30 am	9:00 pm
July	7:30 am	9:00 pm
August	7:30 am	8:00 pm
September	8:00 am	7:00 pm
October	9:00 am	5:30 pm
November	9:00 am	4:00 pm
December	9:00 am	4:00 pm

- .2 In addition to the above allowable working hours, equipment is not to be operated outside the hours of 9:00 am – 8:00 pm, or the hours shown above, whichever is more restrictive.
- .3 Work outside which does not include motorized equipment may be considered and approved by Parks Canada for outside these hours on a case by case basis. This will only be considered to further minimize service and access disruptions to Parks Canada operations beyond what is otherwise noted as required in the specifications.
- .4 The Contractor will not be permitted to work during the period of any holiday long weekend, unless prior written approval is granted by the Departmental Representative:
  - .1 Statutory and Civic Holidays (2022)
    - .1 Labour Day Weekend: 17:00 Friday, September 2, 2022 to 07:00 Tuesday, September 6, 2022.
    - .2 Truth and Reconciliation Day Weekend: From 17:00 Thursday, September 29, 2022 to 07:00 Saturday, October 1, 2022.

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- .3 Thanksgiving Weekend: 17:00 Friday, October 7, 2022 to 07:00 Tuesday October 11, 2022.
  - .4 Remembrance Day: 17:00 Thursday, November 10, 2022 to 07:00 Saturday, November 12, 2022.
  - .5 Christmas Holiday: 17:00 Friday, December 23, 2022 to 07:00 Tuesday, January 3, 2023.
  - .6 Family Day Weekend: 17:00 Friday, February 7, 2023 to 07:00 Tuesday, February 21, 2023.
  - .7 Easter Weekend: 17:00 Thursday, April 6, 2023 to 07:00 Tuesday, April 11, 2023.
  - .8 Victoria Day Weekend: 12:00 Friday, May 19, 2023 to 07:00 Tuesday, May 23, 2023.
  - .9 Canada Day Weekend: 12:00 Friday, June 30, 2023 to 7:00 Tuesday, July 4, 2023.
  - .10 Civic Holiday Weekend: 12:00 Friday, August 4, 2023 to 07:00 Tuesday, August 8, 2023.
  - .11 Truth and Reconciliation Day Weekend: 17:00 Friday, September 29, 2023 to 07:00 Tuesday, October 3, 2023.
- .5 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 a Variance will be entertained.

## **1.5 MAINTAINING PARKS CANADA SITE ACCESS**

- .1 The entirety of the project area is within Parks Canada's Castle Mountain campground. The campground will not be in operation during construction.
- .2 Parks Canada's operations may access the site during the construction period; the contractor must plan their work accordingly to minimize disruption to Parks Canada's operations and meet the site access requirements noted below.
- .3 Parks Canada Staff Pedestrian Access
  - .1 The contractor must maintain Parks Canada staff access by foot throughout the site at all times throughout the duration of the project.
- .4 Parks Canada Vehicle Access
  - .1 The contractor must maintain access for Parks Canada vehicles on all roadways throughout the site at all times through the duration of the project, including outside of working hours.
  - .2 The contractor shall obtain written approval from the Departmental Representative before Parks Canada vehicle access is disrupted for more than 24 hours.

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- .3 The contractor is not responsible for snow plowing to maintain vehicle access to the site during winter-time during periods when the contractor is not working on the site for extended periods.

## **1.6 EXISTING SERVICES**

- .1 Notify the Departmental Representative and utility companies of intended interruption of services and obtain required permission.
- .2 Where Work involves breaking into or connecting to existing services, give the Departmental Representative five business days written notice for necessary interruption of mechanical or electrical service throughout course of work. Keep duration of interruptions to a minimum.
- .3 Provide for personnel and vehicular traffic as necessary. Provide detours, flagging, barricades and traffic controls before beginning work.
- .4 Construct barriers in accordance with Section 01 56 00 - Temporary Barriers and Enclosures.

## **1.7 SPECIAL REQUIREMENTS**

- .1 Submit schedule in accordance with Section 01 32 18 - Construction Progress Schedules - Bar (GANTT) Chart.
- .2 All contractors involved in the project must maintain in good standing a business licence to operate in Banff National Park through the duration of the project.
- .3 All work supporting the Fortis installations included in the contract documents may only be completed by a Fortis approved contractor.
- .4 Ensure that Contractor personnel employed on site become familiar with and obey regulations including safety, fire, traffic, security regulations, the National Parks Act and Canadian Environmental Assessment Act.
- .5 Keep within limits of work and avenues of ingress and egress.
- .6 Deliver materials during normal working hours unless otherwise approved by the Departmental Representative.
- .7 Trenches adjacent to the roadway must be safe for public transportation and not affect the support or structure of adjacent roadways at any time.
- .8 Trenches must be barricaded and blocked off at the end of each working day and/or whenever not being attended to by the contractor.

**END OF SECTION**

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**PART 1        GENERAL**

**1.1            DESCRIPTION**

- .1        Payments shall be made on the basis of the lump sum prices and the unit prices bid in the Unit Price Schedules in the Tender Form.
- .2        The prices bid for various items of work, unless specifically noted otherwise, shall include the supply of all labour, material, plant and equipment required to construct the work in accordance with the drawings and specifications.
- .3        The method of measurement of the quantities for payment and the basis for payment will be in accordance with the following items of this section. All measurement for the determination of payment will be done by the Departmental Representative. For items which require survey for quantity verification, the Contractor shall submit all supporting survey data in electronic format to the Departmental Representative for review a minimum of five business days prior to claiming those items for payment.
- .4        The prices bid for supply and installation of materials shall be full compensation for supplying, delivering, loading, unloading, handling, storage, breakage, waste, hauling, installing, cleaning, testing and placing in service the work together with all work subsidiary and incidentals thereto for which separate payment is not provided elsewhere. Payment shall be only for materials actually installed unless otherwise approved in writing in advance by Departmental Representative.
- .5        The prices bid for items which include the installation of Parks Canada supplied materials shall include the Contractor loading, handling and delivery of items from Parks Canada's Banff operations compound, as well as repair in case of breakage, cleaning, installation, commissioning, testing, and all other costs associated with including the installation in the completed and functioning building.
- .6        All existing materials on-site whether structures, vegetation, topsoil, gravel, sand or other excavated, or piled materials are the property of Parks Canada. Only those materials specifically noted in the specifications or on the drawings as belonging to the Contractor shall become the Contractor's property.
- .7        Where there are excess excavated materials, unsuitable materials or materials of any kind that are not used in the work, such materials are not the property of the Contractor unless authorized in writing by the Departmental Representative or specified to be disposed of by the Contractor outside of the Park.
- .8        The sum of the payments in the Unit Price Schedules of the Tender Form shall constitute full payment for the complete works as described in these documents. Extra payment will only be made for items adding to the scope of the works, as described in these documents and/or shown on the drawings and as evident from inspection of the site of the works.

## PART 2 NON-PAYMENT ITEMS

### 2.1 DESCRIPTION

- .1 Supply of all equipment, labour, materials, plant, and services required to complete the Work for which no specific payment item has been assigned in the Unit Price Schedules of the Tender Form shall be considered incidental to the Works.
- .2 There shall be no separate payment for incidental work. Payment for incidental work shall be considered to be included in the total tendered price of the Unit Price Schedules of the Tender Form.
- .3 All work shown on the plans and drawings, or referred to in the General Conditions, the Supplementary General Conditions, or the General Specifications shall be considered as part of the complete work unless specifically deleted.
- .4 Contractor's unit pricing is to include all supporting activities under the appropriate bid item. Costs associated with shop drawings, survey, permitting, quality control, and shipping/delivery, redline drawings, and testing and commissioning of each item shall be included as incidental costs in the bid price for the respective item.

### 2.2 MATERIALS TO BE SUPPLIED BY PARKS CANADA

- .1 The following items are to be supplied to the Contractor for the purpose of completing the project work. The contractor must supply all materials and additional quantities required to complete the project which are not allowed for in the table below.

Item	Description	Units	Quantity
Outdoor Fixtures			
1.1	Haul-All Trailhead 10 Compartment Food Locker c/w Leg Kit	Ea.	2
1.2	FortisAlberta Transformer Base Prefabricated Concrete Base	Ea.	1
1.3	FortisAlberta Protective Bollard Prefabricated Concrete with Plastic Protective Bollard Cover	Ea.	4
Washroom Building Plumbing Fixtures			
2.1	Toilets Bowl: Toto # C744EL#01 Tank: Toto # ST743E#01	Ea.	6
2.2	Urinal Urinal: American Standard Washbrook # 6590001EC Flush Controller: Delta Teck #86T505	Ea.	1
2.3	Countertop Mounted Sinks Sink: Franke Kindred #OV-1619-6-3 Faucet: Delta #21C143	Ea.	5
2.4	Accessible Wall Mounted Sink Sink: American Standard Murro # 0954904EC Faucet: Delta #21C143	Ea.	1

2.5	Mop Sink Sink: Stern Williams Mop Sink #SB-303 Faucet: Chicago Faucets #897-CP	Ea.	1
2.6	Outdoor Dishwash Station Sink Sink: Tarrison Stainless Steel Commercial Sink # CDS3-18LR-16 Faucets: Zurn # Z1348-BFP-14 (qty=2)	Ea.	1
<b>Item</b>	<b>Description</b>	<b>Units</b>	<b>Quantity</b>
Washroom Building Electrical Fixtures			
3.1	Hand Dryer Xlerator Hand Dryer	Ea.	4
3.2	Adult Change Table Pressalit R8594572000	Ea.	1
Washroom Building Fixtures - Other			
4.1	Soap Dispenser Uline Bulk Liquid Soap Dispenser	Ea.	4
4.2	Standard Wall Mounted Mirror	Ea.	4
4.3	Accessible Wall Mounted Mirror	Ea.	2
4.4	Wall Mounted Waste Receptacle Frost FST303-3NL	Ea.	2
4.5	Wall Mounted Napkin Waste Receptacle Frost FST # 641	Ea.	6
4.6	Baby Change Table Frost FST # 1124-S	Ea.	1
4.7	Toilet Paper Dispenser Frost FST # 169	Ea.	6
4.8	Grab Bars Angle Bar: GBC-357; 24"x 24" x 1.5", 120 Deg. Straight Bar: GBC-152; 24" bar x 1.5"	Ea.	2

- .2 Within ten days of contract award, the Contractor is to inspect the materials being supplied by Parks Canada to identify any quantity discrepancies or material deficiencies and provide written notification to Parks Canada of any issues. Failure to provide written notification of any discrepancies to Parks Canada within ten days, will be implied confirmation the material quantities according to the table above are accurate and suitable for use by the Contractor.
- .3 Many Parks Canada supplied items listed above are stored at the Parks Canada's Banff compound. The Contractor shall provide pick up service to bring supplies from Parks Canada's Banff compound to the construction site. Parks Canada will provide the necessary equipment to load the materials at the Banff compound.
- .4 Any unused items supplied by Parks Canada shall be returned to Parks Canada upon completion of the work; this is to include delivery to Parks Canada's Banff compound. Unused items do not include items which have been cut, damaged, or otherwise no longer in their original new state.

- .5 The Contractor is responsible for replacing any Parks Canada supplied materials which are damaged by the Contractor or under the Contractor's care at their own cost. Parks Canada will not resupply the contractor with replacement materials.

### **PART 3 MEASUREMENT AND PAYMENT CLAUSES**

#### **3.1 GENERAL WORKS**

.1 Mobilization / Demobilization

Payment for this item shall be compensation in full for costs of mobilization: permits; moving personnel, equipment, fencing, safety measures, and materials to the site; setting up temporary facilities; public notices; storage of materials; environmental measures; all preparation for performing the work; full demobilization of the above; site cleanup; and costs associated with the warranty period.

Payment: Lump sum price bid.

Measurement: 50% of the lump sum will be included in the first progress payment certificate; 50% of the lump sum will be included in the final progress payment certificate. Mobilization/ demobilization will only be paid for once, regardless of the number of times the Contractor mobilizes and demobilizes, due to any condition or circumstance.

.2 All Other Scope Not Otherwise Noted in Bid Table

Payment for this item shall be full compensation for all other items outlined in the contract drawings, and/or specifications, but which are not otherwise noted or presumed by the contractor to be included elsewhere in the bid table. The contractor shall request clarification regarding any scope limitations they feel are unclear prior to submitting their bid.

Payment: Lump sum price bid.

Measurement: Lump sum amount is payable based on the percentage of the total contract value completed, exclusive of this item.

.3 Foundation and Floor Slab (Washroom Building)

Payment for this item shall be compensation in full for all costs associated with the construction of the new washroom building foundation, including but not limited to the supply of all labour, equipment and materials, and construction, testing and commissioning of the foundation per the contract documents. Includes preparation, excavation, foundation components, all mechanical and electrical components beneath floor slab, floor slab, and backfill not otherwise covered in the bid table.

Payment: Lump sum price bid.

Measurement: Lump sum amount is payable based on the percentage of work completed with consideration of material delivered to site.

.4 Structural (Washroom Building)

Payment for this item shall be compensation in full for all costs associated with the construction of the structural components of the new washroom building, including but not limited to the supply of all labour, equipment and materials, and construction, testing and commissioning of the above ground structure of the washroom building per the contract documents. Includes all framing, roof trusses, sheathing, building paper and temporary/permanent bracing not otherwise covered in the bid table.

Payment: Lump sum price bid.

Measurement: Lump sum amount is payable based on the percentage of work completed with consideration of material delivered to site.

.5 Mechanical (Washroom Building)

Payment for this item shall be compensation in full for all costs associated with the construction of the mechanical components of the new washroom building, including but not limited to the supply of all labour, equipment and materials, and construction, testing and commissioning of the mechanical components of the washroom building per the contract documents. Includes the supply and installation of all mechanical items associated with the washroom building, including all services within the new washroom building, not already included in the foundation installation; this also includes the pick up of Parks Canada supplied materials from Parks Canada's Banff compound, and installation on site. Scope includes all mechanical items associated with the washroom building which are not otherwise covered in the bid table.

Payment: Lump sum price bid.

Measurement: Lump sum amount is payable based on the percentage of work completed with consideration of material delivered to site.

.6 Electrical (Washroom Building)

Payment for this item shall be compensation in full for all costs associated with the construction of the electrical components of the new washroom building, including but not limited to the supply of all labour, equipment and materials, and construction, testing and commissioning of the electrical components of the washroom building per the contract documents. Includes the supply and installation of all electrical items associated with the washroom building, including everything from the temporary electrical service connection service to the existing overhead power line on site, to all fixtures inside of and on the outside of the new building; this also includes the pick up of Parks Canada supplied materials from Parks Canada's Banff compound, and installation of those fixtures within the new building. Scope includes all electrical items associated with the washroom building which are not otherwise covered in the bid table.

Payment: Lump sum price bid.

Measurement: Lump sum amount is payable based on the percentage of work completed with consideration of material delivered to site.

.7 Interior Finishings (Washroom Building)

Payment for this item shall be compensation in full for all costs associated with the construction of the interior components of the new washroom building, including but not limited to the supply of all labour, equipment and materials, and construction of the interior finishings of the washroom building per the contract documents. Includes the supply and installation of all items inside of the structural framing and sheathing, including everything from the floor finishing, to ceiling and walls insulation, and all non mechanical or electrical components inside the building to finish the building interior to it's completed state; this also includes the pick up of Parks Canada supplied materials from Parks Canada's Banff compound, and installation of those fixtures within the new building. Scope includes all interior architectural items associated with the washroom building which are not otherwise covered in the bid table.

Payment: Lump sum price bid.

Measurement: Lump sum amount is payable based on the percentage of work completed with consideration of material delivered to site.

.8 Exterior Finishings (Washroom Building)

Payment for this item shall be compensation in full for all costs associated with the construction of the exterior components of the new washroom building, including but not limited to the supply of all labour, equipment and materials, and construction of the exterior finishings of the washroom building per the contract documents. Includes the supply and installation of all items outside of the outside plywood sheathing, including everything from the building paper to the outside of siding and roofing as well as all windows, doors and other building envelope items to finish the building exterior to it's completed state. Scope includes all exterior architectural items associated with the washroom building which are not otherwise covered in the bid table.

Payment: Lump sum price bid.

Measurement: Lump sum amount is payable based on the percentage of work completed with consideration of material delivered to site.

.9 Potable Water Well Pitless Adapter (Potable Water Systems)

Payment for this item shall be compensation in full for all costs associated with the replacement of the pitless adapter on the existing well on site per the contract documents. Includes but is not limited to the supply of all equipment, material and labour to complete the removal of the existing pump and pitless adapter, abandonment of existing services, supply and installation of the new pitless adapter, connection of all new utilities, reinstallation of the existing well pump, all excavation and backfill to facilitate the work,

and testing and commissioning of the well pump/pitless adapter once the washroom building is completed.

Payment: Lump sum price bid.

Measurement: Full lump sum amount to be paid once all work is completed.

.10 50mm HDPE Well Supply Waterline (Potable Water Systems)

Payment for this item shall be compensation in full for all costs associated with the installation of the new deep waterline connecting the new pitless adapter to the new washroom building mechanical room per the contract documents. Includes but is not limited to the supply of all equipment, material and labour to complete the supply and installation of the new waterline, all trenching, bedding material and backfill to facilitate the work, and testing and commissioning of the new waterline once the washroom building floor slab is completed.

Payment: Lump sum price bid.

Measurement: Full lump sum amount to be paid once all work is completed.

.11 Temporary Connections, Testing and Commissioning (Potable Water Systems)

Payment for this item shall be compensation in full for all costs associated with the testing and commissioning of the new washroom building plumbing system and outside water distribution lines in lieu of the washroom building's potable water treatment/supply system being absent from the completed building. Includes but is not limited to the supply and installation of temporary plumbing connections inside the mechanical room of the washroom building, capping and valve installation at end of service lines, supply of potable water from a potable water truck, supply and operation of all temporary testing equipment, completion of a flush and pressure test on all waterlines, cleaning of all debris from fixtures, removal of temporary service connections, and blowing out/winterization of all waterlines once the washroom building construction is completed.

Payment: Lump sum price bid.

Measurement: Full lump sum amount to be paid upon completion of all necessary temporary connections, testing and commissioning, including the removal of temporary connections/services.

.12 Septic Tank

Payment for this item shall be compensation in full for all costs associated with the supply and installation of the septic tank servicing the new washroom building per the contract documents. Includes but is not limited to the supply and installation of the septic tank complete with all unique access ports, sanitary connection to washroom building, tank hatches and fittings, septic tank anchoring and backfill, all septic tank sanitary connections, underground insulation, testing, commissioning and cleaning prior to final handover to Parks Canada.

Payment: Lump sum price bid.

Measurement: 30% to be paid when septic tank arrives on site. Remaining 70% to be paid once installation is completed.

.13 Septic Tank Area Electrical

Payment for this item shall be compensation in full for all costs associated with the supply and installation of the electrical and communication connections between the new washroom building and the septic tank per the contract documents. Includes but is not limited to the supply and installation of all conduit and fittings, bedding material, wooden posts and junction boxes, irrigation boxes, weatherproof receptacle and associated supply cable, pull rope inside all empty conduits, testing and commissioning of installed electrical receptacle and all other work required to allow for future electrical and communication installations to all septic tank ports as per drawings.

Payment: Lump sum price bid.

Measurement: 50% to be billed once all underground installations are completed. Remaining 50% to be billed once all remaining work is completed and the surface restoration in the affect area is completed.

.14 Kitchen Shelter Tie-in and Cable Install

Payment for this item shall be compensation in full for all costs associated with the supply and installation of the new electrical service from the new washroom building to the existing kitchen shelter building per the contract documents. Includes but is not limited to the supply and installation of the necessary junction boxes and cables, coring of kitchen shelter floor slab, and testing and commissioning of installed electrical service into kitchen shelter.

Payment: Lump sum price bid.

Measurement: Full lump sum payable once all work is completed.

.15 Fortis Tranformer Pad

Payment for this item shall be compensation in full for all materials and installation required for the installation of the Fortis approved transformer base for the new Fortis supplied pad-mounted transformer as per the contract and Fortis requirements. This includes but is not limited to coordination with Fortis for inspections and testing, supply and installation all materials not supplied by Parks Canada, including installation of the Fortis approved pre-fabricated concrete transformer base and four protective bollards, and the supply/installation of the gravel base, grounding grid. This also includes all testing and commissioning, and all material, labour and equipment, not included in other items, but necessary to meet the intent of the design. All clean up; and any other incidental work for which payment is not specified elsewhere is included.

Payment: Lump sum price bid.

Measurement: Full lump sum payable once all work is completed.

.16 Grubbing/Topsoil Stripping from 'Proposed Septic Field Area'

Payment for this item shall be compensation in full for all costs associated with clearing and grubbing of the proposed septic field area, up to the existing mature trees and roadway on each side of the designated area. Includes but not limited to the removal and disposal of all tree stumps within the area to outside of the Park, the salvaging and relocating of any shrubs within the area to other areas within the campground, the stripping of sod and moss to be reused in restoration areas on site, the stripping of topsoil up to 200mm deep from the proposed septic field area and immediate transport to and placement of the salvaged topsoil within the Old Washroom Building restoration area, along with placing of the salvaged sod and moss over the placed topsoil within the Old Washroom Building Restoration Area. The completed work shall leave the proposed septic field site in a clean condition to allow for non-organic subsoils to be excavated from the site.

Payment: Lump sum price bid.

Measurement: Full lump sum payable once all work is completed.

.17 Restoration of 'Old Washroom Area'

Payment for this item shall be compensation in full for all costs associated with the vegetation restoration of the Old Washroom Area per the contract documents. Includes but is not limited to the removal of any remaining infrastructure from the restoration area, de-compacting the existing soil to 300mm deep and regrading of the restoration area, supply and installation of all erosion control measures, page wire fencing, trees, tree watering bags, planting soils, shrubs, grass plugs, seeding and hydro-mulch.

Payment: Lump sum price bid.

Measurement: Full lump sum payable once all work is completed.

.18 Construction of New Campsite Area

Payment for this item shall be compensation in full for all costs associated with the construction of a new campsite directly adjacent to the Old Washroom Building Restoration Area per the contract documents. Includes but is not limited to the removal and relocation of the existing waste bins, stripping and relocation of existing topsoil, regrading of site, supply and installation of new gravel surface, installation of Parks Canada supplied picnic table and fire pit, and restoration of affected adjacent vegetated areas with salvaged topsoil, seeding and hydro-mulching.

Payment: Lump sum price bid.

Measurement: Full lump sum payable once all work is completed.

.19 Restoration of New Washroom Area

Payment for this item shall be compensation in full for all costs associated with the surface restoration of the New Washroom Area per the contract documents. Includes but is not limited to the rough grading of the area per Departmental Representative's direction, all subgrade preparation, supply and installation of landscaping boulders, concrete sidewalk, gravel pathways and driveways, septic tank area gravel surface, food locker concrete base, page wire fencing, planting soil, trees, tree watering bags, shrubs, grass seeding, and hydro-mulch after seeding. Also to include the placement of 100mm of topsoil over all non gravel or concrete areas from a nearby topsoil stockpile.

Payment: Lump sum price bid.

Measurement: Full lump sum payable once all work is completed.

.20 Septic Tank Area Fencing

Payment for this item shall be compensation in full for all costs associated with the protective wood fence around the septic tank area per the contract documents. Includes but is not limited to the supply and installation of wooden posts with concrete bases, all fencing, vehicle and pedestrian gates with supporting hardware, initial fencing staining and re-staining one year after initial completion.

Payment: Lump sum price bid.

Measurement: Lump sum amount payable based on percentage of work completed.

.21 Washroom Area Stone Retaining Wall

Payment for this item shall be compensation in full for all costs associated with the construction of the stone retaining wall, concrete stairs, and top fencing per the contract documents. Includes but is not limited to the supply and installation of all boulders, drainage, fabric and aggregate backfill material, concrete stairs, and wooden fencing.

Payment: Lump sum price bid.

Measurement: Lump sum amount payable based on percentage of work completed.

.22 Landscape Maintenance

Payment for this item shall be compensation in full for all costs associated with the two-year landscape maintenance period on the affected areas of the site area per the contract documents. Includes but is not limited to non-native vegetation control, watering twice weekly between June 15 – September 15, replacement of dead plant materials, reseeding as required, ongoing erosion control, maintenance of page wire fencing, and all other items required to restore all affected areas of the site to their original or design condition, or better at the end of the landscape maintenance period. Also includes the removal of erosion control at the end of the maintenance period.

Payment: Lump sum price bid.

Measurement: 50% payable after year 1 of landscape maintenance; 50% payable after year 2 of landscape maintenance. Landscape maintenance records to be submitted to Departmental Representative prior to payment being made.

.23 50mm HDPE Water Distribution System Waterline (min. 1.1m deep)

Payment for this item shall be compensation in full for the supply and installation of the underground potable water distribution lines per the contract documents. This includes but is not limited to supplying all labour, equipment and material to complete the necessary trenching, pipe installation, tracer wire, bedding, and backfill. Work under this item begins at the washroom building foundation wall and ends at the location where the waterpipe end exits the ground to the surface for termination. All clean up; and any other incidental work for which payment is not specified elsewhere is included.

Payment: Unit rate bid price per horizontal linear meter of water pipe installed.

Measurement: Survey of the completed sanitary pipe installation.

.24 50mm HDPE Sanitary Forcemain

Payment for this item shall be compensation in full for the supply and installation of the underground sanitary forcemain lines per the contract documents. This includes but is not limited to supplying all labour, equipment and material to complete the necessary trenching, pipe installation, tracer wire, bedding, and backfill. Work under this item begins at the septic tank connection point and ends at the location where the forcemain pipe exits the ground to the surface for termination. All clean up; and any other incidental work for which payment is not specified elsewhere is included.

Payment: Unit rate bid price per horizontal linear meter of sanitary forcemain pipe installed.

Measurement: Survey of the completed sanitary pipe installation.

.25 Effluent Sampling Standpipe

Payment for this item shall be compensation in full for the supply and installation of the effluent sampling standpipe per the contract documents. This includes but is not limited to supplying all labour, equipment and material to complete the necessary trenching, pipe installation, tracer wire, bedding, and backfill. Work under this item includes the tree on the forcemain, all 'downstream' piping to the standpipe, the shut off curb stop, and the entirety of the standpipe. All clean up; and any other incidental work for which payment is not specified elsewhere is included.

Payment: Unit rate bid price per completed effluent sampling standpipe assembly installation.

Measurement: Each installed.

.26 103mm Conduit (Electrical and Communication System Conduits)

Payment for this item shall be compensation in full for the supply and installation of the underground 103mm electrical and communication conduits per the contract documents and Fortis requirements (where applicable). This includes but is not limited to supplying all labour, equipment and material to complete the necessary trenching, conduit installation, warning tape installation, bedding, and backfill; also includes wooden posts and junction boxes where indicated on drawings for conduit terminations on site. Work under this item begins at the washroom building foundation wall and ends at the conduit termination locations inside junction boxes, on kitchen shelter, on wooden post, in Fortis transformer base, underground in capped stubs, etc. Also includes all Fortis coordination and inspections. Excludes conduit installations beneath washroom building and inside septic tank fenced area. All clean up; and any other incidental work for which payment is not specified elsewhere is included.

Payment: Unit rate bid price per horizontal linear meter of 103mm conduit installed.

Measurement: Survey of the completed conduit installations.

.27 52mm Conduit (Electrical and Communication System Conduits)

Payment for this item shall be compensation in full for the supply and installation of the underground 52mm electrical and communication conduits per the contract documents and Fortis requirements (where applicable). This includes but is not limited to supplying all labour, equipment and material to complete the necessary trenching, conduit installation, warning tape installation, bedding, and backfill; also includes wooden posts and junction boxes where indicated on drawings for conduit terminations on site. Work under this item begins at the washroom building foundation wall and ends at the conduit termination locations inside junction boxes, on kitchen shelter, on wooden post, in Fortis transformer base, underground in capped stubs, etc. Also includes all Fortis coordination and inspections. Excludes conduit installations beneath washroom building and inside septic tank fenced area. All clean up; and any other incidental work for which payment is not specified elsewhere is included.

Payment: Unit rate bid price per horizontal linear meter of 52mm conduit installed.

Measurement: Survey of the completed conduit installations.

.28 U/G Junction Box – 600mm (w) x 900mm (l) x 600mm (d)

Payment for this item shall be compensation in full for the supply and installation of the secondary electrical underground pull box per the contract documents. This includes but is not limited to supplying all labour, equipment and material to complete the necessary excavation, conduit connections, bedding, and backfill; also includes the necessary grading and placement to allow for surrounding concrete pathway to be finished flush

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with lid of junction box. All clean up; and any other incidental work for which payment is not specified elsewhere is included.

Payment: Unit rate bid price per completed effluent sampling standpipe assembly installation.

Measurement: Each installed.

.29 Excavate/Relocate Soil from 'Proposed Septic Field Area' to 'New Washroom Restoration Area' for Grading

Payment: Unit rate bid price per cubic meter of material excavated/moved/placed.

Measurement: Measurement to be of undisturbed in-situ material within the proposed septic field area. Contractor is to submit survey data to the Departmental Representative of the proposed septic field area surface following the clearing/grubbing of vegetation and topsoil within the proposed septic field area, and then resurvey/submit survey data to the Departmental Representative upon completion of excavation and final grading of the proposed septic field area. Payment is to be based on the volume of material removed from the proposed septic field area, comparing the initial and final surface survey data.

**END OF SECTION**

**PART 1        GENERAL**

**1.1            PRECONSTRUCTION MEETING**

- .1      Preconstruction start up meeting will be arranged by the Departmental Representative after the Contract is awarded.
- .2      As described in Section 01 35 43 – Environmental Procedures, an environmental briefing for all staff will take place before beginning work at the site.

**1.2            PROGRESS MEETINGS**

- .1      The Contractor will not be required to provide a site trailer for progress meetings on-site. Due to Covid-19, progress meetings will be held by teleconference (via online platforms or phone) whenever possible to minimize physical interaction. Arrangements will be made for onsite meetings if necessary to discuss on site issues.
- .2      Progress meetings will be held on a weekly basis or as assigned by the Departmental Representative until all works are completed. Meeting frequency will be determined by the work in progress.
- .3      Contractor, major Subcontractors involved in Work and the Departmental Representative are to be in attendance. Representatives of the Contractor, Subcontractor and suppliers attending meetings will be qualified and authorized to act on behalf of party each represents.
- .4      The Departmental Representative will give to all parties advance notice of meeting dates, times and locations.
- .5      Minutes will be taken by the Consultant and draft copies will be distributed to attendees for review within three (3) working days after each meeting. Meeting minutes will be finalized and accepted at the start of the next meeting.
- .6      The agenda will include among other things, approval of the previous meeting's minutes, general construction, payment, scheduling, risk, quality, environmental, and safety management items as well as any other reasonably requested by the parties.
- .7      In each progress meeting, the Contractor shall discuss in detail an accurate schedule for work planned to take place in the next week and/or up until the following scheduled progress meeting. This includes but is not limited to general site access, service disruptions, planned work areas, and changing safety concerns.
- .8      In each progress meeting, the Contractor shall raise any foreseeable construction milestones anticipated to be completed prior to the next construction meeting which will require inspection or coordination with the Consultant or Departmental Representative.
- .9      The Contractor shall keep one complete set of contract documents and drawings at the site at all times. Ensure that the documents and the drawings are the current "issued for construction" set.

- .10 In each progress meeting, the Contractor shall notify the Departmental Representative of any recent unforeseeable or upcoming foreseeable issues which will impact scope, cost or schedule, requiring a Change Order or Contemplated Change Notice.

**END OF SECTION**

## **PART 1 GENERAL**

### **1.1 DEFINITIONS**

- .1 Activity: element of Work performed during course of Project. Activity normally has expected duration and expected cost and expected resource requirements. Activities can be subdivided into tasks.
- .2 Bar Chart (GANTT Chart): graphic display of schedule related information. In typical bar chart, activities or other Project elements are listed down left side of chart, dates are shown across top, and activity durations are shown as date-placed horizontal bars. Generally, Bar Chart should be derived from commercially available computerized project management system.
- .3 Baseline: original approved plan (for project, work package, or activity), plus or minus approved scope changes.
- .4 Construction Work Week: 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 activity or other project element. Usually expressed as workdays or workweeks.
- .6 Master Plan: summary-level schedule that identifies major activities and key milestones.
- .7 Milestone: significant event in project, usually completion of major deliverable.
- .8 Project Schedule: planned dates for performing activities and the planned dates for meeting milestones. Dynamic, detailed record of tasks or activities that must be accomplished to satisfy Project objectives. Monitoring and control process involves using Project Schedule in executing and controlling activities and is used as basis for decision making throughout project life cycle.
- .9 Project Planning, Monitoring and Control System: overall system operated by Departmental Representative to enable monitoring of project work in relation to established milestones.

### **1.2 REQUIREMENTS**

- .1 Ensure Master Plan and Detail Schedules are practical and remain within specified Contract duration.
- .2 Plan to complete Work in accordance with prescribed milestones and time frame.
- .3 Limit activity durations to maximum of approximately 10 working days, to allow for progress reporting.
- .4 Ensure that it is understood that Award of Contract or time of beginning, rate of progress, Interim Certificate and Final Certificate as defined times of completion are of essence of this contract.

- .5 Ensure schedule is of sufficient detail regarding site access disruptions, utility service disruptions and building access requirements to allow Parks Canada to modify operations as required to accommodate the ongoing works.
- .6 Schedule updates must show any past or foreseeable future project delays as separate events and show the impact of those delays on dependent tasks. The responsibility for any delays included on the schedule must be agreed upon by the Contractor and the Departmental Representative and documented in writing.
- .7 Prior to mobilization, the Contractor shall submit a draft project schedule for review by the Departmental Representative. The Departmental Representative may provide comments which must be addressed on a resubmitted project schedule prior to mobilization.
- .8 Throughout construction, the contractor shall incorporate the Departmental Representative's comments or requests for schedule formatting changes to ensure the schedule provides sufficient detail for the project progress to be tracked.

### **1.3 SUBMITTALS**

- .1 Provide submittals in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Submit to the Departmental Representative within five (5) working days of Award of Contract Bar (GANTT) Chart schedule that details monitoring and reporting of project progress.

### **1.4 PROJECT SCHEDULE**

- .1 Develop detailed Project Schedule derived from Master Plan.
- .2 Ensure detailed Project Schedule includes as minimum milestone and activity types as follows:
  - .1 General
    - .1 Award.
    - .2 Submittals review and implementation
    - .3 Shop Drawings.
    - .4 Permits.
    - .5 Survey.
    - .6 Mobilization.
    - .7 Environmental Protection Plan (EPP), review and implementation
    - .8 Health and Safety Plan, review and implementation
    - .9 Quality Management Plan
    - .10 Building Construction and installation of associated infrastructure
    - .11 Demobilisation
    - .12 Post-Construction submittals

**1.5 PROJECT SCHEDULE REPORTING**

- .1 Update Project Schedule on a monthly basis reflecting activity changes and completions, as well as activities in progress.
- .2 Include as part of Project Schedule, narrative report identifying Work status to date, comparing current progress to baseline, presenting current forecasts, defining problem areas, anticipated delays, and impact with possible mitigation.

**1.6 PROJECT MEETINGS**

- .1 Discuss Project Schedule at regular site meetings, identify activities that are behind schedule and provide measures to regain slippage. Activities considered behind schedule are those with projected start or completion dates later than current approved dates shown on baseline schedule. Progress payments may be withheld if Contractor does not provide an acceptable schedule upon request of the Department Representative.
- .2 Do not start work until the schedule has been reviewed and approved by Departmental Representative.

**END OF SECTION**

**PART 1        GENERAL**

**1.1            ADMINISTRATIVE**

- .1        Submit to the Departmental Representative submittals listed for review. Submit promptly and in orderly sequence to not cause delay in Work. Failure to submit in ample time is not considered sufficient reason for extension of Contract Time and no claim for extension by reason of such default will be allowed.
- .2        The Contractor shall provide all premobilization submittals to the Departmental Representative no later than ten (10) business days following contract award, and no less than five (5) business days prior to intended mobilization to site.
- .3        The Contractor must provide all submittals at-least five (5) business days prior to any work that will involve the use of the information or material indicated in the submittal
- .4        Do not proceed with Work affected by submittal until review by the Departmental Representative is complete.
- .5        Present shop drawings, product data, and samples in SI Metric units.
- .6        Where items or information is not produced in SI Metric units converted values are acceptable.
- .7        Review submittals prior to submission to the Departmental Representative. This review represents that necessary requirements have been determined and verified, or will be, and that each submittal has been checked and co-ordinated with requirements of Work and Contract Documents. Submittals not stamped, signed, dated and identified as to specific project will be returned without being examined and considered rejected.
- .8        Notify the Departmental Representative, in writing at time of submission, identifying deviations from requirements of Contract Documents stating reasons for deviations, and any cost changes.
- .9        Verify field measurements and affected adjacent works are co-ordinated.
- .10       Contractor's responsibility for errors and omissions in submission is not relieved by Departmental Representative's review of submittals.
- .11       Contractor's responsibility for deviations in submission from requirements of Contract Documents is not relieved by Departmental Representative's review.
- .12       Keep one reviewed copy of each submission on site.
- .13       Electronic submittals in PDF format only.

## **1.2 SHOP DRAWINGS AND PRODUCT DATA**

- .1 The term "shop drawings" means drawings, diagrams, illustrations, schedules, performance charts, brochures and other data which are to be provided by the Contractor to illustrate details of a portion of Work.
- .2 Submit shop drawings bearing stamp and signature of the Contractor's Engineer registered or licensed in the Province of Alberta, Canada, or the suppliers' certified stamp.
- .3 Submittals pertaining to structural steel, structural timber, prefabricated or post tensioned structures shall be accompanied by an affidavit (seal on drawings or written statement) of a qualified Professional Engineer registered in the Province of Alberta, certifying their acceptance/approval of indicated design/details. Additionally, the submittals of any other discipline, which by reason of the various codes of practice, shall be accompanied by a similar affidavit. Indicate materials, methods of construction and attachment or anchorage, erection diagrams, connections, explanatory notes and other information necessary for completion of Work. Where articles or equipment attach or connect to other articles or equipment, indicate that such items have been co-ordinated, regardless of Section under which adjacent items will be supplied and installed. Indicate cross references to design drawings and specifications.
- .4 Allow five (5) business days Departmental Representative's review of each submission.
- .5 Adjustments made on shop drawings by the Departmental Representative do not change the Contract Price. If adjustments affect value of Work, state such in writing to the Departmental Representative prior to submittal and proceeding with Work.
- .6 For additional work not included in the original contract, Contractor shall not proceed with work unless the Departmental Representative issues a change order.
- .7 Do not proceed with work without an approved Change Order (CO).
- .8 Make changes in shop drawings as the Departmental Representative may require, consistent with Contract Documents. When resubmitting, notify the Departmental Representative in writing of revisions other than those requested.
- .9 Accompany submissions with transmittal letter, in duplicate, containing:
  - .1 Date.
  - .2 Project title and number.
  - .3 Contractor's name and address.
  - .4 Identification and quantity of each shop drawing, product data and sample.
  - .5 Other pertinent data.
- .10 Submissions include:
  - .1 Date and revision dates.
  - .2 Project title and number.
  - .3 Name and address of:
    - .1 Subcontractor.

- .2 Supplier
  - .3 Manufacturer.
- .4 Contractor's stamp, signed by Contractor's authorized representative certifying approval of submissions, verification of field measurements and compliance with Contract Documents.
- .5 Details of appropriate portions of Work as applicable:
  - .1 Fabrication.
  - .2 Layout, showing dimensions, including identified field dimensions, and clearances.
  - .3 Setting or erection details.
  - .4 Capacities.
  - .5 Performance characteristics.
  - .6 Standards.
  - .7 Operating weight.
  - .8 Wiring diagrams.
  - .9 Single line and schematic diagrams.
  - .10 Relationship to adjacent work.
- .11 After Departmental Representative's review, distribute copies of approved drawings.
- .12 Submit electronic copy of shop drawings for each requirement requested in specification Sections and as the Departmental Representative may reasonably request.
- .13 Submit electronic copies of product data sheets or brochures for requirements requested in specification Sections and as requested by the Departmental Representative where shop drawings will not be prepared due to standardized manufacture of product.
- .14 Submit electronic copies of test reports for requirements requested in specification Sections and as requested by the Departmental Representative.
  - .1 Report signed by authorized official of testing laboratory that material, product or system identical to material, product or system to be provided has been tested in accord with specified requirements.
  - .2 Testing must have been completed within three (3) years of date of contract award for project.
- .15 Submit electronic copies of certificates for requirements requested in specification Sections and as requested by the Departmental Representative.
  - .1 Statements printed on manufacturer's letterhead and signed by responsible officials of manufacturer of product, system or material attesting that product, system or material meets specification requirements.
  - .2 Certificates must be dated after award of project contract complete with project name.
- .16 Submit electronic copies of manufacturers instructions for requirements requested in specification Sections and as requested by the Departmental Representative.

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- .1 Pre-printed material describing installation of product, system or material, including special notices and Material Safety Data Sheets concerning impedances, hazards and safety precautions.
  - .17 Submit electronic copies of Manufacturer's Field Reports for requirements requested in specification Sections and as requested by the Departmental Representative. Documentation of the testing and verification actions taken by manufacturer's representative to confirm compliance with manufacturer's standards or instructions.
  - .18 Submit electronic copies in PDF format of Operation and Maintenance Data for requirements requested in specification Sections and as requested by the Departmental Representative.
  - .19 Delete information not applicable to project.
  - .20 Supplement standard information to provide details applicable to project.
  - .21 For products which contain options of make and model, clearly identify on the product specification sheets submitted the proposed make and model of the product being proposed for use.
  - .22 Coordinate with the Departmental Representative to set up a numbering system to facilitate the numbering of all shop drawing submittals to allow for tracking. Shop drawings which are not numbered may not be reviewed until a number has been assigned to it.
  - .23 If upon review by the 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.

### **1.3 SAMPLES**

- .1 Submit for review samples in duplicate as requested in respective specification Sections. Label samples with origin and intended use.
- .2 Deliver samples prepaid to the Departmental Representative.
- .3 Notify the Departmental Representative in writing, at time of submission of deviations in samples from requirements of Contract Documents.
- .4 Where colour, pattern or texture is criterion, submit full range of samples.
- .5 Adjustments made on samples by the Departmental Representative do not change the Contract Price. If adjustments affect value of Work, state such in writing to the Departmental Representative prior to submittal and proceeding with Work.
- .6 Make changes in samples which the Departmental Representative may require, consistent with Contract Documents.
- .7 Reviewed and accepted samples will become standard of workmanship and material against which installed Work will be verified.

#### **1.4 PHOTOGRAPHIC DOCUMENTATION**

- .1 Submit electronic copy of digital photography in .jpg format, monthly with progress statement.
- .2 Project identification: name and number of project and date photograph taken indicated.
- .3 All photographs shall be stamped with the date and time.
- .4 Photos should be taken of:
  - .1 All exposed existing utilities which are to remain in place.
  - .2 All underground conduit, pipe, tank and other infrastructure installations once infrastructure is placed or constructed but prior to placement of above bedding or backfill material.
  - .3 All components of buildings, structural pathways or walls, and other installations which will be covered up and inaccessible for inspection once covered; sufficient photographs shall be taken to confirm the Contractor's work has met the requirements of the contract.
  - .4 Both close up to show all details and from further away to show placement with respect to surrounding infrastructure.
- .5 Frequency of photographic documentation: weekly.
  - .1 Prior to commencement of Work
  - .2 Before concealment of Work
  - .3 Upon completion of items in bid and acceptance form.
- .6 Submit USB or portable hard drive with all electronic pictures as part of closeout package

#### **1.5 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 Certificates and Transcripts
  - .1 Immediately after award of Contract, submit Workers' Compensation Board status.
  - .2 Submit transcript of insurance five (5) days after award of Contract.
- .3 Pre-Mobilization Submittals
  - .1 The contractor shall not begin any 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 five (5) business days prior to mobilization to the project site:
    - .1 Construction Schedule
    - .2 Temporary Services and Construction Staging Plan
    - .3 Site specific Environmental Protection Plan

- .4 Traffic Control and Site Access Plan
  - .5 Site Specific Health and Safety Plan
  - .6 On Site Emergency Response Plan
  - .7 Quality Management Plan
  - .8 Subcontractor List, including proof of Fortis approval
  - .9 Proof of Third Party Permits
- .3 Construction Phase Submittals
  - .1 Weekly Progress Reports that outline the Work completed to date as well as the anticipated Work to be performed for the following week on a day to day basis. At a minimum, these are to include:
    - .1 Summary of work completed.
    - .2 Upcoming site access disruptions for Parks Canada staff.
    - .3 Upcoming utility service disruptions.
    - .4 Upcoming contractor access requirements to inside of buildings.
    - .5 Upcoming work areas.
  - .2 Shop Drawings for all applicable contract items are to be submitted to the Departmental Representative for review. Shop Drawings are to be submitted within ten (10) days of contract award. The Departmental Representative shall have five (5) business days to review shop drawings. At minimum, the following shop drawings are required:
    - .1 All relevant structural, architectural, mechanical, electrical and process Washroom Building shop drawings
    - .2 Underground utility shop drawings as referenced in the utility specifications.
    - .3 Septic tank shop drawings
    - .4 Mechanical Room shop drawings
    - .5 HVAC and ventilation shop drawings
    - .6 Water Treatment Facility Room shop drawings
    - .7 Electrical shop drawings for electrical work, including single line diagrams
    - .8 Sieve analysis for granular base course and bedding material
    - .9 Manufacturers product data, specifications, and certifications for products required to complete the Work.
    - .10 Soil and weed seed analysis for any soils to be imported into the Park.
    - .11 Seed analysis and certifications.
    - .12 Nursery plant material supplier information.
    - .13 All other required shop drawings to complete the work.

- .3 Quality Inspection Reports – The Contractor shall maintain daily inspection reports that itemize the results of all Quality Control Inspections conducted by the Contractor. The reports shall be made available for review by the Departmental Representative upon request. A summary of all Quality Control inspections conducted to date shall be submitted by the Contractor with each payment request.
  - .4 All testing reports
  - .5 Adjustments made on shop drawings by the Departmental Representative do not change the Contract Price. If adjustments affect value of Work, state such in writing to the Departmental Representative prior to submittal and proceeding with Work.
  - .6 For additional work not included in the original contract, Contractor shall not proceed with work unless the Departmental Representative issues a change order.
  - .7 Do not proceed with work without an approved Change Order (CO).
  - .8 Within two weeks of contract milestone dates passing, the Contractor shall submit all relevant redline drawings for the work required to be completed by the contract milestone date. (ie. foundation, underground utility and septic tank shop drawings to be submitted by November 29, 2022)
- .4 Project Completion Submittals
- .1 The contractor shall provide to the Departmental representative with the following close out items within 30 days of substantial completion. In case of staging not allow all submittals to be provided within 30 days, the Departmental Representative may at their sole discretion provide the contractor with a written extension for all or some of the submittals. Required closeout submittals include but may not be limited to:
    - .1 Redline drawings of all Work completed
    - .2 Quality Assurance/Quality Control Records
    - .3 USB with all construction photos
    - .4 Operating and Maintenance manual
    - .5 Warranty Management Plan

**END OF SECTION**

**PART 1        GENERAL**

**1.1            RELATED SECTIONS**

- .1        Section 01 33 00 - Submittal Procedures
- .2        Section 01 41 00 - Regulatory Requirements

**1.2            REFERENCES**

- .1        Canada Labour Code, Part 2, Canada Occupational Safety and Health Regulations
- .2        Health Canada/Workplace Hazardous Materials Information System (WHMIS)
  - .1        Material Safety Data Sheets (MSDS).
- .3        Province of Alberta
  - .1        Occupational Health and Safety Act, R.S.A. 2000.

**1.3            SUBMITTALS**

- .1        Make submittals in accordance with Section 01 33 00 - Submittal Procedures.
- .2        Submit site-specific Health and Safety Plan: Within five (5) business days after date of Notice of Award and prior to commencement of Work. Health and Safety Plan must include:
  - .1        Results of site specific safety hazard assessment.
  - .2        Special project protocols and mitigation to address Covid-19 health and safety concerns.
- .3        Submit electronic copy of Contractor's authorized representative's work site health and safety inspection reports to the Departmental Representative.
- .4        Submit copies of reports or directions issued by Federal, Provincial and Territorial health and safety inspectors.
- .5        Submit copies of incident and accident reports.
- .6        Submit WHMIS MSDS - Material Safety Data Sheets.
- .7        Departmental Representative will review Contractor's site-specific Health and Safety Plan and provide comments to Contractor within five (5) days after receipt of plan. Revise plan as appropriate and resubmit plan to the Departmental Representative.
- .8        Departmental Representative's review of Contractor's final Health and Safety plan should not be construed as approval and does not reduce the Contractor's overall responsibility for construction Health and Safety.
- .9        On-site Contingency and Emergency Response Plan: address standard operating procedures to be implemented during emergency situations.

#### **1.4 FILING OF NOTICE**

- .1 File Notice of Project with Provincial authorities prior to beginning of Work. Provide copies of documents to 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 the 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.

#### **1.7 REGULATORY REQUIREMENTS**

- .1 Do Work in accordance with Section 01 41 00 - Regulatory Requirements and National Parks Act.

#### **1.8 GENERAL REQUIREMENTS**

- .1 Submit 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 Include in Health and Safety Plan detailed Covid-19 mitigations that meet or exceed the more stringent of current Province of Alberta guidelines and Parks Canada policy. This may require regular updates to accommodate changing guidelines and policies to address changing Covid-19 conditions.
- .3 The Departmental Representative may respond in writing, where deficiencies or concerns are noted and may request re-submission with correction of deficiencies or concerns.

#### **1.9 RESPONSIBILITY**

- .1 The Contractor shall act as the Prime Contractor in all matters relating to Occupational Health and Safety for all aspects of the project.
- .2 The contractor shall be responsible for health and safety of all persons and contractors 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.

**1.10 COMPLIANCE REQUIREMENTS**

- .1 Comply with Occupational Health and Safety Act, General Safety Regulation, Alberta Reg.
- .2 Comply with Occupational Health and Safety Regulations.
- .3 Comply with Occupational Health and Safety Act, General Safety Regulations, O.I.C.
- .4 Comply with Canada Labour Code, Canada Occupational Safety and Health Regulations.

**1.11 UNFORSEEN HAZARDS**

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

**1.12 HEALTH AND SAFETY CO-ORDINATOR**

- .1 Employ and assign to Work, competent and authorized representative as Health and Safety Co-ordinator. Health and Safety Co-ordinator must:
  - .1 Have minimum 2 years site-related working experience specific to activities associated with general 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 Coordinate with Departmental Representative to arrange for a Parks Canada environmental officer to provide an environmental and wildlife briefing to Contractor's employees.
  - .6 Have valid First Aid Certification.

**1.13 POSTING OF DOCUMENTS**

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

**1.14 CORRECTION OF NON-COMPLIANCE**

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

**1.15 WORK STOPPAGE**

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

**END OF SECTION**

## **PART 1 GENERAL**

### **1.1 DEFINITIONS**

- .1 Environmental Pollution and Damage: presence of chemical, physical, biological elements or agents which adversely affect human health and welfare; unfavorably alter ecological balances of importance to human life; affect other species of importance to humankind; or degrade environment aesthetically, culturally and/or historically.
- .2 Environmental Protection: prevention/control of pollution and habitat or environment disruption during construction. Control of environmental pollution and damage requires consideration of land, water, and air; biological and cultural resources; and includes management of visual aesthetics; noise; solid, chemical, gaseous, and liquid waste; radiant energy and radioactive material as well as other pollutants. All work as per Environmental Assessment Report, to be included as Appendix "A".
- .3 National Parks Act: Federal law that regulates protection of natural areas of national significance.
- .4 Canada Environmental Assessment Act (CEAA). The CEAA is a federal statute that requires federal departments to conduct environmental assessments for prescribed projects and activities before providing federal approval or financial support.
- .5 Parks Canada Environmental Surveillance Officer (ESO) Briefing: ESOs communicate information such as the environmental, wildlife and cultural concerns for the site.

### **1.2 SUBMITTALS**

- .1 Submittals: in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Prior to commencing construction activities or delivery of materials to site, submit Environmental Protection Plan for review and approval by the Departmental Representative. The Environmental Protection Plan (EPP) is to present a comprehensive overview of known or potential environmental issues which must be addressed during construction. Work shall not be permitted to start until the EPP has been approved by the Departmental Representative.
- .3 Address topics at level of detail commensurate with environmental issue and required construction tasks.
- .4 The EPP shall include:
  - .1 All information required to communicate how the contractor intends to implement all environmental mitigations outlined in the contract documents.
  - .2 Project setting and pertinent site specific information and/or conditions.
  - .3 Names of persons responsible for ensuring adherence to Environmental Protection Plan.
  - .4 Names and qualifications of persons responsible for manifesting hazardous waste to be removed from site.

- .5 Erosion and Sediment Control Plan - identifying type and location of erosion and sediment controls to be provided including monitoring and reporting requirements to assure that control measures are in compliance with erosion and sediment control plan, Federal, Provincial, and Municipal laws and regulations.
- .6 Work Area Plan - showing proposed staging areas, waste storage facility location, fuel storage and refueling areas, soil and material stockpiling and storage areas, and Plan to include measures for marking limits of use areas including methods for protection of features to be preserved within authorized work areas.
- .7 Spill Response Plan: including procedures, instructions, and reports to be used in event of unforeseen spill of regulated substance.
- .8 Waste Management and Disposal Plan - identifying methods and locations for solid waste disposal including demolition and construction waste, clearing debris and excess soil to be disposed of outside the Park.
- .9 Regulatory Framework - identifying plan to follow all applicable regulatory requirements.
- .10 Emergency Response Plan - as it pertains to environmental considerations on site not otherwise covered in the EPP. This may include but is not limited to dealing with wildlife, unforeseen site conditions, accidents, etc.

### **1.3 FIRES**

- .1 Fires and burning of rubbish or clearing and grubbing debris within the Park is not permitted.

### **1.4 DISPOSAL OF WASTES**

- .1 Do not bury rubbish and waste materials on site. All rubbish and waste materials are to be removed and hauled to an approved waste facility.
- .2 All commercial waste, construction waste and surplus soil generated from excavations and grading must be removed from Banff National Park and disposed of at an appropriate waste disposal facility.
- .3 Do not dispose of waste or volatile materials, such as mineral spirits, oil or paint thinner into waterways, storm or sanitary sewers.
- .4 All food and domestic waste is to be continuously secured from wildlife and removed from site daily. Contractor to supply bear proof waste bins.
- .5 No waste is to be disposed of in the existing campground bins.
- .6 Contractor to provide portable sanitary facilities (Porta Potties) for Contractor's use. Existing campground and day use area public facing facilities may also be used, however Parks Canada reserves the right to revoke this privilege at any time at their sole discretion. The contractor will at no time be permitted to use the Parks Canada staff washroom facilities.
- .7 The contractor shall make every reasonable effort to recycle waste materials whenever possible.
- .8 Parks Canada reserves the right to obtain appropriate records from the contractor to confirm waste has been properly disposed of.

## **1.5 DRAINAGE**

- .1 Provide erosion and sediment control plan that identifies type and location of erosion and sediment controls to be provided. Plan: include monitoring and reporting requirements to assure that control measures are in compliance with erosion and sediment control plan, Federal, Provincial, and Municipal laws and regulations.
- .2 Provide temporary drainage and pumping as necessary to keep excavations and site free from water.
- .3 Do not pump water containing suspended materials into waterways, sewer or drainage systems.
- .4 Control disposal or runoff of water containing suspended materials or other harmful substances in accordance with local authority requirements.

## **1.6 SITE CLEARING AND PLANT PROTECTION**

- .1 Protect trees and plants on site and adjacent properties where indicated.
- .2 All anticipated necessary tree clearing has already been completed in advance of this contract. No additional trees are to be removed or harmed without the prior written permission of the Departmental Representative.
- .3 Protect roots of all trees to drip line during excavation and site grading to prevent disturbance or damage. Avoid excavation within 1 meter of the drip line of existing trees and where excavation within the drip line is required, the contractor shall adjust excavation methods as required to prevent avoidable root damage. Parks Canada reserves the right to at their sole discretion, require the contractor install hoarding around the drip line of any or all trees within the project area to minimize risk of damage.
- .4 Parks Canada reserves the right at their sole discretion to require the contractor to remove and dispose of any trees which have been damaged, have their roots damaged or compromised by the Contractor's activities in order to maintain the site in a safe condition.
- .5 Avoid unnecessary traffic, dumping, stockpiling and storage of materials over root zones and within 1m of drip line of existing trees.
- .6 Minimize stripping of topsoil and vegetation to only where necessary for the scope of this contract.
- .7 Contractors are to avoid disturbance or damage to Douglas Fir trees within the project area, at all costs. Contractor is liable to severe penalties if Douglas Fir trees are damaged or removed.
- .8 Avoid ground disturbance outside of the delineated work area and utility alignments.
- .9 Protect Vertical (Rocky Mountain) Juniper shrubs if encountered.
- .10 Ensure stockpiled material is not placed on top of existing shrubs, small trees or saplings.

## **1.7 EQUIPMENT**

- .1 Ensure all equipment is in good working order, free of leaks, properly tuned and fitted with standard air emission control devices.
- .2 All equipment must be steam cleaned prior to mobilization to site. The contractor shall inspect all equipment to ensure it is clean and free of excess grease, vegetative debris and dirt prior to arrival in Banff National Park.
- .3 All equipment being brought to site is subject to a mandatory equipment inspection by the Parks Canada ESO. 48 hours' notice is required to schedule an equipment inspection.
- .4 Any equipment to be operated off hardened surfaces should have low pressure rubber-tracked tires or rubber tracks, or be operated to minimize damage to vegetation and soil.
- .5 Equipment is to be shut down when not in immediate use to minimize idling.
- .6 All equipment is to have a spill containment kit.
- .7 All equipment is to be refueled within the designated refueling area. The designated refueling area is to be located to prevent any spills from entering drainage paths or sanitary systems.
- .8 Within vegetated areas, construction equipment is to stay on proposed utility right-of-ways. Equipment is not to travel through otherwise undisturbed areas.
- .9 Minimize or halt equipment operation during wet conditions when the soil shows signs of ponding or rutting.
- .10 Careful machine operation is required to ensure that damage to surrounding vegetation does not occur.
- .11 Have a water source available to wet down exposed soil and dry areas to minimize dust on site.

## **1.8 EXCAVATIONS, SOIL, VEGETATION RECLAMATION**

- .1 See Sections:
  - .1 31 14 13.00 Soil Stripping and Stockpiling
  - .2 31 23 33.00 Excavation, Trenching and Backfill
  - .3 32 91 13.13 Topsoil Placement and Grading

## **1.9 NON-NATIVE VEGETATION (NNV)**

- .1 Review locations of NNV infestations within the project area with the Parks Canada ESO prior to start-up. Plan activities to avoid these areas where possible. If NNV infestation areas are within the project footprint and require disturbance, plan to work in these areas last and do not mix soils from these areas with the soils from un-infested areas on the site.

## **1.10 WILDLIFE**

- .1 All wildlife attractants must be secured (e.g., petroleum products, food, drink containers and garbage) within wildlife proof containers, a secure building or vehicle. Keep food waste separated from construction waste and remove daily.
- .2 Notify the Parks Canada ESO and Banff Dispatch (403-762-1470) immediately should wildlife gain access to attractants.
- .3 If wildlife is observed at or near the work site, allow the animal(s) the opportunity to leave the work area on their own away from areas of potential conflict.
- .4 Banff Dispatch must be alerted immediately to any potential human-wildlife conflict (e.g., aggressive behaviour, persistent intrusion), distress or mortality. In the case of aggressive behaviour or persistent intrusion, stop work and evacuate the area.
- .5 Should active nests, dens, roost or calving areas be discovered, stop work and contact the Parks Canada ESO immediately for direction.
- .6 Conduct activities during the approved work hours for the project, avoiding critical wildlife foraging times (dusk and dawn).
- .7 Never approach, feed or harass wildlife.
- .8 The Parks Canada ESO will inspect old infrastructure to be removed (power poles, etc.) within five days prior to removal to confirm no wildlife species (e.g., birds and bats) are present. If wildlife species are present, infrastructure cannot be removed until after the wildlife have vacated.
- .9 The Parks Canada ESO will assess the alignments for the presence of ground squirrel burrows prior to start-up. If burrows are identified in the area, excavations must be timed to occur between April 15<sup>th</sup> and September 15<sup>th</sup>, to the extent practical. If excavations cannot occur between those dates, additional mitigation may be required at the direction of the Parks Canada ESO.

## **1.11 CULTURAL RESOURCES**

- .1 The Accidental Finds Clause applies to all project activities.
  - .1 Accidental Finds Clause: There may be cultural resources present in the project area that have not yet been discovered (even after an archaeological assessment has been carried out or no assessment was deemed necessary for the project). If staff observe any significant cultural resources while working, they should stop work in the immediate area, and contact the Departmental Representative, or the Parks Canada ESO, to discuss any protective measures that might be needed. Significant resources that could be considered grounds for work stoppage include, but are not limited to, human remains, unique or diagnostic artifacts, and/or artifacts directly associated with known sites and/or unidentified sites in the area.

**1.12 NOTIFICATION**

- .1 Departmental Representative will notify Contractor in writing of observed noncompliance with Federal, Provincial or Municipal environmental laws or regulations, permits, and other elements of Contractor's Environmental Protection plan.
- .2 Contractor: after receipt of such notice, inform Departmental Representative of proposed corrective action and take such action for approval by Departmental Representative.
- .3 Departmental Representative will issue stop order of work until satisfactory corrective action has been taken.
- .4 No time extensions granted or equitable adjustments allowed to Contractor for such suspensions.
- .5 Cover or wet down dry materials and dispose of rubbish to prevent blowing dust and debris. Provide dust control for temporary roads.

**1.13 ENVIRONMENTAL ORIENTATION**

- .1 A mandatory Environmental Orientation must be attended by all on-site personnel prior to start-up. This orientation can be scheduled through the Departmental Representative. 48 hours' notice is required to schedule this orientation.

**END OF SECTION**

**PART 1        GENERAL**

**1.1            REFERENCES AND CODES**

- .1        Perform Work in accordance with contract documents, Alberta Building Code and National Building Code of Canada (NBC) including amendments up to tender closing date and other codes of provincial or local application provided that in case of conflict or discrepancy, more stringent requirements apply.
- .2        Meet or exceed requirements of:
  - .1            Contract documents.
  - .2            Specified standards, codes and referenced documents.
  - .3            Provincial Codes.
  - .4            Parks Canada Permits and Codes.

**1.2            CANADIAN ENVIRONMENTAL PROTECTION ACT**

- .1        Perform Work in accordance with Canadian Environmental Protection Act.

**1.3            NATIONAL PARKS ACT**

- .1        Perform Work in accordance with Canada National Parks Act and Regulations.

**1.4            THIRD PARTY PERMITS**

- .1        The Contractor shall obtain third party inspection permits for all building construction and electrical works to be completed under this contract.
- .2        The Contractor shall provide confirmation of third party inspection permits prior to beginning work on the respective pieces of infrastructure affected by the permits.
- .3        Third party final inspection reports are to be provided to the Departmental Representative prior to issuing the Occupancy Permit and Certificate of Substantial Completion.

**END OF SECTION**

## **PART 1      GENERAL**

### **1.1      DEFINITIONS**

- .1      Quality Control (QC): The process of checking specific product or services to determine if they comply with relevant quality standards and identify ways to eliminate causes of unsatisfactory product or service performed.
- .2      Quality Assurance (QA): The process of ensuring that the Contractor's Quality Management Plan (QMP) (QC, non-conformances, etc.) is being followed. The results of the QA are provided as feedback to both the Contractor and the Departmental Representative. Where required, the Contractor shall implement changes to the project based on the feedback received from the QA process.

### **1.2      QUALITY MANAGEMENT PROGRAM**

- .1      The Contractor shall prepare a Quality Management Program. The purpose of the program shall be to ensure the performance of the Work in accordance with Contract requirements.
- .2      The Quality Management Program shall be described in a Quality Management Plan. The Contractor shall submit the Quality Management Plan to the Departmental Representative for acceptance in accordance with Section 01 33 00 - Submittal Procedures. The Plan shall develop a logical system for tracking and documenting the Quality Control of the Work as well as the Contractor's internal Quality Assurance procedures to verify the compliance of the Quality Control process. 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 Contractor shall appoint qualified and experienced Quality Control Personnel, who is dedicated to quality matters and who will report regularly to the Quality Control Manager as well as Contractor's management at a level which shall ensure that Quality Control requirements are not to be subordinated to manufacturing, construction or delivery. The Quality Control Personnel shall be empowered by the Contractor to resolve quality matters. Personnel involved in Quality Assurance shall be independent of the Quality Control Process.
- .4      The Quality Management Plan shall include samples of all forms to be filled in by the Quality Control Personnel. All forms shall be signed by the Quality Control Manager and submitted promptly to the Departmental Representative.
- .5      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. Quality Assurance Inspectors retained by the Departmental Representative, will periodically perform a second independent check to assess if the Quality Control process is being followed.
- .6      The Contractor must facilitate any independent Quality Assurance checks by representatives designated by the Departmental Representative.

- .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 Control Manager and submitted to the Departmental Representative.

### 1.3 TESTING

- .1 Testing required to provide Quality Control to assure that the Work strictly complies with the Contract requirements shall include, not be limited to:
  - .1 Testing of all granular and bedding material.
  - .2 Compaction Testing of all backfill and road base materials.
  - .3 Testing of all structural concrete, granular material and compaction, asphalt, and all source acceptance testing.
  - .4 Pressure testing of new mechanical and water distribution systems installations.
  - .5 Testing of new electrical distribution system for safe operation.
  - .6 Testing of septic tank as required by manufacturer.
  - .7 All other testing specified in the Contract Documents.
  - .8 Any other testing required as a condition for deviation from the specified Contract procedures.
- .2 The quality control testing proposed and testing frequency shall at a minimum, achieve the requirements of the following:
  - .1 Wherever these standard specifications refer to standards (e.g. CSA, ASTM, and others) the minimum testing frequencies in these standards shall be utilized.
  - .2 The Contractor and its independent Quality Assurance testing agency that will carry out the testing must satisfy themselves that the test frequencies being completed are sufficient to ensure the quality requirements of the QMP.
- .3 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 in advance 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; and
  - .4 Identify test reports with the name and address of the organization performing all tests, and the date of the tests.
- .4 Approval of tested samples will be for characteristics or use named in such approval and shall not change or modify any Contract requirements.
- .5 Quality Assurance testing will be undertaken by the Departmental Representative through an independent CSA certified testing firm. The independent testing firm will complete random sampling, inspection, and testing for the purposes of determining the compliance with specifications and other contract documents. The frequency, location of the inspections, sampling, and tests shall be at the completion of sub grade preparation, granular base course placement, at various stages of the campground kiosk construction,

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utility construction, water treatment facility construction, concrete delivery on site, granular base course placement and asphalt paving.

- .6 Cost of the independent quality assurance testing will be borne by the Departmental Representative.
- .7 The Departmental Representative may perform quality audits as desired. Such audits will not relax the responsibility of the contractor to perform work in accordance with Specifications. To facilitate this work the Contractor shall:
  - .1 Notify appropriate agency and Departmental Representative in advance of work which the Departmental Representative may want to test.
  - .2 Submit samples and/or materials required for testing. As specifically requested in the Specifications or as requested by the Departmental Representative. Submit within 2 days so as not to cause delay in the work.
  - .3 Provide labour and facilities to obtain and handle samples and materials on site.
- .8 The Contractor shall submit all Quality Control test results and third party inspection reports to the Departmental Representative within 48 hours of the respective report being available. All Quality Control and third party inspection reports must be submitted to the Departmental Representative a minimum of 72 hours prior to dependent work being started by the Contractor.

#### **1.4 INSPECTION**

- .1 Refer to GC 2.5 – Review and Inspection of Work.
- .2 Further to GC 2.5:
  - .1 The Contractor shall notify the Departmental Representative 72 hours prior to any special tests or inspections required.
  - .2 The contractor shall be responsible for coordinating with Fortis all inspections to be completed on contractor installed Fortis owned or Fortis supporting infrastructure.

#### **1.5 INDEPENDENT INSPECTION AGENCIES**

- .1 The contractor shall be responsible for engaging an independent third party permitting and inspection service. Cost of such services will be borne by the contractor and are to be considered incidental to the contract.
- .2 Parks Canada has engaged the design consultant to provide ongoing inspection services to ensure work is completed according to the contract. The presence of those services does not relieve the contractor from their quality control and inspection responsibilities.
- .3 Provide equipment required for executing inspection and testing by appointed agencies.
- .4 Employment of inspection/testing agencies does not relax responsibility to perform Work in accordance with Contract Documents.
- .5 If defects are revealed during inspection and/or testing, the appointed agency will request additional inspection and/or testing to ascertain full degree of defect. Correct defect and

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irregularities as advised by the independent testing firm at no cost to the Departmental Representative. Pay costs for retesting and re-inspection.

## **1.6 ACCESS TO WORK**

- .1 Allow inspection/testing agencies access to Work, off site manufacturing and fabrication plants.
- .2 Co-operate to provide reasonable facilities for such access.

## **1.7 PROCEDURES**

- .1 Notify appropriate agency and the Departmental Representative in advance of requirement for tests, in order that attendance arrangements can be made.
- .2 Submit samples and/or materials required for testing, as specifically requested in specifications. Submit with reasonable promptness and in orderly sequence to not cause delays in Work.
- .3 Provide labour and facilities to obtain and handle samples and materials on site. Provide sufficient space to store and cure test samples.
- .4 Provide Departmental Representative with list of required inspection milestones.

## **1.8 REJECTED WORK**

- .1 Any instances of unacceptable work discovered by either the Quality Control or Quality Assurance personnel will require the preparation of a non-conformance report (NCR).
- .2 If instances of unacceptable work are discovered by the Departmental Representative, the Departmental Representative may issue a non-conformance report (NCR).
- .3 Remove defective Work, whether result of poor workmanship, use of defective products or damage and whether incorporated in Work or not, which has been rejected by the Departmental Representative as failing to conform to Contract Documents. Replace or re-execute in accordance with Contract Documents.
- .4 Make good other Contractor's work damaged by such removals or replacements promptly.
- .5 Payment for the work itself may be withheld until the NCR issue has been resolved to the satisfaction of the Departmental Representative.
- .6 If in opinion of the Departmental Representative, it is not expedient to correct defective Work or Work not performed in accordance with Contract Documents, the Departmental Representative will deduct from the Contract Price difference in value between Work performed and that called for by Contract Documents, the amount of which will be determined by the Departmental Representative.

**1.9           REPORTS**

- .1       Submit one electronic copy of all inspection and test reports to the Departmental Representative.
- .2       Submit to the Departmental Representative one paper copy and one electronic copy of all Non-Conformance Reports.
- .3       Provide copies to the subcontractor of work being inspected or tested and the manufacturer or fabricator of material being inspected or tested.

**1.10          TESTS AND MIX DESIGNS**

- .1       Furnish test results as requested.
- .2       Cost of tests beyond those called for in Contract Documents or beyond those required by law of Place of Work will be appraised by the Departmental Representative and may be authorized as recoverable.

**1.11          EQUIPMENT AND SYSTEMS**

- .1       Submit commissioning reports for mechanical and electrical equipment systems.

**END OF SECTION**

**PART 1 GENERAL**

**1.1 SUBMITTALS**

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

**1.2 INSTALLATION AND REMOVAL**

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

**1.3 DEWATERING**

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

**1.4 WATER SUPPLY**

- .1 The Contractor shall provide continuous supply of potable water for construction use.
- .2 Treated water for construction is available from the Johnston Canyon Campground between June 1 to September 15 each year. Between September 16 and May 30 each year, Parks Canada may only be able to supply treated water for construction from a site within the Town of Banff.
- .3 The Contractor may apply to collect untreated water for construction from a surface water source within 5km of the project site, pending the Contractor proposing sufficient intake mitigates to prevent harm to fish. Parks Canada will determine the most suitable source location at the time of the request and issue a Restricted Activity Permit for the Contractor to collect water.
- .4 Arrange for connection and pay costs for installation, maintenance and removal.

**1.5 TEMPORARY HEATING AND VENTILATION**

- .1 Provide temporary heating required during construction period, including attendance, maintenance and fuel.
  - .1 The Contractor may utilize the existing temporary electrical supply to the site to provide electric heating of enclosed interior spaces. Parks Canada supplied electricity shall not be utilized to heat outdoor or open spaces.
- .2 Construction heaters used inside buildings must be vented to outside or be non-flameless type. Solid fuel salamanders are not permitted.
- .3 Provide temporary heat and ventilation in enclosed areas as required to:
  - .1 Facilitate progress of Work. Protect Work and products against dampness and cold.
  - .2 Prevent moisture condensation on surfaces.

- .3 Provide ambient temperatures and humidity levels for storage, installation and curing of materials.
- .4 Provide adequate ventilation to meet health regulations for safe working environment.
- .4 Maintain temperatures of minimum 10 degrees C in areas where construction is in progress.
- .5 Ventilating:
  - .1 Prevent accumulations of dust, fumes, mists, vapors or gases in areas occupied during construction.
  - .2 Provide local exhaust ventilation to prevent harmful accumulation of hazardous substances into atmosphere of occupied areas.
  - .3 Dispose of exhaust materials in manner that will not result in harmful exposure to persons.
  - .4 Ventilate storage spaces containing hazardous or volatile materials.
  - .5 Ventilate temporary sanitary facilities.
  - .6 Continue operation of ventilation and exhaust system for time after cessation of work process to assure removal of harmful contaminants.
- .6 Permanent heating system of building, to be used when available. The Contractor shall be responsible for damage to heating system if use is permitted. The contractor shall ensure the utilized systems are still in brand new condition upon completion of the project.
- .7 On completion of Work for which permanent heating system is used, replace filters, and clean heating system.

## **1.6 TEMPORARY POWER AND LIGHT**

- .1 Parks Canada will supply temporary 2-pole, 60Amp, 120 Volt power to the site using the existing overhead powerline indicated on the contract drawings. If the Contractor chooses to use this power source:
  - .1 The Contractor will be responsible for operating and maintaining the existing overhead powerline for the duration of their utilization of the line, including the removal of any downed trees and repairs to the powerline resulting from downed trees.
  - .2 The Contractor will be responsible for installing the temporary connection(s) to the existing overhead powerline.
  - .3 The Contractor shall install a main temporary panel with a 2-pole, 60 Amp main breaker to prevent overloading the service. All temporary services to be installed on site, including the temporary washroom building connection must be supplied through this breaker.
- .2 The Contractor shall provide and pay for any temporary power service requirements beyond what can be supplied from the overhead powerline during construction. This includes any generators required to support site offices, vehicle/equipment plug-ins, temporary lighting, operating of power tools, and supporting heating and hoarding requirements, at no cost to the Departmental Representative.

- .3 Furnish and install all necessary temporary wiring, distribution boxes, panels, etc., and upon completion of the work, remove all such temporary materials with the exception of the temporary electrical supply connection for the washroom building main electrical panel.

#### **1.7 TEMPORARY COMMUNICATION FACILITIES**

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

#### **1.8 TEMPORARY SANITARY FACILITIES**

- .1 Contractor shall provide portable toilets for construction use. Existing campground facilities are not to be used.

#### **1.9 FIRE PROTECTION**

- .1 Provide and maintain temporary fire protection equipment during performance of Work required by organization having jurisdiction and governing codes, regulations and bylaws.
- .2 Burning rubbish and construction waste materials is not permitted on site.

### **PART 2 PRODUCTS**

#### **2.1 NO PRODUCTS**

### **PART 3 EXECUTION**

#### **3.1 TEMPORARY EROSION AND SEDIMENTATION CONTROL**

- .1 Provide temporary erosion and sedimentation control measures to prevent soil erosion and discharge of soil-bearing water runoff or airborne dust to adjacent properties and walkways, according to the requirements of authorities having jurisdiction.
- .2 Inspect, repair, and maintain erosion and sedimentation control measures during construction until permanent vegetation has been established.
- .3 Remove erosion and sedimentation controls and restore and stabilize areas disturbed during removal.

**END OF SECTION**

**PART 1 GENERAL**

**1.1 REFERENCES**

- .1 Canadian General Standards Board (CGSB)
  - .1 CAN/CSA-S269.2-M1987 (R2003), Access Scaffolding for Construction Purposes.

**1.2 SUBMITTALS**

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

**1.3 INSTALLATION AND REMOVAL**

- .1 Install and remove construction facilities only after securing approval from Departmental Representatives.
- .2 Prepare site plan indicating proposed location and dimensions of areas to be fenced and used by Contractor, any staging or material/equipment storage areas, refueling area, number of trailers to be used, access to fenced area and details of fence installation.
- .3 Identify areas which have to be gravelled to prevent tracking of mud.
- .4 Indicate use of supplemental or other staging area, if required.
- .5 Provide construction facilities in order to execute work expeditiously.
- .6 Remove from site all such work after use.

**1.4 HOISTING**

- .1 Provide, operate and maintain hoists and cranes required for moving of materials and equipment. Make arrangements with Subcontractors for their use of hoists if required.
- .2 Hoists and cranes to be operated by qualified operators.

**1.5 SITE STORAGE/LOADING**

- .1 Confine work and operations of employees by Contract Documents. Do not unreasonably encumber premises with products.
- .2 Do not load or permit to load any part of Work with weight or force that will endanger Work.
- .3 Store materials and equipment on site to prevent loss of items or damage from snow during winter conditions.

**1.6 CONSTRUCTION PARKING**

- .1 Parking will be permitted on site in areas designated by the Departmental Representative.
- .2 Provide and maintain adequate access to project site.

**1.7 OFFICES**

- .1 Provide a heated and ventilated office of sufficient size to accommodate site personnel, subject to current COVID-19 restrictions.
- .2 Provide marked and fully stocked first aid case in a readily available location.
- .3 Subcontractors to provide their own offices as necessary. Direct location of these offices.

**1.8 EQUIPMENT, TOOL AND MATERIALS STORAGE**

- .1 Provide and maintain, in clean and orderly condition, lockable weatherproof sheds for storage of tools, equipment and materials.
- .2 Locate materials not required to be stored in weatherproof sheds on site in manner to cause least interference with work activities.

**1.9 SANITARY FACILITIES**

- .1 Provide sanitary facilities for work force in accordance with governing regulations and ordinances.
- .2 Post notices and take precautions as required by local health authorities. Keep area and premises in sanitary condition.

**1.10 CLEAN-UP**

- .1 Remove construction debris, waste materials, packaging material from work site daily.
- .2 Clean dirt or mud tracked onto paved or surfaced roadways.
- .3 Store materials resulting from demolition activities that are salvageable.
- .4 Do not stack stored new or salvaged material in construction facilities.

**1.11 WINTER CONSTRUCTION**

- .1 Special construction methods required to perform the work in severe weather shall be the responsibility of the Contractor.
- .2 Where the specifications call for work to be performed within a given temperature range or above a minimum temperature, it shall be the Contractor's responsibility to provide all temporary enclosures and heat necessary to provide the conditions specified at the Contractor's expense.
- .3 Where compaction of backfill is specified, the Contractor shall perform the work in a manner such that compaction can be achieved and material is maintained in an unfrozen condition during backfilling.
- .4 Where weather conditions are such that compaction of backfill consisting of excavated materials is not possible; the Contractor shall provide unfrozen granular material for backfill, at the Contractor's expense.

**1.12 ACCESS ROADS**

- .1 Construct, remove and rehabilitate access roads only after securing approval from Departmental Representative.
- .2 Construct temporary access roads as necessary to perform the work, and maintain temporary access roads until construction is over or until permanent access is established.
- .3 Locations and drainage facilities for temporary access roads are subject to the approval of the Departmental Representative.
- .4 No direct payment will be made to the Contractor for construction of temporary access roads and removal and restoration after construction completion.
- .5 If authorized to use existing roads for access to the project site, the Contractor shall maintain such roads for duration of the contract and make good damage resulting from Contractor's use of road.
- .6 Any driving off road requires prior approval from the Departmental Representative.

**1.13 EXISTING UTILITIES AND STRUCTURES**

- .1 Existing utilities and structures include the following: pipes, culverts, ditches or other items which are a part of an existing sewerage, drainage or water system; or which are a part of a gas, electrical, telephone, television, telecommunications or other utility system. Also included are swales, poles, fences or any other structures encountered during construction.
- .2 The Contractor shall be responsible for protection, removal or replacement of existing utilities and structures, or for repair of any damage, which may occur during construction.
- .3 Existing utilities and structures may be shown on the drawings, or described in the specifications. Such information is shown for design purposes and the existence, location and detail given is information that is obtained during the design period and is not necessarily complete, correct or current.
- .4 The Contractor shall pay all costs and be responsible for establishing locations and state of use of all existing utilities that may affect the work. The Contractor shall make satisfactory arrangements with the utilities companies involved for the location, protection and inspection of existing utilities.
- .5 Notices in writing shall be given by the Contractor to the utilities companies 96 hours before work commences in the vicinity of existing utilities.
- .6 The Contractor shall pay all the costs involved in protection of utilities, inspection of utilities, and all costs due to delays because of existing utilities and structures.
- .7 The Contractor shall provide for the uninterrupted flow of all water courses, sewers and drains encountered during the work.
- .8 Access shall be maintained to all existing structures such as valves, hydrants, meter chambers and control structures at all times during construction.

- .9 If interruption of service provided by an existing utility is necessary, the planned shutdown shall be approved by the utility companies and the Departmental Representative. Requests for shutdown shall be made by the Contractor in writing at least 96 hours in advance.
- .10 The Contractor shall notify all customers or make arrangements with the utility company and the Departmental Representative to notify all customers 48 hours in advance of a shut-down.

#### **1.14 CONSTRUCTION SIGNAGE AND SAFETY**

- .1 The Contractor shall be responsible for the regulation of traffic during construction, and shall perform the work in a manner that will cause the least disruption of traffic.
  - .1 The campground will not be open to the public during construction. Permitted vehicles will include those associated with the work and Parks Canada staff.
- .2 The Contractor shall co-ordinate the work with the Departmental Representative to minimize traffic problems.
- .3 Provision of flagmen, traffic signs, and other traffic controls shall be the Contractor's responsibility and shall be in accordance with the RTAC Manual of Uniform Traffic Control Devices and shall be located to the satisfaction of the Departmental Representative.
- .4 The Contractor shall supply and maintain at no extra cost all barriers, barricades, warning signs, detours, fences, flagmen and all other devices to protect the workers and general public against accidents or injury. All applicable safety standards shall be followed. All excavations or obstructions shall be clearly marked between sunset and sunrise with proper warning flares or lights.

#### **1.15 HAUL ROUTES**

- .1 Haul routes (roadways, lanes) shall be subject to the approval of the Departmental Representative. The Contractor shall be responsible for damage and/or spillage on all roads used for hauling materials and equipment to and from the site. The Contractor shall immediately clean and/or restore the affected areas.
- .2 Trucks must be loaded in such a manner that no spillage occurs during the haul.

#### **1.16 NOTIFICATION**

- .1 Notification of Disruption of Sanitary Services
  - .1 In the event that it should become necessary to disrupt sanitary services to any building during construction, the Contractor is required to provide written notice 96 hours prior to the intended disruption.
  - .2 Any disruption to private residences must be restricted to the Contractor's working hours. Temporary services shall be provided to the residents after the Contractor has completed work for the day if required. The cost shall be included in the overall tender price. No extra payments will be allowed.

## **1.17 MAINTENANCE OF UTILITY SERVICES**

- .1 The Contractor shall be responsible for providing, maintaining and repairing temporary utility services. The costs for providing temporary utility services shall be included in the overall tender price and no extra payment will be allowed.
- .2 During construction and warranty periods, if the Contractor fails to respond to requests for remedial works regarding maintaining or repairing temporary utility services, within reasonable time, the Departmental Representative shall have the right to carry out the necessary remedial works and shall charge the costs of the remedial works done to the Contractor.

## **1.18 TRAFFIC REGULATION**

- .1 The Contractor shall be responsible for the regulation of traffic during construction, and shall perform the work in a manner that will cause the least disruption of traffic.
  - .1 The campground will not be open to the public during construction. Permitted vehicles will include those associated with the work and Parks Canada staff.
- .2 The Contractor shall co-ordinate the work with the Departmental Representative to minimize traffic problems.
- .3 Provision of flagmen, traffic signs, and other traffic controls shall be the Contractor's responsibility and shall be in accordance with the RTAC Manual of Uniform Traffic Control Devices and shall be located to the satisfaction of Departmental Representative.
- .4 The Contractor shall supply all barriers, barricades, warning signs, detours, fences, flagmen and all other devices to protect the public. All applicable safety standards shall be followed.
  - .1 All excavations or obstructions shall be clearly marked between sunset and sunrise with proper warning flares or lights.
  - .2 Replace any existing road signs if they are removed or damaged during construction.
- .5 The Contractor shall obtain prior approval to block traffic temporarily if it is necessary to do so to perform the work. Obtain the written approval of Parks Canada, and the Departmental Representative. At least 2 weeks prior to actually blocking traffic notify the following:
  - .1 Parks Canada
  - .2 Utility Companies
- .6 One lane of Bow Valley Parkway must be kept open at all times.
- .7 The Contractor shall maintain/provide access to all properties adjacent to the work at all times.
- .8 Adequate construction parking meeting local regulations shall be provided by the Contractor.
- .9 Haul routes shall be maintained by the Contractor. They shall be kept open to traffic and shall be clean at all times.
- .10 Contractor may only close one half of any road at any one time during construction.

**PART 2        PRODUCTS**

**2.1        NO PRODUCTS.**

**PART 3        EXECUTION**

**3.1        TEMPORARY EROSION AND SEDIMENTATION CONTROL**

- .1        Provide temporary erosion and sedimentation control measures in accordance with Section 01 35 43  
         - Environmental Procedures.

**END OF SECTION**

## **PART 1 GENERAL**

### **1.1 REFERENCES**

- .1 Canadian General Standards Board (CGSB)
  - .1 CGSB 1.59-97, Alkyd Exterior Gloss Enamel.
  - .2 CAN/CGSB 1.189-00, Exterior Alkyd Primer for Wood.
- .2 Canadian Standards Association (CSA International)
  - .1 CSA-O121-M1978 (R2003), Douglas Fir Plywood.

### **1.2 INSTALLATION AND REMOVAL**

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

### **1.3 HOARDING**

- .1 Erect temporary site enclosures using construction grade lumber framing at and exterior grade fir plywood to CSA O121.
- .2 Apply plywood panels vertically, flush and butt jointed.
- .3 Erect temporary site enclosure using 1.8m high temporary construction panel fencing, around any building openings, septic tank, manufactured material storage and any open trenching at the end of each work day. Maintain fence in good repair.
- .4 Provide barriers around trees and plants designated to remain. Protect from damage by equipment and construction procedures.

### **1.4 GUARD RAILS AND BARRICADES**

- .1 Provide secure, rigid guard rails and barricades around deep excavations, open shafts, open stair wells, open edges of floors and roofs.
- .2 Provide 1.8m high temporary construction panel fencing around all excavations, open trenches or uncovered conduit installations at the end of each day, or when the area is not immediately being worked on. Fencing laid flat on the ground to cover holes is not permitted.
- .3 The Contractor shall install sufficient fencing and signage at key entrance points to the site to prevent vehicle and pedestrian access to the site throughout the project. The Contractor will be required to adjust and potentially add additional fencing to prevent public access at the discretion of the Departmental Representative.

### **1.5 WEATHER ENCLOSURES**

- .1 Provide weather tight closures to tops of shafts and other openings in floors and roofs.

- .2 Design enclosures to withstand wind pressure and snow loading.

#### **1.6 DUST TIGHT SCREENS**

- .1 Provide dust tight screens or partitions to localize dust generating activities, and for protection of workers, finished areas of Work and public.
- .2 Maintain and relocate protection until such work is complete.

#### **1.7 ACCESS TO SITE**

- .1 Provide and maintain access roads, sidewalk crossings, ramps and construction runways as may be required for access to Work. Obtain approval from Departmental Representative prior to installation.
- .2 The Contractor shall install a lock onto the main front gate to the campground for the duration of their work and remove it immediately upon completion. The Contractor supplied lock must be 'daisy chained' with the existing Parks Canada installed lock to allow Parks Canada 24-hour access to the site.
- .3 The Contractor must keep the main campground gate closed and locked when not immediately using the gate area in order to prevent visitor access to the site. The gate must be locked at all times when the Contractor is not on site.

#### **1.8 PUBLIC TRAFFIC FLOW**

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

#### **1.9 WILDLIFE PROTECTION**

- .1 All fencing, barricades, hoarding, and similar is to be approved by the Departmental Representative to be safe for use around wildlife to prevent the risk of wildlife entanglement.
- .2 Wires, ropes, and snow fencing is not permitted to be used on site.
- .3 The Contractor is responsible for ensuring the site is secure for wildlife access or implement the necessary measures to prevent wildlife access to the site entirely. Mitigation measures must consider all varieties of wildlife known to frequent the project area.

#### **1.10 FIRE ROUTES**

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

#### **1.11 PROTECTION FOR OFFSITE AND PUBLIC PROPERTY**

- .1 Protect surrounding private and public property from damage during performance of Work.
- .2 Be responsible for damage incurred.

**1.12 PROTECTION OF BUILDING FINISHES**

- .1 Provide protection for finished and partially finished building finishes and equipment during performance of Work.
- .2 Provide necessary screens, covers, and hoardings.
- .3 Confirm with Departmental Representative locations and installation schedule prior to installation.
- .4 Be responsible for damage incurred due to lack of or improper protection.

**1.13 WASTE MANAGEMENT AND DISPOSAL**

- .1 Separate waste materials for reuse and recycling.

**END OF SECTION**

## **PART 1 GENERAL**

### **1.1 REFERENCES**

- .1 Within text of each specification section, reference may be made to reference standards.
- .2 Conform to these reference standards, in whole or in part as specifically requested in specifications.
- .3 If there is question as to whether products or systems are in conformance with applicable standards, the Departmental Representative reserves right to have such products or systems tested to prove or disprove conformance.
- .4 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.
- .5 Cost for such testing will be born by the Departmental Representative in event of conformance with Contract Documents or by the Contractor in event of non-conformance.

### **1.2 QUALITY**

- .1 Products, materials, equipment and articles incorporated in Work shall be new, not damaged or defective, and of best quality for purpose intended. If requested, furnish evidence as to type, source and quality of products provided.
- .2 Procurement policy is to acquire, in cost effective manner, items containing highest percentage of recycled and recovered materials practicable consistent with maintaining satisfactory levels of competition. Make reasonable efforts to use recycled and recovered materials and in otherwise utilizing recycled and recovered materials in execution of work.
- .3 Defective products, whenever identified prior to completion of Work, will be rejected, regardless of previous inspections. Inspection does not relieve responsibility, but is precaution against oversight or error. Remove and replace defective products at own expense and be responsible for delays and expenses caused by rejection. Should disputes arise as to quality or fitness of products, decision rests strictly with the Departmental Representative based upon requirements of Contract Documents.
- .4 Should disputes arise as to quality or fitness of products, decision rests strictly with the Departmental Representative based upon requirements of Contract Documents.
- .5 Unless otherwise indicated in specifications, maintain uniformity of manufacturer for any particular or like item throughout the project.

### **1.3 AVAILABILITY**

- .1 Within 10 working days of award of contract, review product delivery requirements and anticipate foreseeable supply delays for items. If delays in supply of products are foreseeable, notify the Departmental Representative in writing of such, in order that substitutions or other remedial action may be authorized in ample time to prevent delay in performance of Work.

- .2 In event of failure to notify the Departmental Representative at commencement of Work and should it subsequently 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 or Contract Time.

#### **1.4 STORAGE, HANDLING AND PROTECTION**

- .1 Handle and store products in manner to prevent damage, adulteration, deterioration and soiling and in accordance with manufacturer's instructions when applicable.
- .2 Store packaged or bundled products in original and undamaged condition with manufacturer's seal and labels intact. Do not remove from packaging or bundling until required in Work.
- .3 Store products subject to damage from weather in weatherproof enclosures.
- .4 Store cementitious products clear of earth or concrete floors, and away from walls.
- .5 Keep sand, when used for grout or mortar materials, clean and dry. Store sand on wooden platforms and cover with waterproof tarpaulins during inclement weather.
- .6 Store sheet materials, and lumber on flat, solid supports and keep clear of ground. Slope to shed moisture.
- .7 Store and mix paints in heated and ventilated room. Remove oily rags and other combustible debris from site daily. Take every precaution necessary to prevent spontaneous combustion.
- .8 Remove and replace damaged products at own expense and to satisfaction of the Departmental Representative.
- .9 Touch-up damaged factory finished surfaces to the Departmental Representative's satisfaction. Use touch-up materials to match original. Do not paint over name plates.
- .10 The Contractor shall be responsible for the replacement of Parks Canada supplied materials which are damaged, lost or stolen as a result of improper handling, storage, negligence on the part of the Contractor or general site conditions/hazards. Replacement items shall be identical to the original lost or damaged items.

#### **1.5 TRANSPORTATION**

- .1 The Contractor shall be responsible for all costs of transportation of products required in performance of Work.
- .2 The Contractor shall be responsible for all costs of transportation and handling of Parks Canada supplied materials from Parks Canada's Banff operations compound to the site.
- .3 The Departmental Representative will be responsible for transportation costs from the supplier to Parks Canada's Banff operation compound, for products to be supplied by the Departmental Representative.

## **1.6 MANUFACTURER'S INSTRUCTIONS**

- .1 Unless otherwise indicated in the 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 the Departmental Representative in writing, of conflicts between specifications and manufacturer's instructions, so that the Departmental Representative will establish course of action.
- .3 Improper installation or erection of products, due to failure in complying with these requirements, authorizes the Departmental Representative to require removal and re-installation at no increase in Contract Price or Contract Time.
- .4 Ensure Quality of Work is of highest standard, executed by workers experienced and skilled in respective duties for which they are employed. Immediately notify the Departmental Representative if required Work is such as to make it impractical to produce required results.
- .5 Do not employ anyone unskilled in their required duties. The Departmental Representative reserves right to request dismissal from site, workers deemed incompetent or careless.
- .6 Decisions as to standard or fitness of Quality of Work in cases of dispute rest solely with the Departmental Representative whose decision is final.

## **1.7 COORDINATION**

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

## **1.8 CONCEALMENT**

- .1 In finished areas conceal pipes, ducts and wiring in floors, walls and ceilings, except where indicated otherwise.
- .2 Notify the Departmental Representative and provide an opportunity for inspection of items a minimum of 72 hours before concealing items.
- .3 Before installation inform the Departmental Representative if there is interference. Install as directed by the Departmental Representative.

## **1.9 REMEDIAL WORK**

- .1 Perform remedial work required to repair or replace parts or portions of Work identified as defective or unacceptable. Co-ordinate adjacent affected Work as required.
- .2 Perform remedial work by specialists familiar with materials affected. Perform in a manner to neither damage nor put at risk any portion of Work.

**1.10 LOCATION OF FIXTURES**

- .1 Consider location of fixtures, outlets, and mechanical and electrical items indicated as approximate, to be confirmed by the Department Representative.
- .2 Inform the Departmental Representative of conflicting installation. Install as directed by the Departmental Representative.

**1.11 FASTENINGS**

- .1 Provide metal fastenings and accessories in same texture, colour and finish as adjacent materials, unless indicated otherwise.
- .2 Prevent electrolytic action between dissimilar metals and materials.
- .3 Use non-corrosive hot dip galvanized steel fasteners and anchors for securing exterior work, unless stainless steel or other material is specifically requested in affected specification Section.
- .4 Space anchors within individual load limit or shear capacity and ensure they provide positive permanent anchorage. Wood, or any other organic material plugs are not acceptable.
- .5 Keep exposed fastenings to a minimum, space evenly and install neatly.
- .6 Fastenings which cause spalling or cracking of material to which anchorage is made are not acceptable.

**1.12 FASTENINGS - EQUIPMENT**

- .1 Use fastenings of standard commercial sizes and patterns with material and finish suitable for service.
- .2 Use heavy hexagon heads, semi finished unless otherwise specified. Use No. 304 stainless steel for exterior areas.
- .3 Bolts may not project more than one diameter beyond nuts.
- .4 Use plain type washers on equipment, sheet metal and soft gasket lock type washers where vibrations occur. Use resilient washers with stainless steel.

**1.13 PROTECTION OF WORK IN PROGRESS**

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

**1.14 EXISTING UTILITIES**

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

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

**END OF SECTION**

## **PART 1        GENERAL**

### **1.1            SUBMITTALS**

- .1        Submittals: in accordance with Section 01 33 00 - Submittal Procedures.
- .2        Submit written request in advance of cutting or alteration which affects:
  - .1        Structural integrity of elements of project.
  - .2        Integrity of weather exposed or moisture resistant elements.
  - .3        Efficiency, maintenance, or safety of operational elements.
  - .4        Visual qualities of sight exposed elements.
  - .5        Work of the Departmental Representative or separate contractor.
  - .6        Integrity of engineered pre-fabricated materials.
  - .7        Existing structures, infrastructure or facilities on site.
- .3        Include in request:
  - .1        Identification of project.
  - .2        Location and description of affected Work.
  - .3        Statement on necessity for cutting or alteration.
  - .4        Description of proposed Work, and products to be used.
  - .5        Alternatives to cutting and patching.
  - .6        Effect on Work of the Departmental Representative or separate contractor.
  - .7        Written permission of affected separate contractor.
  - .8        Date and time work will be executed.

### **1.2            MATERIALS**

- .1        Required for original installation.
- .2        Change in Materials: Submit a written request for substitution and do not proceed until authorized by Departmental Representative.

### **1.3            PREPARATION**

- .1        Inspect existing conditions, including elements subject to damage or movement during cutting and patching.
- .2        After uncovering, inspect conditions affecting performance of Work.
- .3        Beginning of cutting or patching means acceptance of existing conditions.
- .4        Provide supports to assure structural integrity of surroundings; provide devices and methods to protect other portions of project from damage.
- .5        Provide protection from elements for areas which are to be exposed by uncovering work; maintain excavations free of water.

#### **1.4 EXECUTION**

- .1 Execute cutting, fitting, and patching to complete Work.
- .2 Fit several parts together, to integrate with other Work.
- .3 Uncover Work to install ill-timed Work.
- .4 Remove and replace defective and non-conforming Work.
- .5 Provide openings in non-structural elements of Work for penetrations of mechanical and electrical Work.
- .6 Execute Work by methods to avoid damage to other Work, and which will provide proper surfaces to receive patching and finishing.
- .7 Employ original installer to perform cutting and patching for weather exposed and moisture resistant elements, and sight exposed surfaces.
- .8 Cut rigid materials using masonry saw or core drill. Pneumatic or impact tools not allowed on masonry work without prior approval.
- .9 Restore work with new products in accordance with requirements of Contract Documents.
- .10 Fit Work airtight to pipes, sleeves, ducts, conduit, and other penetrations through surfaces.
- .11 Refinish surfaces to match adjacent finishes: Refinish continuous surfaces to nearest intersection. Refinish assemblies by refinishing entire unit.
- .12 Conceal pipes, ducts and wiring in floor, wall and ceiling construction of finished areas except where indicated otherwise.
- .13 Water supply and distribution piping to be concealed beneath flooring shall be installed inside PVC conduit extending to minimum 3m outside of building foundation.
  - .1 PVC conduit to be 2x the size of the waterline to be installed inside.
  - .2 Conduit bends to be minimum 1.2m radius to allow installation and removal of the waterline without the assistance of equipment or pipe heating.
- .14 All conduits entering the ground from the new washroom building are to enter through the interior floor slab; conduits entering/exiting the building through the exterior walls are not permitted.

#### **1.5 WASTE MANAGEMENT AND DISPOSAL**

- .1 Separate waste materials for reuse and recycling.

**END OF SECTION**

**PART 1        GENERAL**

**1.1            PROJECT CLEANLINESS**

- .1      Maintain Work in tidy condition, free from accumulation of waste products and debris, other than that caused by the Departmental Representative or other Contractors.
- .2      Remove waste materials from site at daily regularly scheduled times or dispose of as directed by the Departmental Representative. Do not burn waste materials on site.
- .3      Clear snow and ice from access to site, bank/pile snow in designated areas only.
- .4      Make arrangements with and obtain permits from authorities having jurisdiction for disposal of waste and debris.
- .5      Provide on-site a container for collection of waste materials and debris.
- .6      Provide and use marked separate bins for recycling.
- .7      Dispose of waste materials and debris off site.
- .8      Clean interior areas prior to start of finishing work, and maintain areas free of dust and other contaminants during finishing operations.
- .9      Store volatile waste in covered metal containers, and remove from premises at end of each working day.
- .10     Remove all waste, equipment, storage material and other project related items from restoration areas of the site as soon as reasonably possible to allow restoration of those areas to be completed as quickly as possible.
- .11     Restoration of areas is to be completed immediately following the completion of preceding work in those areas in order to maximize the growth of planted/seeded material prior to the completion of the project.
- .12     Remove from site all unnecessary items and prepare site prior to winter conditions to prevent materials, equipment and hazards from being covered or hidden in snow.

**1.2            FINAL CLEANING**

- .1      When Work is Substantially Performed, remove staking, surplus products, tools, construction machinery and equipment not required for performance of remaining Work.
- .2      Remove waste products and debris other than that caused by others, and leave Work clean and suitable for occupancy.
- .3      Prior to final review remove surplus products, tools, construction machinery and equipment.
- .4      Remove waste products and debris other than that caused by the Departmental Representative or other Contractors.

- .5 Remove waste materials from site at regularly scheduled times or dispose of as directed by the Departmental Representative. Do not burn waste materials on site.
- .6 Make arrangements with and obtain permits from authorities having jurisdiction for disposal of waste and debris.
- .7 Remove stains, spots, marks and dirt from decorative work, electrical and mechanical fixtures, furniture fitments, walls, and floors.
- .8 Clean lighting reflectors, lenses, and other lighting surfaces.
- .9 Prior to final handover to the Departmental Representative, the Contractor shall have the new washroom building thoroughly cleaned by a professional cleaning service.

### **1.3 WASTE MANAGEMENT AND DISPOSAL**

- .1 Separate waste materials for reuse and recycling.

**END OF SECTION**

**Part 1            General**

**1.1            SECTION INCLUDES**

- .1       Requirements for placing Work in a state of readiness for acceptance by Departmental Representative.
- .2       Section supplements, but does not supersede, specific requirements of other Sections.

**1.2            DEFINITIONS**

- .1       Pre-Start-Up: Pre-start-up consists of the non-operating functions required to bring Work to a state of readiness for placing systems into service. It includes, but is not limited to; cleaning, leakage and pressure testing, cold alignment checks, disinfection, system flushing, lubrication of mechanical equipment, rotation checks and wiring loop checks. Contractor will conduct inspections of all components and sub-components and will arrange for inspections of equipment installations by qualified equipment manufacturers' representatives as required by Contract Documents. At this stage, deficiency lists are prepared and Contractor is to remedy outstanding incomplete or incorrect work in accordance with terms of Contract. Contractor will obtain completed Equipment Installation Certification Forms for each specified piece of equipment and will submit these to Departmental Representative for review. Once Departmental Representative is satisfied that each piece of equipment in a system or subsystem has been properly checked out and all apparent deficiencies have been remedied, a Green "Ready-to-Start" tag must be placed on the equipment designating that the Pre-Start-Up Phase for that particular system is complete.
  - .2       Start-Up: Once each piece of equipment within a defined system carries a "Ready-to-Start" tag, then that individual system can be started and tested. Both "Dry-Run" and "Wet-Run" tests are required. Contractor must conduct performance tests of all equipment in conjunction with the manufacturers' representatives as required by the Contract Documents and under the witness of Departmental Representative. Deficiencies that are uncovered must be corrected and retesting must be conducted as required. The Contractor will prepare Start-Up Completion Certificates certifying that the equipment or system is complete, successfully tested, started, and ready for commissioning and continuous operation.
  - .3       Commissioning: Commissioning consists of placing all the various systems in Work into continuous operation in an orderly manner. The Contractor is responsible for the commissioning activities and must have equipment manufacturer representatives at the site, as well as qualified mechanical, electrical, control and instrumentation personnel. Contractor may be assisted by Departmental Representative relative to process considerations and by Departmental Representative's operations and maintenance staff. Commissioning is considered to be complete when all systems have been operating continuously for a period of 80 hours without fault and in accordance with the specified performance requirements.
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### **1.3 QUALITY CONTROL**

- .1 Appoint a professional engineer or qualified operations specialist as Testing and Commissioning Manager to manage, coordinate and supervise the Testing, Start-up and Commissioning Program. Qualifications to include experience in managing testing, start-up and commissioning of mechanical, electrical, instrumentation, building systems and piping systems. Provide resume to Departmental Representative for review prior to commencement of program.
- .2 Contractor to provide pre-start-up, start-up and commissioning plan for review by Departmental Representative and the Design Professional.
- .3 When specified in individual Sections of Contract Documents, require manufacturer or supplier to provide authorized representative(s).
- .4 Contractor is to complete all equipment setup, balancing, calibration, etc. prior to testing with the Departmental Representative. The Departmental Representative reserves the right to have the Contractor cover any costs for consultant time spent on site for commissioning of systems which are not properly prepared or ready for testing.
- .5 Testing:
  - .1 Provide all required testing equipment and ancillary equipment to verify specified performance.
  - .2 Calibrate all test equipment to plus or minus 2 percent of actual value at full scale.
  - .3 Employ recognized, industry standard calibration procedures or as specified in individual Sections.
  - .4 Submit calibration plans and results to Departmental Representative.
- .6 Attend and participate in Pre-start-up, Start-up and Commissioning workshops with Departmental Representatives.

### **1.4 SAFETY**

- .1 Ensure all requisite safety equipment, devices, detectors, materials and procedures are in place, tested and operational before commencing.
- .2 Conform to requirements of all regulatory authorities having jurisdiction.
- .3 Maintain communications with fire, police, environmental and health authorities.

### **1.5 ENVIRONMENTAL PROTECTION**

- .1 Comply with all requirements of federal, provincial and local jurisdictions having authority.

### **1.6 PRE-START-UP**

- .1 Prepare Pre-start-up Equipment Checkout Listing which includes all Process Mechanical, Commodity-retaining Structures, Building Mechanical, Instrumentation and Controls and Electrical Equipment. Group listing into logical systems or sub-systems for orderly progression of activities during start-up.
  - .2 Identify all pieces of equipment by Tag Numbers.
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- .3 To extent practical, remove all scaffolding, debris, planks tools and other construction-related material.
  - .4 Remove all sand, silt, dirt and debris from tanks, channels, chambers, instrumentation and control panels and electrical panels and vacuum clean.
  - .5 Clean all surfaces of tanks and conduits, including walls, roofs, floors and columns with high pressure water jets or as specified in individual Sections.
  - .6 Clean interior of all pipes and fluid-carrying equipment, including pumps and inspect with Departmental Representative present.
  - .7 Conduct leakage and pressure tests in accordance with individual Sections.
  - .8 Conduct disinfection procedures in accordance with requirements of individual Sections.
  - .9 Provide Checkout Tag for each piece of equipment.
  - .10 Checkout Tags to be filled in by each applicable trade verifying that all appropriate checks have been made, including but not limited to, cleaning, inspection, leakage testing, lubrication, rotation, calibration, adjustment and wire loop checks.
  - .11 Equipment Manufacturer's Representatives to inspect equipment in accordance with applicable individual Sections. Certify equipment has been properly installed and is ready to start.
  - .12 Contractor to submit Equipment Checkout Listing to Departmental Representative. Equipment Checkout Listing to include the following:
    - .1 System description.
    - .2 Equipment Name and Tag Number of each component within System.
    - .3 Supplier's Name of each equipment component, complete with sign-off where applicable.
    - .4 Mechanical Trade sign-off (Blue and White Cards completed).
    - .5 Electrical/Instrumentation Trades sign-off (Red, Yellow and White Cards completed).
    - .6 Contractor sign-off (all cards completed).
  - .13 Attach the following to Equipment Checkout Listing:
    - .1 Manufacturer's Representatives' Installation Certification Form.
    - .2 Hydrostatic Test Certification Forms for Process Tanks.
    - .3 Pressure Test Certification Forms for Process Tanks.
    - .4 Disinfection Certification Forms where applicable.
    - .5 Instrumentation and Electrical Equipment Loop Check Forms.
    - .6 Instrumentation Calibration Forms.
    - .7 Listing of outstanding contract deficiencies for each system.
  - .14 Ensure all requisite safety equipment, devices, detectors, materials and procedures are in place, tested and operational before commencing.
  - .15 Request, in writing, a Pre-Start-Up Inspection by Departmental Representative. Once Departmental Representative has conducted the Pre-Start-Up Inspection and is satisfied
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that each piece of equipment has been properly checked-out, a green “Ready-to-Start” tag will be attached to each piece of equipment in the system.

## **1.7 START-UP**

- .1 Conduct workshop with Departmental Representatives to identify and integrate activities of all parties in start-up of Work. Prepare Start-up Plan which includes the following:
  - .1 Plan objectives.
  - .2 Facilities to be started.
  - .3 Sequence of events and start-up schedule.
  - .4 Responsibilities of each party.
  - .5 List of individuals involved complete with contact telephone numbers.
  - .6 English language description of each systems’ intended means of operation.
  - .7 Initial operating conditions and parameters.
  - .8 Intended final operating conditions and parameters.
  - .9 Laboratory requirements and arrangements for outside testing services.
  - .10 Sampling and monitoring requirements.
  - .11 Contingency plans to respond to potential emergencies.
  - .12 Safety and environmental considerations.
- .2 Develop Training plan and implement.
- .3 Provide Operating and Maintenance Manuals as required by individual Sections.
- .4 Conduct Dry Run Tests for all equipment, witnessed by Departmental Representative.
- .5 Conduct Wet Run Tests for all equipment, witnessed by Departmental Representative.
- .6 Correct any deficiencies uncovered during testing.
- .7 Provide Pre-Commissioning Certification Form.

## **1.8 COMMISSIONING**

- .1 Assemble Contractor’s commissioning team to respond to requests for assistance by Departmental Representative. Team to consist of representatives of Contractor and Contractor’s mechanical, electrical and instrumentation staff or subcontractors, as appropriate.
- .2 Contractor’s representative to be at site during normal working hours for entire commissioning period. Contractor’s commissioning team to be at site during normal working hours for the first 5 days of commissioning of each identified commissioning package and available within 4 hours’ notice during remainder of each commissioning period. Contractor’s representative and the commissioning team may be required to be at site outside of normal working hours during the commissioning period, at the discretion of Departmental Representative and must be available within four hours’ notice.
- .3 Remove and clean or replace as required all permanent and temporary filters and strainers in pipeline systems; replace HVAC filters; dewater and clean sumps and leave process systems clean and filled with clean water, unless otherwise directed by Departmental Representative.

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- .4 Departmental Representative to commission Work in stages based on commissioning packages. Each commissioning package to consist of fully functional portions or groups of operationally tested systems capable of operating in concert to provide a complete service or function that is of value to Departmental Representative.
  - .5 Commissioning to be generally conducted in manual mode first, followed by automatic operation.
  - .6 Period of time for continuous automatic operation for acceptance of commissioning is 160 hours with all systems operating continuously without fault and all process, mechanical, control and electrical equipment free of vibration, overloading or overheating and functioning in accordance with specified rates, methods and performance.
  - .7 Failure of any part of Work during the period of continuous automatic operation will require restart of that portion or system of Work, following rectification of the fault or failure.
  - .8 If it is necessary to suspend start-up, commissioning or continuous operation during the commissioning period due to deficiencies or failure in any system, the full cost of interruption, call-back, testing and resumption of start-up, commissioning, or continuous operation will be paid by Contractor.

**1.9 MATERIAL ACCEPTANCE**

- .1 Provide all material quality control testing reports indicating that all material specifications are met.

**1.10 DESIGN GRADE ACCEPTANCE**

- .1 Provide as-build survey reports indicating that all design grade requirements are met.

**Part 2 Products**

- .1 Not Used.

**Part 3 Execution**

- .1 Not Used.

**END OF SECTION**

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## **PART 1        GENERAL**

### **1.1            INSPECTION AND DECLARATION**

- .1 Contractor's Inspection: Contractor and Sub-Contractors: conduct inspection of Work, identify deficiencies and defects, and repair as required to conform to Contract Documents.
  - .1 Notify the Departmental Representative in writing of satisfactory completion of the Contractor's Inspection and that corrections have been made. Photographs of corrections made should be provided wherever relevant.
  - .2 Request Departmental Representative Inspection.
- .2 Departmental Representative Inspection: The Departmental Representative and Contractor will perform inspection of Work to identify obvious defects or deficiencies. The Contractor to correct work accordingly.
- .3 Completion: submit written certificate that following have been performed:
  - .1 Work has been completed and inspected for compliance with Contract Documents.
  - .2 Defects have been corrected and deficiencies have been completed.
  - .3 Equipment and systems have been tested, adjusted and balanced and are fully operational.
  - .4 Required Certificates have been submitted.
  - .5 All final permit inspection records have been submitted.
  - .6 Operation of systems has been demonstrated to Departmental Representative's personnel.
  - .7 Work is complete and ready for final inspection.
- .4 Final Inspection: when items noted above are completed, request final inspection of Work by Departmental Representative and Contractor. If Work is deemed incomplete by the Departmental Representative, complete outstanding items and request re-inspection.
- .5 Declaration of Substantial Performance: when the Departmental Representative considers deficiencies and defects have been corrected and it appears requirements of Contract have been substantially performed, make application for certificate of Substantial Performance. Successful completion of the Start-up Test Period is a prerequisite to achieving Substantial Performance.
  - .1 Due to the contract milestones, the contract may have multiple stages of substantial performance to reflect major contract milestones. The Departmental Representative will at their sole discretion determine whether to issue multiple Certificates of Substantial Completion for fully completed aspects of the work, or wait until all work is completed to issue one Certificate of Substantial Completion for all work.
  - .2 In order to receive partial Certificates of Substantial Completion (ie. for the washroom building, and for site restoration work), all closeout submittals must be received for the project components for which the contractor is requesting the Certificate of Substantial Completion be issued for.

- .6 Commencement of Warranty Periods: date of Departmental Representative's acceptance of submitted declaration of Substantial Performance shall be date for commencement for warranty period.
- .7 Final Payment: when the Departmental Representative considers final deficiencies and defects have been corrected and it appears requirements of Contract have been totally performed, make application for final payment. Refer to CCDC 2. If Work is deemed incomplete by the Departmental Representative, complete outstanding items and request re-inspection.
- .8 Payment of Holdback: after issuance of certificate of Substantial Performance of Work, submit an application for payment of holdback amount in accordance with CCDC 2.

## **1.2 CLEANING**

- .1 Remove waste and surplus materials, rubbish and construction facilities from the site in accordance with Section 01 74 11 - Cleaning

**END OF SECTION**

**PART 1 GENERAL**

**1.1 SUBMITTALS**

- .1 Submittals: in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Prepare instructions and data in accordance with Section 01 91 61 - Operation and Maintenance Manual using personnel experienced in maintenance and operation of described products.
- .3 Copy will be returned after final inspection, with the Departmental Representative's comments.
- .4 Revise content of documents as required prior to final submittal.
- .5 Two weeks prior to Substantial Performance of the Work, submit to the Departmental Representative, four final hard copies of operating and maintenance manuals in English and electronic PDF files on USB.
- .6 Ensure spare parts, maintenance materials and special tools provided are new, undamaged or defective, and of same quality and manufacture as products provided in Work.
- .7 Furnish evidence, if requested, for type, source and quality of products provided.
- .8 Defective products will be rejected, regardless of previous inspections. Replace products at own expense.
- .9 Pay costs of transportation.
- .10 Two weeks prior to Substantial Performance of work, submit to the Departmental Representative, all photographs taken by the Contractor and their representatives.
  - .1 Photographs are to be submitted on a USB stick
  - .2 Photographs are to be organized into folders by project component, and then by date.
  - .3 All photographs to be date and time stamped.

**1.2 OPERATION AND MAINTENANCE MANUAL**

- .1 In accordance with Section 01 91 61 - Operation and Maintenance Manual.

**1.3 AS-BUILTS AND SAMPLES**

- .1 Maintain, in addition to requirements in General Conditions, at site for the Departmental Representative, one record copy of:
  - .1 Contract Drawings including any redline comments/changes.
  - .2 Specifications.
  - .3 Addenda.
  - .4 Change Orders and other modifications to Contract.

- .5 Reviewed shop drawings, product data, and samples. Field test records.
- .6 Inspection certificates.
- .7 Manufacturer's certificates.
- .2 Store record documents and samples in field office apart from documents used for construction. Provide files, racks, and secure storage.
- .3 Label record documents and file in accordance with Section number listings in List of Contents of this Project Manual. Label each document "PROJECT RECORD" in neat, large, printed letters.
- .4 Maintain record documents in clean, dry and legible condition. Do not use record documents for construction purposes.
- .5 Keep record documents and samples available for inspection by the Departmental Representative.

#### **1.4 RECORDING ACTUAL SITE CONDITIONS**

- .1 Record information on a clean set of black line construction drawings.
- .2 Provide felt tip marking pens, maintaining separate colours for each major system, for recording information.
- .3 Record information concurrently with construction progress. Do not conceal Work until required information is recorded.
- .4 Contract Drawings and shop drawings: mark each item to record actual construction, including:
  - .1 Measured depths of elements of foundation in relation to finish first floor datum.
  - .2 Measured horizontal and vertical locations of underground utilities and appurtenances, referenced to permanent surface improvements.
  - .3 Measured locations of internal utilities and appurtenances, referenced to visible and accessible features of construction.
  - .4 Field changes of dimension and detail.
  - .5 Changes made by change orders.
  - .6 Details not on original Contract Drawings.
  - .7 References to related shop drawings and modifications.
- .5 Specifications: mark each item to record actual construction, including:
  - .1 Manufacturer, trade name, and catalogue number of each product actually installed, particularly optional items and substitute items.
  - .2 Changes made by Addenda and change orders.
- .6 Other Documents: maintain manufacturer's certifications, inspection certifications, and field test records, required by individual specifications sections.

**1.5 FINAL SURVEY**

- .1 Submit final site survey certificate certifying that elevations and locations of completed Work are in conformance, or non-conformance with Contract Documents.
  - .1 Survey data to be provided in CAD format with separate layers set up for each separate utility type and various surface features.
  - .2 Survey data shall compliment redline drawings to provide all necessary as-built information for the Departmental Representative to produce accurate as-built drawings.

**1.6 SPARE PARTS**

- .1 Provide spare parts, in quantities specified in individual specification sections.
- .2 Provide items of same manufacture and quality as items in Work.
- .3 Deliver to site; place and store.
- .4 Receive and catalogue items. Submit inventory listing to the Departmental Representative. Include approved listings in Maintenance Manual.
- .5 Obtain receipt for delivered products and submit prior to final payment.

**1.7 MAINTENANCE MATERIALS**

- .1 Provide maintenance and extra materials, in quantities specified in individual specification sections.
- .2 Provide items of same manufacture and quality as items in Work.
- .3 Deliver to site; place and store.
- .4 Receive and catalogue items. Submit inventory listing to the Departmental Representative. Include approved listings in Maintenance Manual.
- .5 Obtain receipt for delivered products and submit prior to final payment.

**1.8 SPECIAL TOOLS**

- .1 Provide special tools, in quantities specified in individual specification section.
- .2 Provide items with tags identifying their associated function and equipment.
- .3 Deliver to site; place and store.
- .4 Receive and catalogue items. Submit inventory listing to the Departmental Representative. Include approved listings in Maintenance Manual.

**1.9 STORAGE, HANDLING AND PROTECTION**

- .1 Store spare parts, maintenance materials, and special tools in manner to prevent damage or deterioration.
- .2 Store in original and undamaged condition with manufacturer's seal and labels intact.

- .3 Store components subject to damage from weather in weatherproof enclosures.
- .4 Store paints and freezable materials in a heated and ventilated room.
- .5 Remove and replace damaged products at own expense and to satisfaction of the Departmental Representative.

#### **1.10 WARRANTIES AND BONDS**

- .1 Assemble approved information in binder and submit upon acceptance of work. Organize binder as follows:
  - .1 Separate each warranty or bond with index tab sheets keyed to Table of Contents listing.
  - .2 List subcontractor, supplier, and manufacturer, with name, address, and telephone number of responsible principal.
  - .3 Obtain warranties and bonds, executed in duplicate by subcontractors, suppliers, and manufacturers, within ten days after completion of applicable item of work.
  - .4 Verify that documents are in proper form, contain full information, and are notarized.
  - .5 Co-execute submittals when required.
  - .6 Retain warranties and bonds until time specified for submittal.
- .2 Except for items put into use with Departmental Representative's permission, leave date of beginning of time of warranty until Date of Substantial Performance is determined.
- .3 Respond in a timely manner to oral or written notification of required construction warranty repair work.
- .4 Written verification will follow oral instructions. Failure to respond will be cause for the Departmental Representative to proceed with action against Contractor.

#### **1.11 PRE-WARRANTY CONFERENCE**

- .1 Meet with the Departmental Representative, to develop understanding of requirements of this section. Schedule meeting prior to contract completion, and at time designated by the Departmental Representative.
- .2 The Departmental Representative will establish communication procedures for:
  - .1 Notification of construction warranty defects.
  - .2 Determine priorities for type of defect.
  - .3 Determine reasonable time for response.
- .3 Provide name, telephone number and address of licensed and bonded company that is authorized to initiate and pursue construction warranty work action.
- .4 Ensure contact is located within local service area of warranted construction, is continuously available, and is responsive to inquiries for warranty work action.

**1.12            WARRANTY TAGS**

- .1        Tag, at time of installation, each warranted item. Provide durable, oil and water resistant tag approved by the Departmental Representative.
- .2        Attach tags with copper wire and spray with waterproof silicone coating.
- .3        Leave date of acceptance until project is accepted for occupancy.
- .4        Indicate following information on tag:
  - .1        Type of product/material.
  - .2        Model number.
  - .3        Serial number.
  - .4        Contract number.
  - .5        Warranty period.
  - .6        Inspector's signature.
- .5        Construction Contractor.

**END OF SECTION**

**Part 1            General**

**1.1            MANUAL**

- .1    An organized compilation of operating and maintenance data including detailed technical information, documents and records describing O&M of individual products or systems as specified in individual sections of Divisions 03 to 33.

**1.2            SCOPE**

- .1    Record documents.
- .2    Equipment and systems, including specific model numbers and supplier.
- .3    Product data, materials and finishes and related information.
- .4    Operation and maintenance (O&M) manual.
- .5    Warranties and bonds.

**1.3            SUBMITTALS**

- .1    Prepare instructions and data by personnel experienced in maintenance and operation of described products, including engineering and architectural items.
  - .2    Submit a skeleton of the O&M Manual, including table of contents, section tabs, scale mock-up of printing proposed for the binders and sample of proposed record drawing storage mechanism, to Departmental Representative for approval before 60% of the work is approved for payment. No payment over 60% of the Contract value will be made until this is received.
  - .3    Incorporate Operating and Maintenance Data provided with the major equipment supply into two (2) copies of one (1) volume to include all equipment and systems installed under this project.
  - .4    Submit two (2) copies of completed volumes of O&M Manual in final form fifteen (15) days prior to scheduled start-up and commissioning, including any partial start-up and commissioning.
  - .5    One (1) copy will be returned after commissioning, with Departmental Representative's comments. The second copy will be returned for finalization after submission of three (3) final copies.
  - .6    Revise content of documents as required prior to final submittal.
  - .7    Provide an electronic copy of the final O&M Manuals in PDF format, stored on CD. Organize the electronic manual in a similar format to the hard copy version.
  - .8    O&M Manual is to include items supplied to the Contractor by Parks Canada. Product data sheets for those items will be provided to the contractor by the Departmental Representative.
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#### **1.4 BINDERS (HARD COPY MANUALS)**

- .1 Binders: commercial quality, 3" x 5.5" expanding piano hinge barlock binder, black vellum lined, 220 pt boards with round corners for 8.5"x 11" sheet size.
- .2 When multiple binders are used, correlate data into related consistent groupings.
- .3 Cover: Identify each binder with gold embossed title "Operation and Maintenance Manual" on front cover and spine; list title of Project, identify subject matter of contents.
- .4 Arrange content by systems, in accordance with the Table of Contents. O&M Manual shall be one (1) combined manual.
- .5 Provide colour coded tabbed fly leaf for each separate product and system, with typed description of product and major component parts of equipment.
- .6 Tests: Manufacturer's printed data, or typewritten data on 20-pound paper.
- .7 Provide drawings with reinforced punched binder tab. Bind in with text; fold larger drawings to size of text pages.
- .8 Drawings larger than 11" X 17": insert drawings in sturdy vinyl envelopes with reinforced binding holes, open on one side and overall folded size not exceeding 8.5" X 11". Do not punch holes in the drawings.

#### **1.5 CONTENTS**

- .1 Arrange the material in volumes as described below. Provide a separate binder for each volume unless directed otherwise by Departmental Representative. Where more than one binder is required to accommodate the documentation for a volume, increase or decrease the number of volumes and renumber as necessary.  
  
Volume 1 - Operating Manual  
Volume 2 -  
Architectural/Structural  
Volume 3 - Mechanical Operations and  
Maintenance Volume 4 - Electrical and  
Instrumentation Operations
  - .2 Permanently number each set.
  - .3 Letter the spine of the binder with the full identification title of the project and the front face with the following on the respective binders:  
  
Full identification title of the  
project Volume Number  
Volume Title  
Owner's name, e.g. [Parks Canada  
Agency] Number of Sets (e.g. 1 of 3)
  - .4 Departmental Representative will prepare the manual content in Volume 1. All other Volumes are the responsibility of Contractor. Provide the binders and the dividing tabs to Departmental Representative for the compilation of Volume 1.
  - .5 Arrange the binders according to the Construction Specifications Institute MASTERFORMAT - Master List of Sections, Titles and Numbers, utilizing laminated
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mylar plastic divider tabs, colour coded according to section. Markings on the tabs are to be type written. Tab colours are to be as follows:

- .1 Division – white
- .2 Sections – orange
- .3 Subsections – yellow
- .6 Make up each binder as follows:
  - .1 Tab: Table of Contents - details the titles of various divisions of the manual in the binder.
  - .2 Tab: Introduction to manual - written explanation of the layout of the manual and intended use.
- .7 Include separately the following:
  - .1 Consultant: name, address, telephone and FAX numbers, name of Project Manager.
  - .2 Contractor: name, address, telephone and FAX numbers, name of Project Manager.
  - .3 Major Sub-Contractors: name, address, telephone and FAX numbers of sub-contractors included in that binder.
- .8 Provide the following for each respective discipline:
  - .1 Tab: Division number XX:
  - .2 Index - information in that division in order of appearance in the specification,
  - .3 List of sub-contractors and suppliers - name, address, and telephone and FAX numbers,
  - .4 Specification section cross reference, and
  - .5 Drawing List.
- .9 Organize the various applicable sections under separate divider tabs labelled division/number as required by the project. A typical outline is as follows:

**Tab: DIVISION 7 - THERMAL AND MOISTURE PROTECTION**

07 11 13 - Bituminous Dampproofing  
07 16 19 - Metal Oxide Waterproofing  
07 18 00 - Traffic Coatings  
07 19 00 - Water Repellents  
07 21 13 - Board Insulation  
07 21 16 - Blanket Insulation  
07 21 23 - Loose-Fill Insulation  
07 24 00 - Exterior Insulation and Finish Systems  
07 26 00 - Vapour Retarders  
07 31 29 - Wood Shingles and Shakes  
07 61 00 - Sheet Metal Roofing  
07 62 00 - Sheet Metal Flashing and Trim  
07 72 33 - Roof Hatches  
07 92 00 - Joint Sealing

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- .10 Provide the information given below, where applicable, for each system and major piece of equipment. Refer to each piece of equipment by its name and tag number. Where manufacturer's literature covers several models or options, highlight the applicable information, using a non-fading marker or thick red box to make the relevant information obvious to the reader, and cross out redundant information.
- .1 Index of information in that section in order of appearance;
  - .2 Description of system, components and technical data. Include interfaces, sequences, operations; characteristic changes for seasonal operation;
  - .3 Maintenance and operating instructions including:
    - .1 Master list of all building components, including specific make and model, supplier and reference to O&M Manual detailed document location to allow for easy future replacement
    - .2 Installation instructions
    - .3 Procedure for starting
    - .4 Proper adjustment
    - .5 Test procedures
    - .6 Inspection and Maintenance interval list/schedule by component type
    - .7 Procedure for operating
    - .8 Procedure for shutdown
    - .9 Procedure for winterizing
    - .10 Procedure for spring start up
    - .11 Safety precautions
    - .12 List of electrical relay settings and control and alarm contact settings.
  - .4 Troubleshooting data;
  - .5 Preventative maintenance program complete with:
    - .1 Suggested check list sheets
    - .2 List of points to be greased or oiled
    - .3 Recommended type, grade and temperature range of lubricants
    - .4 List of wear points to be inspected and/or adjusted regularly.
    - .5 Suggested schedule for lubrication and inspection
  - .6 Schematic, single line, and wiring diagrams;
  - .7 Valve tag list;
  - .8 Recommended spare parts list;
  - .9 Certification, guarantee, warranty;
  - .10 Service representatives - name, address and telephone number;
  - .11 Suppliers for replacement parts - name, address, and telephone numbers;
  - .12 Test results; witness testing and commissioning, reports;
  - .13 Test data for piping systems (degreasing, flushing, disinfection);
  - .14 Hydrostatic or air tests performance;
  - .15 Equipment alignment certificates;
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- .16 Balancing reports for air and water systems;
- .17 Inspection approval certificates for all types of systems; plumbing and piping, hot air and ventilating, electrical supervisory, etc.
- .11 At Departmental Representative's discretion, provide the information in plastic map pockets in appropriate sections in the binders.

## **1.6 MATERIALS AND FINISHES**

- .1 Building Products, Applied Materials and Finishes: include product data, with catalogue number, size, composition and colour and texture designations.
- .2 Instructions for cleaning agents and methods, precautions against detrimental agents and methods and recommended schedule for cleaning and maintenance.
- .3 Moisture-protection and Weather-exposed Products: include manufacturer's recommendations for cleaning agents and methods, precautions against detrimental agents and methods and recommended schedule for cleaning and maintenance.
- .4 Additional Requirements: as specified in individual specification Sections.

## **1.7 WARRANTIES AND BONDS**

- .1 Separate each warranty or bond with index tab sheets keyed to the List 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 (10) days after completion of the applicable item of work.
- .4 Verify that documents are in proper form, contain full information and are notarized.
- .5 Co-execute submittals when required.
- .6 Retain warranties and bonds until time specified for submittal.

## **Part 2 Products**

Not Used.

## **Part 3 Execution**

Not Used.

**END OF SECTION**

## **PART 1        GENERAL**

### **1.1            SUMMARY**

- .1        This Section includes general requirements relating to commissioning of the project's components and systems, specifying general requirements to performance verification of components, equipment, sub-systems, systems, and integrated systems.
- .2        Functional and Performance Testing shall be carried out at various stages throughout construction with final testing to be completed upon completion of the building construction. Start-up of the system and the Start-up Test Period shall occur prior to construction completion in spring 2023.

### **1.2            DEFINITIONS**

- .1        System: The overall process, or a portion thereof, that performs a specific function. A system may consist of two or more subsystems as well as two or more types of equipment.
- .2        Functional Test: A test or tests in the presence of the Departmental Representative to demonstrate that the installed equipment or system meets manufacturer's installation and adjustment requirements and other requirements specified, including, but not limited to, noise, vibration, alignment, speed, proper electrical and mechanical connections, thrust restraint, proper rotation, and initial servicing.
- .3        Performance Test: A test performed in the presence of the Departmental Representative and after any required functional test specified, to demonstrate and confirm that the equipment and/or system meet the specified performance requirements.
- .4        Start-up Test Period:
  - .1        Start-up of the entire facility or any portion thereof includes coordinating operation of the facilities by the Contractor, Subcontractors, facility operating personnel, and manufacturer's representatives for equipment items and systems after all required functional and performance tests have been completed.
  - .2        Start-up of the entire facility or any portion thereof shall be considered complete when, in the opinion of the Departmental Representative, the facility or designated portion has operated in the manner intended for 160 hours without significant interruption. This period is in addition to any training, functional or performance test periods specified elsewhere. A significant interruption will require the start-up then in progress to be stopped and restarted after corrections are made.
  - .3        Complete start-up is a prerequisite to achieving substantial performance.
- .5        Operation Period: The operation period begins when the facility has been successfully started up as defined under Start-up Test Period and has met all substantial performance requirements.
- .6        Significant Interruption: May include any of the following events:
  - .1        Failure of Contractor to maintain qualified on-site start-up personnel as scheduled.
  - .2        Failure to meet specified performance for more than 24 consecutive hours.

- .3 Failure of any critical equipment unit, system, or subsystem that is not satisfactorily corrected within 5 hours after failure.
- .4 Failure of non-critical unit, system or subsystem that is not satisfactorily corrected within 24 hours after failure.
- .5 As may be determined by the Departmental Representative.

### **1.3 SUBMITTALS**

- .1 Submittals: in accordance with Section 01 33 00 - Submittal Procedures.
  - .1 Request in writing to the Departmental Representative for changes to submittals and obtain written approval at least 8 weeks prior to start of Commissioning.
  - .2 Submit proposed Commissioning procedures to the Departmental Representative where not specified and obtain written approval at least 4 weeks prior to start of Commissioning.
  - .3 Provide additional documentation relating to Commissioning process as required by the Departmental Representative.

### **1.4 CONTRACTOR TESTING AND START-UP RESPONSIBILITIES**

- .1 General
  - .1 Perform all Work for functional and performance tests specified.
  - .2 Demonstrate proper function of all equipment, systems, and control devices.
  - .3 Complete all Work associated with the unit and related processes before testing, including related manufacturer's representative services.
  - .4 Provide all related operating and maintenance manuals, and spare parts and special tools as specified before testing any unit or system.
  - .5 Furnish qualified manufacturer's representatives when required to assist in testing. A representative of the packaged lift station manufacturer will be required for testing and start-up.
  - .6 Utilize the Manufacturer's Certificate of Proper Installation Form, supplemented as necessary, to document all functional and performance procedures, results, problems, and conclusions.
  - .7 Prepare testing plan and schedule and attend pretest (functional and performance) meetings related to test schedule, plan of test, materials, chemicals, and liquids required, facilities' operations interface, and Departmental Representative involvement.
  - .8 Designate and provide one or more persons to be responsible for coordinating and expediting Contractor's testing and start-up duties. The person or persons shall be present during all testing and pre startup meetings and shall be available at all times during the start-up period.
  - .9 Provide water and all temporary services, or connections, if required, for functional/performance testing.
  - .10 Submit to the Departmental Representative all quality control inspection and material testing reports for the installation of the item(s) being tested prior to testing beginning.
- .2 Start-up Test Period:

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- .1 As applicable to the equipment furnished, state in writing that all necessary hydraulic structures, piping systems, and valves have been successfully tested; that all necessary equipment systems and subsystem have been checked for proper installation, started and successfully tested to indicate that they are all operational; that the systems and subsystems are capable of performing their intended functions; and that the facilities are ready for start-up and intended operation.
  - .2 Provide all water, power, chemicals, equipment, piping, and other items as required for testing, unless otherwise indicated.
  - .3 Prepare start-up plan and schedule in cooperation with the Departmental Representative. Attend prestart-up planning meetings and arrange for attendants by key major equipment manufacturer representatives as required by the Contract Documents.
  - .4 Designate and provide one or more persons to be responsible for coordinating and expediting Contractor's start-up duties.
  - .5 Make adjustments, repairs, and corrections necessary to complete plant start-up.
  - .6 Provide sampling labour and materials as required and provide laboratory analyses.
  - .7 After the station is operating, complete the testing of those items of equipment, systems, and subsystems, which could not be or were not adequately or successfully tested prior to station start-up.
- .3 Testing preparation:
- .1 Temporary Facilities: Provide all temporary valves, gauges, piping, and other materials and equipment required to conduct testing.
  - .2 Ready-to-test determination will be by the Departmental Representative based at least on the following:
    - .1 Notification by Contractor of equipment and system readiness for testing.
    - .2 Acceptable testing plan.
    - .3 Adequate completion of Work adjacent to, or interfacing with, equipment to be tested.
    - .4 Availability and acceptability of manufacturer's representative, when specified, to assist in testing of respective equipment.
    - .5 Control devices have been tested for function and operation over design range.
    - .6 Equipment and electrical tagging complete.
    - .7 All spare parts and tools on hand.
- .4 Functional testing:
- .1 Begin testing at a time mutually agreed upon by the Departmental Representative and Contractor.
  - .2 Notify, in writing, the Departmental Representative at least 7 days prior to scheduled date of functional tests.
  - .3 Separate items of equipment demonstrated to function properly during subsystem testing might require no further functional test if documentation of subsystem testing is acceptable to the Departmental Representative.
  - .4 Conduct functional test until each individual component item or system has achieved 1 continuous hour of satisfactory operation. Demonstrate all operational features and controls during this period while in automatic modes.

- .5 If, in the Departmental Representative's opinion, each system meets the functional requirements specified, such system will be accepted as conforming for purposes of advancing to performance testing phase, if required. If, in the Departmental Representative's opinion, functional test results do not meet requirements specified, the systems will be considered as nonconforming.
- .6 Performance testing shall not commence until the equipment or system meets functional tests specified.
- .7 Document test on the manufacturer's certificate of proper installation form.
- .5 Performance testing:
  - .1 Begin testing at a time mutually agreed upon by the Departmental Representative and Contractor, as appropriate.
    - .1 The Departmental Representative will be present during test.
    - .2 Notify the Departmental Representative at least 7 days prior to scheduled date of test.
  - .2 Follow approved testing plan and detailed procedures specified.
  - .3 Source and type of fluid, gas, or solid for testing shall be as specified.
  - .4 Unless otherwise indicated, provide all labour, materials, and supplies for conducting the test and taking all samples and performance measurements.
  - .5 Prepare performance test report summarizing test method. Include test logs, pertinent calculations, and obtain manufacturer's certification of performance when specified.
- .6 Acceptance:
  - .1 The Departmental Representative will accept equipment and systems as having achieved Substantial Performance and ready for continuous operation only after successful testing and start-up is completed and documented, test and start-up reports are submitted, and manufacturer's services completed for training of facility operating personnel.
  - .2 The Contractor is responsible for continuing to operate the tested facilities to the Departmental Representative's satisfaction until all necessary testing reports and documentation have been submitted to the Departmental Representative and the handover of facilities has been coordinated with the Departmental Representative.

**END OF SECTION**

## **PART 1        GENERAL**

### **1.1        SUMMARY**

- .1        The work under this Section includes the preparation and supply of an Operation and Maintenance (O&M) manual for the Castle Mountain Campground Rehabilitation Phase 2 works.
- .2        The O&M manual is to describe and detail all operational and maintenance requirements of the new washroom building, and all utilities, tanks and other items installed as part of the project.
- .3        Provide an overview of both the existing and upgraded system. Describe building systems including design intent, criteria and loads, capacities and limitations. Include general concept of operations, modes of operation, operation sequences and procedures, and maintenance requirements.
- .4        The O&M manual is to include a front end volume which provides a summary of all components, to serve as an operator's guide to foreseeable operations as communicated by the Departmental Representative. This is to include a schedule of all regular inspections, calibration and servicing requirements, spring start up and fall shut down procedures, product information to allow for easy ordering of replacement or parts, and all other details operators will regularly require to operate the facilities under normal conditions.
- .5        A separate O&M manual is to be provided for:
  - .1        The new washroom building. This is to serve as a stand alone document for the building and all components within or which are part of the building.
  - .2        All outdoor tanks, underground utilities, etc.
- .6        The Contractor shall discuss with the Departmental Representative any uncertainty between the split of the O&M manuals prior to starting assembly of those documents.

### **1.2        GENERAL**

- .1        In addition to the installation, operation and maintenance information supplied for field use, the Contractor shall provide four copies of clean, unmarked operation and maintenance manuals, and electronic PDF files on USB.
  - .1        Bind data in vinyl hard covered, 3 ring loose leaf binders for 219 x 279 mm size paper.
  - .2        Enclose title sheet, labelled "Operation and Maintenance Manual", project name, date and list of contents.
  - .3        Labelled tabs shall separate the sections and the tabs shall be plastic laminated for protection.
  - .4        The print shall be black and all manuals must be properly typed with proper grammar and spelling in a clear and concise manner.
  - .5        Arrange content by systems, under Section numbers and sequence of Table of Contents.

- .6 Drawings: provide with reinforced punched binder tab. Bind in with text; fold larger drawings to size of text pages.
- .7 When multiple binders are used correlate data into related consistent groupings. Identify contents of each binder on spine.

### **1.3 GENERAL EQUIPMENT AND SYSTEMS REQUIREMENTS**

- .1 Each Item of Equipment and Each System: include description of unit or system, and component parts. Give function, normal operation characteristics, and limiting conditions. Include performance curves, with engineering data and tests, and complete nomenclature and commercial number of replaceable parts.
- .2 Panel board circuit directories: provide electrical service characteristics, controls, and communications.
- .3 Include installed colour coded wiring diagrams.
- .4 Operating Procedures: include start-up, break-in, and routine normal operating instructions and sequences. Include regulation, control, stopping, shut-down, and emergency instructions. Include summer, winter, and any special operating instructions.
- .5 Maintenance Requirements: include routine procedures and guide for trouble-shooting; disassembly, repair, and reassembly instructions; and alignment, adjusting, balancing, and checking instructions.
- .6 Provide servicing and lubrication schedule, and list of lubricants required.
- .7 Include manufacturer's printed operation and maintenance instructions.
- .8 Include sequence of operation by controls manufacturer.
- .9 Provide original manufacturer's parts list, illustrations, assembly drawings, and diagrams required for maintenance.
- .10 Provide installed control diagrams by controls manufacturer.
- .11 Provide Contractor's co-ordination drawings, with installed colour coded piping diagrams.
- .12 Provide charts of valve tag numbers, with location and function of each valve, keyed to flow and control diagrams.
- .13 Provide list of original manufacturer's spare parts, current prices, and recommended quantities to be maintained in storage.
- .14 Include test and balancing reports as specified in Section 01 45 00 - Quality Control and 01 91 13 - General Commissioning Requirements.
- .15 Typewritten Text: as required to supplement product data. Provide logical sequence of instructions for each procedure, incorporating manufacturer's instructions specified in Section 01 45 00 - Quality Control.
- .16 Training: refer to Section 01 91 13 - General Commissioning Requirements.

- .17 Additional requirements: as specified in individual specification sections.
- .18 Coordinate with the Departmental Representative to provide labeled reference drawings as required to identify specific components which cannot be clearly or efficiently communicated in the text of the document such as blow out valve locations, shut off valves, etc.

#### **1.4 MATERIALS AND FINISHES**

- .1 Building Products, Applied Materials, and Finishes: include product data, with catalogue number, size, composition, and colour and texture designations. Provide information for re-ordering custom manufactured products.
- .2 Instructions for cleaning agents and methods, precautions against detrimental agents and methods, and recommended schedule for cleaning and maintenance.
- .3 Additional Requirements: as specified in individual specifications sections.

#### **1.5 TABLE OF CONTENTS**

- .1 The operating and maintenance manuals shall be assembled according to the following Table of Contents:
  - .1 Introduction:
    - .1 To include location of facility and components of facility.
  - .2 Facility Explanation:
    - .1 Provide a description of the project and the purpose of the O&M manual being presented. Provide an overview of the facility, include both the existing and upgraded system, and describe the integration of the two systems.
    - .2 Describe process and building systems including design intent, criteria and loads, capacities and limitations.
    - .3 Include an explanation of each system and component and define purpose, size, and method of operation.
  - .3 One complete set of Sub-contractors Process and Building System Drawings, Shop Drawings, Equipment Specifications, Manufacturer's Data, Trouble Shooting Information.
  - .4 General Information:
    - .1 Maintenance instructions for finished surfaces and materials.
    - .2 Copy of hardware and paint schedules, including a piping colour code.
    - .3 Names, addresses and phone numbers of subcontractors and suppliers.
    - .4 Certification and permits.
    - .5 Guarantees, warranties and bonds showing:
      - .1 Guarantee commencement date.
      - .2 Duration of guarantee.
      - .3 Clear indication of what is being guaranteed and what remedial action will be taken under guarantee.

**1.6**

**TIMING**

- .1 The Operation and Maintenance Manual must be submitted and accepted as complete by the Departmental Representative before any consideration for the Substantial Completion Certificate can be given.

**END OF SECTION**

## **PART 1 - GENERAL**

### **1.1 Related Requirements**

- .1 Section 03 20 00: Concrete Reinforcing.
- .2 Section 03 30 00: Cast-in-Place Concrete.

### **1.2 References**

- .1 Editions of all Referenced Standards to be the ones designated by the applicable Building Code in force at the time of building permit application, as indicated on Structural Drawings. For Standards not referenced by the Building Code, use the latest editions.
- .2 CSA Group (CSA):
  - .1 CSA A23.1/A23.2, Concrete Materials and Methods of Concrete Construction/Methods of Test and Standard Practices for Concrete.
  - .2 CSA O121, Douglas Fir Plywood.
  - .3 CSA O141, Softwood Lumber.
  - .4 CSA O151, Canadian Softwood Plywood.
  - .5 CSA O153, Poplar Plywood.
  - .6 CSA S269.1, Falsework and Formwork
- .3 American Concrete Institute (ACI):
  - .1 ACI 117, Specification for Tolerances for Concrete Construction and Materials.
  - .2 ACI 347, Guide to Formwork for Concrete.

## **PART 2 - PRODUCTS**

### **2.1 Design Requirements**

- .1 Design in accordance with CSA S269.1.
- .2 The Department Representative accepts no responsibility for structural adequacy of formwork, falsework and re-shoring and will not review its design.

### **2.2 Materials**

- .1 Formwork materials: to CSA S269.1.
  - .1 For concrete without special architectural features, use wood and wood product formwork materials to CSA O121, CSA O141, CSA O151, CSA O437 or CSA O153.
  - .2 Form ties:
    - .1 Removable or internally disconnecting tie rods with or without spreader tubes, or snap-off metal ties, fixed or adjustable length, free of devices leaving holes larger than 25 mm (1") diameter in concrete surface.
    - .2 For Architectural concrete, use ties with plastic cones at each end.

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- .3 Form ties to be designed to act as ties and spreaders and to have a minimum working strength of 13 kN (3000 pounds).
  - .4 Snap ties to snap cleanly at least 25 mm (1") from concrete surface without damage to the concrete.
  - .5 Snap ties in Architectural concrete, to be internally disconnecting type which snaps cleanly at least 38 mm (1½") from concrete surface without damage to the concrete.
  - .3 Form liner: high density overlay plywood to CSA O121 or other special materials to achieve the required concrete finish.
  - .4 Form stripping agent: colourless mineral oil, non-toxic, low VOC, free of kerosene, with viscosity between 15 to 24 mm²/s (70 and 110s Saybolt Universal) at 40°C, flashpoint minimum 150°C, open cup.
  - .5 Grooves, reglets and chamfers: White pine selected for straightness and accurately dressed to size.
  - .2 Falsework materials: to CSA S269.1.
  - .3 Void Form: Cellular cardboard with minimum compressive strength of 62 kPa (9 psi) designed to carry weight of wet concrete and loads associated with placing concrete and also designed to disintegrate and create an air space below the fully hardened concrete.
  - .4 Frost cushion: expanded polystyrene, non-degradable, minimum compressive strength 27.5 kPa, configured to compensate for frost swelling of underlying soils and designed to carry a maximum load of 24 kPa with 5% deformation

### **2.3 Accessories**

- .1 Dovetail anchor slots: minimum 0.6 mm thick galvanized steel with insulation filled slots.
- .2 Weep hole tubes: plastic.

## **PART 3 - EXECUTION**

### **3.1 Fabrication and Erection**

- .1 Confirm to CSA A23.1.
- .2 Fabricate and erect falsework in accordance with CSA S269.1.
- .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 CSA S269.1 to produce finished concrete conforming to shape, dimensions, locations and levels indicated within tolerances required by CSA A23.1/A23.2.
- .6 Make formwork tight and flush faced to prevent the leakage of mortar and the creation of unspecified fins or panel outlines.
- .7 Form sides of footings unless Structural Drawings and Geotechnical report allow use of earth forms.
- .8 Obtain the Department Representative's approval for formed openings, slots and chases not indicated on Structural Drawings.

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- .9 Provide water stops and keys around temporary openings in basement and retaining walls for shoring rakers or similar purposes.
  - .10 Do not permit loads from formwork to be transmitted to adjacent existing structure.
  - .11 Apply a form coating and release agent uniformly to the contact surface of formwork panels before reuse.
  - .12 Use 19 mm (3/4") chamfer strips on external corners and 19 mm (3/4") fillets at interior corners, unless specified otherwise. Note that chamfers and fillets are not necessarily shown on drawings, for drafting simplicity.
  - .13 Form chases, slots, openings, drips, recesses, expansion and control joints as indicated on Architectural and Structural drawings.
  - .14 Build in anchors, sleeves, and other inserts required to accommodate Work specified in other sections.
  - .15 Anchors and inserts not to protrude beyond surfaces designated to receive applied finishes, including painting.
  - .16 Clean formwork in accordance with CSA A23.1/A23.2, before placing concrete.
  - .17 Build top form on sloping concrete where required to prevent concrete from flowing out of the form. Provide vents to allow air and bleed water to escape.
  - .18 Do not close wall forms before reinforcing steel has been reviewed by the Department Representative.
  - .19 Where removable tie rods are used for form ties, plug and seal tie holes to maintain the fire resistance, gas impermeability, soundproofing and waterproofing of the adjacent concrete.
  - .20 Provide lateral bracing as required to keep walls stable after formwork removal.
  - .21 Void form:
    - .1 Conform to manufacturer's recommendations.
    - .2 Place on sand leveling bed.
    - .3 Protect from moisture until concrete is about to be placed.
    - .4 Protect from excessive construction loads. Overlay with max. 3 mm (1/8") thick fibreboard if required to protect it from damage during construction.
    - .5 If void form collapses during construction, remove and replace affected area.
  - .22 Frost cushion:
    - .1 Store on site on raised platforms protected with lightproof cover.
    - .2 Place at bottom of form with flat surface facing upward.
    - .3 Provide plywood overlay as required to distribute stresses from point loads.

### 3.2 Joints

- .1 Refer to Typical Details and Drawings Notes for locations, detailing and maximum spacing requirements of all concrete joints.

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- .2 Provide construction joints in formed slab and slab on deck.
  - .3 Provide evenly spaced vertical control joints in walls.
  - .4 Provide expansion joints where shown on Structural Drawings. Remove all forming and filler material used during construction and provide clear space between structural elements equal to width specified.
  - .5 Provide construction gaps (closure strips) where shown on Structural Drawings.
  - .6 Refer to Section 03 30 00 for construction joints, sawcut joints, expansion / contraction joints and isolation joints in slab on grade and concrete toppings (as applicable).

### **3.3 Field Quality Control**

- .1 Refer to Section 01 45 00 - Quality Control.
- .2 Obtain field review of falsework and reshoring by the Professional Engineer responsible for that work prior to each pour. The Department Representative will not field review the formwork, falsework or reshoring.
- .3 An independent Inspection and Testing Agency will be appointed to inspect all features of formwork affecting appearance of finished architectural concrete surfaces for conformance with Contract documents.

### **3.4 Quality Assurance Inspections**

- .1 The Contractor shall notify the Departmental Representative to allow for inspection of any underlying materials, reinforcing materials, or formwork prior to closing up, or covering any items. In such cases, a minimum 72-hour notice must be provided to allow for scheduling of inspections.
- .2 The Contractor shall thoroughly photograph and make those photos available, of all concrete formwork.

**END OF SECTION**

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## **PART 1 - GENERAL**

### **1.1 Related Requirements**

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

### **1.2 References**

- .1 Editions of all Referenced Standards to be the ones designated by the applicable Building Code in force at the time of building permit application, as indicated on Structural Drawings. For Standards not referenced by the Building Code, use the latest editions.
- .2 CSA Group (CSA):
  - .1 CSA A23.1/A23.2, Concrete Materials and Methods of Concrete Construction/Test Methods and Standard Practices for Concrete.
  - .2 CSA G30.18, Carbon Steel Bars for Concrete Reinforcement.
  - .3 CSA G40.20/G40.21, General Requirements for Rolled or Welded Structural Quality Steel/Structural Quality Steel.
  - .4 CSA W186, Welding of Reinforcing Bars in Reinforced Concrete Construction.
- .3 Reinforcing Steel Institute of Canada (RSIC):
  - .1 Reinforcing Steel Manual of Standard Practice.
- .4 American Concrete Institute (ACI):
  - .1 SP-66, ACI Detailing Manual.
- .5 ASTM International Inc.:
  - .1 ASTM A1064/A1064M, Standard Specification for Carbon Steel Wire and Welded Wire Reinforcement, Plain and Deformed, for Concrete.
  - .2 ASTM A775/A775M, Standard Specification for Epoxy-Coated Reinforcing Steel.
  - .3 ASTM D3963 / D3963M, Standard Specification for Fabrication and Jobsite Handling of Epoxy-Coated Steel Reinforcing Bars.
  - .4 ASTM A1044 / A1044M, Standard Specification for Steel Stud Assemblies for Shear Reinforcement of Concrete.

### **1.3 Quality Assurance**

- .1 Qualifications
  - .1 Welding of reinforcing steel to be performed by welders certified under CSA W186.
  - .2 Shear stud reinforcing to be fabricated in an ICC ES approved facility.
  - .3 Epoxy coated reinforcing to be fabricated in plants certified by the CRSI for epoxy coated steel.

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- .1 The Contractor shall coordinate to have the Departmental Representative inspect all reinforcing steel a minimum of 24 hours prior to the pouring of concrete. The Contractor must provide a minimum 72-hour notice to the Departmental Representative prior to any inspections. The Departmental Representative will not be responsible for any costs associated with delays in concrete pouring resulting from the findings of the inspection.
  - .2 The Contractor shall have all corrected reinforcing steel deficiencies re-inspected by the Departmental Representative prior to covering with formwork or pouring concrete. At the Departmental Representative's discretion, the re-inspection may be supplemented with photos of the corrected deficiencies to be provided by the Contractor.

#### **1.4 Quality Control**

- .1 Submit in accordance with Section 01 45 00 - Quality Control.
- .2 Source Quality Control Submittals:
  - .1 Upon request, provide the Department Representative with certified copy of mill test report of reinforcing steel, showing physical and chemical analysis.
  - .2 Upon request, inform the Department Representative of proposed source of reinforcement material to be supplied.
  - .3 Upon request, provide the Department Representative with a copy of plant certificate by the Concrete Reinforcing Steel Institute for epoxy coating of reinforcement.

#### **1.5 Action and Informational Submittals**

- .1 Provide submittals in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Product Data:
  - .1 Submit manufacturer's data sheets for mechanical rebar splices.
- .3 Shop Drawings:
  - .1 Prepare shop drawings in accordance with RSIC Manual of Standard Practice unless the Contract Documents contain a more stringent requirement. Conform to ACI SP-66 Detailing Manual whenever a detail condition is not covered by any of the above.
  - .2 Submit plans, elevations, sections and details necessary to fabricate, place and review reinforcement without reference to structural drawings, including masonry wall reinforcement. Draw to scale not smaller than 1:50 ( $\frac{1}{4}" = 1'-0"$ ).
  - .3 Show on drawings:
    - .1 Sizes, spacings and locations of reinforcement, with identifying labels.
    - .2 Bar bending details.
    - .3 Lengths and locations of all lap splices.
    - .4 Types and locations of mechanical splices.
    - .5 Placing sequence.
    - .6 Large scale details at areas of steel concentration (such as column / beam / wall intersections), and around cast-ins.

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- .7 Bar lists.
  - .8 Quantities of reinforcement (including all rebar added to accommodate installation).
  - .9 Construction joint, control joint and pour gap locations.
  - .10 Strip dimensions for flat slab and flat plate.
  - .11 Concrete cover.
  - .12 Details and layouts of shear stud reinforcing.
  - .4 Do not release for fabrication reinforcing bars whose length may be affected by field conditions, such as the final elevation of footings, until obtaining the required field measurements.

## **PART 2 - PRODUCTS**

### **2.1 Materials**

- .1 Reinforcing steel: carbon steel, deformed bars to CSA G30.18., unless indicated otherwise.
- .2 Weldable Reinforcing steel: weldable low alloy steel deformed bars to CSA G30.18.
- .3 Stainless Reinforcing steel: deformed bars to ASTM A955/A955M.
- .4 Cold-drawn annealed steel wire ties: to ASTM A1064/A1064M.
- .5 Welded steel wire fabric: to ASTM A1064/A1064M. Provide in flat sheets only.
- .6 Chairs, bolsters, bar supports, spacers: to CSA A23.1/A23.2.
- .7 Mechanical splices: to concentrically align bars and develop specified tensile strength of rebar. Threaded couplers to have plastic internal coupler thread protectors.
- .8 Rebar terminators: oversized taper-threaded couplings capable to develop specified tensile strength of rebar; area to be not less than 5 times the rebar area.
- .9 Plain round bars: to CSA G40.20/G40.21.
- .10 Expansion cap for dowels at expansion / contraction joints: plastic, tight fitting, with internal pin to locate dowel and create void for expansion.

## **PART 3 - EXECUTION**

### **3.1 Fabrication**

- .1 Fabricate reinforcing steel in accordance with CSA A23.1/A23.2 and Reinforcing Steel Manual of Standard Practice.
- .2 Weld reinforcement in accordance with CSA W186 where indicated.
- .3 Fabricate shear stud reinforcing according to ASTM A1044. Weld studs to rail to develop yield strength of stud.
- .4 Ship bundles of bar reinforcement, clearly identified in accordance with bar lists.
- .5 Provide standard hooks at ends of all hooked bars.

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- .6 Substitute different size bars only if permitted in writing by the Department Representative.

### **3.2 Field Bending**

- .1 Do not field bend or field weld reinforcement except where indicated or authorized by the Department Representative.
- .2 When field bending is authorized, bend without heat, applying slow and steady pressure. Use tools which will limit bend radii to the values given in CSA A23.1.
- .3 Where key-creating stay form with pre-installed blind dowels is used, bend the dowels out using special tools approved by the stay form manufacturer.
- .4 Replace bars which develop cracks or splits.

### **3.3 Placing Reinforcement**

- .1 Place reinforcing steel in accordance with contract documents and CSA A23.1 / A23.2.
- .2 Use only the placing drawings reviewed by the Department Representative.
- .3 Remove all loose scale, dirt, oil or other coatings which would reduce bond.
- .4 Ensure cover to reinforcement is maintained during concrete pour.
- .5 Turn ends of tie wire towards the interior of concrete.
- .6 Support bars, chairs and spacers:
  - .1 Provide sufficient support bars, chairs, carriers and side form spacers as necessary to secure against displacement of reinforcement and maintain concrete cover before and during concrete placement. Support devices contacting surfaces exposed to the exterior to be non-corroding. Bars which are not shown on Structural Drawings and whose only function is supporting other reinforcing in lieu of other supporting devices to be considered accessories.
  - .2 Use bar supports for beams and slabs.
  - .3 Use side form spacers for walls and columns.
  - .4 Use plastic or plastic tipped bar supports and spacer with colour to match concrete for exposed concrete surfaces.
  - .5 Use plastic bar supports, epoxy coated support bars and plastic-coated tie wire for epoxy coated reinforcement.
  - .6 Use precast concrete chairs where supports rest on the ground. Where welded wire fabric is used in slabs-on-grade, place precast concrete chairs at 600 mm (2'-0") on centre each way. Do not attempt to position welded wire fabric by lifting it after concrete is poured.
- .7 Do not splice reinforcing at locations other than shown on placing or structural drawings without the Department Representative's written approval.
- .8 Do not cut reinforcement without the Department Representative written approval.
- .9 Unless otherwise noted on drawings, stagger alternate mechanical couplers 750 mm (2'-6") apart.

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- .10 Install end bearing compression splices so that bearing ends are fitted to within 3 degrees of full bearing after splice installed.
  - .11 Do not field weld reinforcement except where indicated or authorized by the Department Representative.
  - .12 Do not weld epoxy coated reinforcement.
  - .13 Obtain the Department Representative field review of all reinforcing materials and placement before pouring concrete.

#### **3.4 Field Touch-Up**

- .1 Touch up damaged and cut ends of epoxy coated reinforcing steel with compatible finish to provide continuous coating.

**END OF SECTION**

## **PART 1 - GENERAL**

### **1.1 Related Requirements**

- .1 Section 03 10 00: Concrete Forming and Accessories.
- .2 Section 03 20 00: Concrete Reinforcing.
- .3 Section 03 35 00: Concrete Finishing.

### **1.2 References**

- .1 Editions of all Referenced Standards to be the ones designated by the applicable Building Code in force at the time of building permit application, as indicated on Structural Drawings. For Standards not referenced by the Building Code, use the latest editions.
- .2 CSA Group (CSA):
  - .1 CSA A23.1/A23.2, Concrete Materials and Methods of Concrete Construction/Methods of Test and Standard Practices for Concrete.
  - .2 CSA A283, Qualification Code for Concrete Testing Laboratories.
  - .3 CSA A3000, Cementitious Materials Compendium (Consists of A3001, A3002, A3003, A3004 and A3005).
  - .4 CSA S413, Parking Structures.
- .3 ASTM International Inc.:
  - .1 ASTM C309, Standard Specification for Liquid Membrane-Forming Compounds for Curing Concrete.
  - .2 ASTM C920 – Standard Specification for Elastomeric Joint Sealants
  - .3 ASTM D1751, Standard Specification for Preformed Expansion Joint Filler for Concrete Paving and Structural Construction (Nonextruding and Resilient Bituminous Types).
  - .4 ASTM E1155M Standard Test Method for Determining FF Floor Flatness and FL Floor Levelness Number (Metric)
  - .5 ASTM C1059, Standard Specifications for Latex Agents for Bonding Fresh to Hardened Concrete
- .4 Canadian General Standards Board (CGSB):
  - .1 CGSB-51.34, Vapour Barrier, Polyethylene Sheet for Use in Building Construction.

### **1.3 Quality Assurance**

- .1 Qualifications
  - .1 Concrete supplier to have a valid “Certificate of Ready Mixed Concrete Production Facilities” issued by the relevant Ready Mixed Concrete Association.
- .2 Notify the Departmental Representative a minimum of 72 hours prior to pouring concrete to allow for scheduling of quality assurance testing and inspections.

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## **1.4 Quality Control**

- .1 Submit in accordance with Section 01 45 00 - Quality Control.
- .2 Minimum two weeks prior to starting concrete work, provide valid 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 For concrete with high volume of supplementary cementing materials (HVSCM concrete, as defined in CSA A23.1), perform trial mixes to ensure that the required properties are achieved.
- .4 Minimum four weeks prior to starting concrete work, provide the name and contact information of the proposed quality control testing agency to be used. The quality control testing agency may not be the same to be used by the Departmental Representative for Quality Assurance testing.
- .5 Minimum four weeks prior to starting concrete work, provide proposed quality control procedures on following items:
  - .1 Hot weather concrete.
  - .2 Cold weather concrete.
  - .3 Finishing.
  - .4 Protection.

## **1.5 Administrative Requirements**

- .1 Pre-installation Meeting: convene pre-installation meeting one week prior to beginning concrete works. Ensure key personnel to attend.
- .2 Batch Logs: keep record of each batch delivered to site.
- .3 Concrete Delivery Slips: Keep all concrete delivery slips ("driver's tickets") on site until building is completed. Record on delivery slip where concrete was placed, including time and date.

## **1.6 Action and Informational Submittals**

- .1 Provide submittals in accordance with Section 01 33 00 – Submittal Procedures.
- .2 Minimum 2 weeks prior to starting concrete work, submit all concrete mix designs, and indicate where each concrete mix is to be used.
- .3 Minimum 2 weeks prior to placing concrete, submit drawings showing proposed locations of all construction and control joints (including wall and slab on grade control joints) for the Department Representative review and approval.
- .4 Provide composite layout drawings showing all cast in place pipes and conduits.
- .5 Minimum submission requirements for each concrete mix design shall include the following:
  - .1 Minimum specified compressive strength at 28 days (or at the time specified on drawings).

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- .2 Maximum aggregate size.
  - .3 Aggregate type (if not normal density).
  - .4 Concrete density range, wet and dry (if not normal density).
  - .5 CSA exposure class.
  - .6 Cement type (if not type GU).
  - .7 Percentage and type of supplemental cementing materials.
  - .8 Maximum water/cementitious materials ratio.
  - .9 Slump at point of discharge.
  - .10 Assumed method of placement of concrete.
  - .11 Corrosion inhibitor (name and quantity, if applicable).
  - .12 Plastic or steel fibres (type, name and quantity, if applicable).
  - .13 Alkali-aggregate resistance.
  - .14 Architectural requirements (colour of cement and aggregate, if applicable).
  - .15 Maximum time from batching to placing concrete (if retarding admixtures are used).
  - .6 Concrete pours: provide accurate records of all concrete pours marked on a set of Structural Drawings.
  - .7 Flatness and levelness: when requested, submit measurements of slab tolerances for each concrete pour.
  - .8 On completion of the works, provide written report to the Department Representative certifying that the concrete in place meets performance requirements established in Part 2 - Products.

## **PART 2 - PRODUCTS**

### **2.1 Design Criteria**

- .1 To CSA A23.1/A23.2, Alternative 1 – Performance, and as described under Mixes and on Structural Drawings.

### **2.2 Performance Criteria**

- .1 Concrete supplier to meet the concrete performance criteria established by the Department Representative and to provide verification of compliance.

### **2.3 Materials**

- .1 Portland cement: to CSA A3001.
- .2 Cementitious hydraulic slag: to CSA A3000.
- .3 Fly ash: to CSA A3001, Type CI.
- .4 Water: to CSA A23.1.

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- .5 Aggregates: to CSA A23.1/A23.2. Do not use recycled concrete as aggregate.
  - .6 Admixtures: not to contain chlorides.
  - .7 Corrosion-inhibiting admixture: calcium nitrite solution.
  - .8 Plastic fibre additive: fibrillated polypropylene micro fibres at least 19 mm (3/4") in length.
  - .9 Shrinkage compensating grout: premixed compound consisting of non-metallic aggregate, Portland cement, water reducing and plasticizing agents to CSA A23.1/A23.2. Minimum compressive strength: 40 MPa at 28 days.
  - .10 Non premixed dry pack grout: composition of non metallic aggregate and Portland cement with sufficient water for mixture to retain its shape when made into ball by hand and capable of developing compressive strength of 40 MPa at 28 days.
  - .11 Curing/sealing compound: to CSA A23.1/A23.2 and ASTM C309, Type 1, Class B, water based acrylic, compatible with surface hardener where hardener is used.
  - .12 Pre-moulded joint fillers: min.12 (1/2") bituminous impregnated fiber board to ASTM D1751.
  - .13 Compressible filler: flexible polyethylene closed cell expansion joint filler to ASTM D 4819, type II.
  - .14 Joint Sealants: to ASTM C920, class 100/50.
  - .15 Weep hole tubes: plastic.
  - .16 Evaporation reducer: water based polymer liquid forming continuous monomolecular temporary film on fresh concrete surface.
  - .17 Penetrating sealer: water based, clear water repellent, at least equivalent to AT&U Type 1b as specified in Alberta Infrastructure and Transportation Publication B388.
  - .18 Bonding adhesive: synthetic latex per ASTM C1059.
  - .19 Non- slip nosing insert for concrete stairs: fine aluminum oxide strips, 6 mm (1/4") wide x 10 mm (3/8") deep.
  - .20 Vapour barrier to be min 0.25mm (10mils) polyethylene to CAN/SCGS-51.34. Provide vapour barrier under slabs placed on the ground. Lap minimum 150 (6") at joints and seal.
  - .21 Rigid insulation: extruded polystyrene boards per ASTM C578, structural grade, compressive strength 40 psi (275 kPa).
  - .22 Control joint filler: semi-rigid two component epoxy or polyurea with 100% solids, Shore A hardness (per ASTM D2240) min. 85, tensile strength at 7 days (per ASTM D638) min 5.0 MPa.
  - .23 Crack Filler: low viscosity epoxy resin
  - .24 Bond Breaker: 0.25 mm (10 mil) polyethylene or grade D, 30 minute building paper perforated with 8 mm (5/16") holes at 150 mm (6") centres, each way.
  - .25 Air Entrainment: all concrete to be placed inside and outside of the building are to have 4-7%.

## 2.4 Concrete Mixes

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- .1 Use ready-mix concrete. Proportion concrete in accordance with CSA A23.1, Alternative 1 - Performance Method for Specifying Concrete.
  - .2 Set performance characteristics of concrete in plastic state in coordination with all trades involved.
  - .3 Meet performance criteria of concrete in hardened state as shown on Structural Drawings and provide verification of compliance.
  - .4 Do not use admixtures containing chlorides.
  - .5 Supplementary cementing materials (SCM):
    - .1 Conform to CSA A23.1.
    - .2 Follow slag and fly ash manufacturers' directions for proportioning and mixing of concrete.
    - .3 Avoid using SCM in architecturally exposed concrete. If necessary to achieve the required exposure classification, SCM not to affect colour and texture of finished concrete.
    - .4 Do not use concrete with more than 40% of SCM when ambient temperature is forecast to be below +10°C at the time of concrete pour and during the seven days after the pour, except for footings, walls and columns.
    - .5 Reduce W/C ratio to 0.45 where using more than 40% of SCM in concrete for slabs and other horizontal finished surfaces, in order to reduce bleed water and to increase rate or strength gain.

## **PART 3 - EXECUTION**

### **3.1 Preparation**

- .1 Provide advanced notice as indicated on drawings to allow the Department Representative's field review of reinforcing prior to placing of concrete/closing of wall forms.
- .2 Obtain the Department Representative's written approval before placing concrete.
- .3 Obtain written approval of each foundation bearing surface by the Geotechnical Consultant before placing concrete.
- .4 Remove water and disturbed soil from excavations before placing concrete.
- .5 Before placing slab-on-grade, confirm that subgrade and backfill meet specifications and are free of frost and surface water.
- .6 Provide vapour barrier under all slabs placed on the ground including slabs-on-grade and framed slabs.
  - .1 Lap minimum 150 mm at joints and seal.
  - .2 Seal all punctures before placing concrete.
  - .3 Use patching material at least 150 mm larger than puncture and seal.
- .7 Place concrete reinforcing in accordance with Section 03 20 00 - Concrete Reinforcing.

### **3.2 Installation/Application**

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- .1 Set sleeves, conduits, pipe hangers, weep hole tubes, drains and other inserts and openings as indicated or specified elsewhere.
  - .2 Check locations and sizes of sleeves and openings shown on Structural Drawings with Architectural, Mechanical and Electrical Drawings. Notify the Department Representative of any discrepancies.
  - .3 Obtain approval from the Department Representative for any required sleeves and openings which are not shown on Structural Drawings or reviewed sleeving drawings.
  - .4 Set anchor rods using templates under supervision of appropriate trade prior to placing concrete. Locate each anchor rod group to within 6 mm (1/4") of required location.

### **3.3 Placing Concrete**

- .1 Place concrete in accordance with CSA A23.1.
- .2 Delivery and place concrete with minimum re-handling.
- .3 If concrete is pumped or placed pneumatically, control discharge velocity to prevent separation or scattering of concrete mix ingredients.
- .4 Place concrete in a continuous operation without cold joints. If cold joints develop inadvertently, notify the Department Representative to obtain instructions for required remedial work.
- .5 Where higher strength concrete needs to be puddled in slabs above columns and walls, place adjacent lower strength slab concrete within 30 minutes of pouring the puddled concrete.
- .6 Do not overload forms.
- .7 Use rubber tipped vibrators for concrete containing epoxy coated reinforcement.
- .8 Cast slabs and beams at least two hours after casting the supporting columns and walls.
- .9 Cast slabs with a top surface that is level or sloping as required by the Drawings. Allow for cambering where required.
- .10 Where steel beams are used, ensure that slab thickness is as specified. Measure from top of steel to control thickness.
- .11 Concrete exposed to view:
  - .1 Exposed surfaces to be dense, even, uniform in colour, texture and distribution of exposed aggregate.
  - .2 Defects such as honeycombing, voids, loss of fines, visible flow lines, cold joints or excessive bug holes may be cause for rejection at the discretion of the Architect.
- .12 Maintain accurate records of all poured concrete including extent, date and location of each pour, concrete mix used, ambient air temperature, test samples taken and falsework removal date and mark on a set of Structural Drawings.
- .13 All concrete to be placed to negate the need for parging of surfaces to meet the finishing specifications. Parging will not be permitted without prior written approval from the Departmental Representative.

### **3.4 Finishing Concrete**

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- .1 Finish concrete to CSA A23.1/A23.2.
  - .2 Cooperate with any trade applying finishes to concrete surfaces and provide surfaces which will ensure adequate bond. Provide chases and reglets where required.
  - .3 Finishing Formed Surfaces:
    - .1 Completely fill holes left by through-bolts with grout.
    - .2 Do not patch surfaces unless instructed in writing by the Department Representative.
    - .3 Concrete exposed to view:
      - .1 Provide smooth-form finish.
      - .2 Rub exposed sharp edges with carborundum to produce 3 mm (1/8") radius edges unless otherwise indicated.

### **3.5 Concrete Curing and Protection**

- .1 At a minimum cure and protect concrete in accordance with CSA A23.1
- .2 Extend curing and protection period until concrete has reached following strength levels for structural safety:
  - .1 Framed slabs and beams: 75% of specified 28 day strength.
  - .2 Columns, walls, piers and footings: 50% of specified 28 day strength
- .3 For concrete containing supplementary cementing materials, curing and protection times may need to be extended beyond those outlined by CSA A23.1 to achieve the required structural properties.
- .4 Cure slab surfaces immediately after finishing is completed. Unless otherwise noted or required, use a curing compound compatible with applied finishes.
- .5 Do not use curing compound on parking garage slabs and where bonded topping is to be applied. Cover slab surfaces with absorptive mat or fabric and keep continuously wet.
- .6 Slabs on grade and structural slabs receiving resilient floor or other moisture sensitive finishes:
  - .1 Apply 24 hours of continuous sprinkling with water. Start immediately after finishing slab.
  - .2 Cover slab for at least the following 72 hours using plastic sheets with joints taped and free edges covered.
  - .3 Protect finished and cured slab from surface water (i.e. rain, snow).
  - .4 Refer to Architectural Specifications for required testing methods prior to placing floor finishes.
- .7 Concrete exposed to view:
  - .1 Protect during construction period from wear, damage, marking, discolouration, staining and becoming coated with concrete leakage.
  - .2 Unless rejected, repair damage and remove marks and stains to the approval of the Architect.

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- .8 Do not load concrete until sufficient strength is developed.

### 3.6 Slabs on Grade

- .1 Ensure finished floor slab surface meets grading requirements to provide sufficient drainage to floor drains and prevent any surface ponding without additional patching or leveling following the initial placement.
- .2 Ensure finished floor slab surface uniformly meets the design floor elevation under the interior wall locations as part of the initial pour. Additional chipping, patching or levelling following the initial concrete placement will not be permitted without a credit being provided.
- .3 Construction joints and control joints:
- .1 Refer to Notes on Structural Drawings for maximum spacing requirements.
- .2 Saw cut control joints to depth equal to one quarter of the concrete thickness u/n. Alternatively, for slabs on grade not exposed to view or vehicle traffic, create control joints by inserting pre-assembled "T" shaped plastic joints into fresh concrete; remove top part prior to concrete finishing.
- .3 Locate joints on column lines wherever possible and on intermediate lines, which result in approximately square panels, without re-entrant corners.
- .4 Do not create "L" shaped panels nor "T" shaped joint intersections.
- .5 Protect edges of sawcuts from breakage.
- .6 Clean out sawcuts in concrete exposed to view or vehicle traffic and fill with control joint filler after concrete is at least 120 days old.
- .7 Sawcut top 25 mm (1") at construction joints in exposed concrete for a width of 5 mm (3/16") and fill with control joint filler after concrete is at least 120 days old. Alternatively, form construction joint with a 5mm (3/16") thick chamfer strip at top. Depth of the strip to be at least equal to 1/4 of slab thickness.
- .8 Clean out sawcuts in other concrete and fill with a sand-cement paste one month prior to installing floor coverings.
- .4 Isolation Joints:
- .1 Unless otherwise shown on structural drawings, provide pre-moulded joint filler of the same depth as the thickness of the concrete wherever slabs-on-grade abut foundation walls, columns and piers. Omit if slab is chased or dowelled into structure.
- .2 Furnish filler for each joint in single piece for depth and width required for joint.
- .3 When more than one piece of filler is required for a joint, fasten abutting ends and hold securely to shape by stapling or other positive fastening.
- .5 Cracks in Slabs-on-Grade:
- .1 Extensive cracking of slabs-on-grade or cracks in excess of 3 mm (1/8") in width may be cause for rejection of slab or portion of slab at the Architect's discretion.
- .2 Protect edges of cracks in slabs-on-grade from breakage.

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- .3 Exposed slab on grade: Unless slab is rejected, repair cracks that are over 0.4 mm (0.016") wide:
    - .1 Fill cracks with a sand-cement grout after concrete is at least 120 days old.
    - .2 Seven days later, cut out top 20 mm (3/4") of crack for a width of 5 mm (3/16") and fill with control joint filler.
  - .4 Architectural slab on grade: Unless slab is rejected, repair cracks that are over 0.2 mm (0.008") wide:
    - .1 Fill cracks with epoxy after concrete is at least 180 days old.
    - .2 Take all measures necessary to prevent epoxy on surface of exposed slab.
    - .3 Have manufacturer's technical representative present during initial repairs.

### **3.7 Penetrating sealer**

- .1 Concrete to receive penetrating sealer to be at least 28 days old.
- .2 Surfaces to be treated with the sealer to be dry and free of dirt and other contaminants.
- .3 Completely remove all curing compounds before the sealer application.
- .4 Follow manufacturer's recommendations for coverage rate and application procedure.
- .5 Do not apply in inclement weather or if ambient air temperature or concrete surface temperature is less than 5°C or more than 38°C.

### **3.8 Inspection and Testing:**

- .1 An independent Inspection and Testing Agency (certified under CSA A283 with category to suit testing provided) will be appointed to carry out inspection and testing of concrete and concrete materials and check conformance with applicable Standards and Contract documents.
- .2 Assist the Inspection and Testing Agency in its work. Notify as to the Work Schedule and provide safe access to the work area as required. Provide concrete samples.
- .3 The Agency will submit reports covering the work inspected and the testing performed. The reports will include the Supplier's mix design numbers, locations in structure to which the tests relate and comments on abnormal results and conditions. The reports will be provided not later than five working days after the testing is completed.
- .4 Sampling, storing, curing and testing of concrete will be in accordance with CSA A23.1/A23.2.
- .5 The Agency will review all submittals pertaining to concrete mix designs and certification of plant, equipment and materials.
- .6 Compressive Strength Testing:
  - .1 One test is required for each 25 cubic meters of placed concrete, but not less than one test for each concrete mix placed each day. At least 3 tests are required for each class of concrete used.

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- .2 A group of three cylinders for each test will be provided, Location of concrete placement will be recorded for each cylinder set. One specimen will be tested at 7 and one at 28 days. The third specimen will be tested at 56 days if the required strength at 28 days is not achieved.
  - .3 If the final concrete strength is specified at 56, 90 or 120 days, a group of four cylinders will be provided. One specimen will be tested at 7 and one at 28 days, with the third specimen tested at the time the final concrete strength is specified. If the required strength is not achieved at the time specified, the fourth specimen will be tested 28 days later.
  - .4 One additional cylinder will be provided for each concrete mix during cold weather concreting. The specimens will be cured on site adjacent to and under the same conditions as the work they represent and will be tested prior to form removal.
  - .5 If standard on site cured cylinders are used to determine concrete strength prior to removal of formwork, they will be kept adjacent to and under the same conditions as the work they represent.
  - .6 If pull out tests are used to determine concrete strength prior to removal of formwork, the Inspection and Testing Agency will supply, locate and test pull out inserts. The inserts not to be located on surfaces exposed to view.
  - .7 If maturity tests are used to determine concrete strength prior to removal of formwork, the Inspection and Testing Agency will develop strength-maturity relationship curves, provide and install temperature sensors into fresh concrete and interpret readings in accordance with ASTM 1074,
  - .7 Slump testing:
    - .1 A minimum of one standard slump test will be conducted for every compressive strength test taken.
  - .8 Air Entrainment Testing:
    - .1 A minimum of one standard test for air content in plastic concrete will be conducted for each 25 cubic meters of each air entrained concrete mix, or each time a separate concrete pour is taking place, whichever is greater.
  - .9 Mass Concrete Testing:
    - .1 All concrete slabs (including raft foundation slabs) over 600 mm (2'-0") thick, and all walls over 1000 mm (3'-4") thick are considered mass concrete.
    - .2 The Agency will record concrete temperature at placing.
    - .3 The Agency will record concrete temperature and temperature gradient during the 7 day curing period by providing, installing and monitor sufficient number of thermocouples.
  - .10 Fresh Density Testing:

One standard fresh density test will be performed on site for each 50 cubic meters of semi-low density, low density and high-density concrete. Assist the Agency to correlate fresh density with air-dry density prior to the work beginning on site. Reports will include both fresh density and air-dry density.
  - .11 Bond Strength Testing:

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- .1 One standard bond test will be provided for each 200 square meters of bonded concrete topping placed over hardened concrete and designed to act compositely with it.

**END OF SECTION**

**Part 1            General**

**1.1            SECTION INCLUDES**

- .1    Section includes, but is not limited to:
  - .1       Concrete floor finishing, and floor flatness and level tolerances.
  - .2       Concrete floor sealing.

**1.2            RELATED REQUIREMENTS**

- .1    Section 07 92 00 - Joint Sealants
- .2    Drawings S100, S101, and S110

**1.3            REFERENCE STANDARDS**

- .1    ASTM International (ASTM)
  - .1       ASTM C309-19, Standard Specification for Liquid Membrane-Forming Compounds for Curing Concrete.

**1.4            ACTION AND INFORMATIONAL SUBMITTALS**

- .1    Submit submittals in accordance with Section 01 33 00 - Submittal Procedures.
- .2    Product Data:
  - .1       Provide manufacturer's printed product literature and data sheets for concrete sealers, and include product characteristics, performance criteria, finish and limitations.
  - .2       Provide electronic copies of SDS.
  - .3       Include application instructions for concrete sealers.
- .3    Shop Drawings:
  - .1       Submit a detailed proposed floor slab grading plan, before installing under slab rough ins. Include confirming slab elevation at wall locations, transition areas, each floor drain and floor mounted fixture elevation, and slope, measured in percentages, for all portions of the floor, including the maximum and minimum slopes on each quarter area that slopes towards each floor drain.
    - .1           Refer to 3.3 SLAB FINISHES for slope requirements.
    - .2           Identify any areas where the above noted requirements are not achievable.
  - .2       The review version of the shop drawings act as the design to be constructed.

**1.5            QUALITY CONTROL**

- .1    Quality Control: In accordance with Section 01 45 00 - Quality Control.
- .2    Minimum four weeks before starting concrete finishing work, provide proposed quality control procedures for review by Consultant on following items:
  - .1       Finishing, and
  - .2       Sealing.

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## **1.6 DELIVERY, STORAGE AND HANDLING**

- .1 Deliver, store and handle materials in accordance with Section 01 61 00 - Common Product Requirements and with manufacturer's written instructions.
- .2 Delivery and Acceptance Requirements: Deliver materials to site in original factory packaging, labelled with manufacturer's name, address.
- .3 Storage and Handling Requirements: Comply with requirements of Workplace Hazardous Materials Information System (WHMIS) regarding storage, handling and disposal of hazardous materials.

## **1.7 SITE CONDITIONS**

- .1 Temperature, relative humidity, moisture content.
  - .1 Apply membranes only when surfaces and ambient temperatures are within manufacturers' prescribed limits.
  - .2 Concrete substrate to be within moisture limits prescribed by manufacturer. Install membrane on dry substrate, free of snow and ice, use only dry materials and apply only during weather that will not introduce moisture into system.
- .2 Temporary lighting: Minimum 1200 W light source, placed 2.5 m above floor surface, for each 40 sq m of floor being treated.
- .3 Electrical power: Provide sufficient electrical power to operate equipment normally used during construction.
- .4 Work area: Make work area watertight, protected against rain and detrimental weather conditions.
- .5 Temperature: Maintain minimum 10 degrees C ambient temperature for seven days before installation and minimum 48 hours after completion of work and maintain relative humidity maximum 40% during same period.
- .6 Safety: Comply with requirements of Workplace Hazardous Materials Information System (WHMIS) regarding use, handling, storage, and disposal of hazardous materials.
- .7 Ventilation:
  - .1 Ventilate area of work by use of reviewed portable supply and exhaust fans.
  - .2 Ventilate enclosed spaces in accordance with Section 01 51 00 - Temporary Utilities.
  - .3 Provide continuous ventilation during and for 48 hours after coating application.

## **Part 2 Products**

### **2.1 PERFORMANCE REQUIREMENTS**

- .1 Product quality and quality of work in accordance with Section 01 61 00 - Common Product Requirements.
- .2 Submit written declaration components used are compatible and do not adversely impact finished flooring products and their installation adhesives.
- .3 Do not use curing compounds on surfaces to which other materials are to be bonded.

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## **2.2 SEALING COMPOUNDS**

- .1 Surface sealer: To ASTM 309 Type 1, Class A, clear. Acceptable products:
  - .1 Florseal WB18, by Sika.
  - .2 Intraguard, by W.R. Meadows.
  - .3 Other preapproved alternate.
- .2 Surface sealers are not manufactured or formulated with aromatic solvents, formaldehyde, halogenated solvents, mercury, lead, cadmium, hexavalent chromium and their compounds.

## **2.3 CHEMICAL HARDENERS**

- .1 Non-metallic, aggregate. Acceptable products:
  - .1 Sika Diamag 7 by Sika.
  - .2 Target Non-metallic floor hardener by Target.
  - .3 Other preapproved product.

## **2.4 SEALANTS**

- .1 Sealant: in accordance with Section 07 92 00.

## **2.5 MIXES**

- .1 Mixing ratios: In accordance with manufacturer's written instructions.

# **Part 3 Execution**

## **3.1 EXAMINATION**

- .1 Verify that slab and substrate surfaces, and site conditions are ready to receive work and in accordance with manufacturer's written instruction and as indicated on design and reviewed shop drawings.
  - .1 Visually inspect substrate.
  - .2 Inform Consultant of unacceptable conditions immediately upon discovery.
  - .3 Proceed with installation only after unacceptable conditions have been remedied.

## **3.2 PREPARATION OF EXISTING SLAB**

- .1 Rub exposed sharp edges of concrete with carborundum to produce 3 mm radiused edges unless otherwise indicated.
- .2 Saw cut control joints in accordance with Drawings S100 and S110.
- .3 Use strong solvent or mechanical stripping to remove chlorinated rubber or existing surface coatings.
- .4 Use protective clothing, eye protection, and respiratory equipment during stripping of chlorinated rubber or existing surface coatings.
- .5 Protect adjacent surfaces with plastic sheeting during color staining and sealing.

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### 3.3 SLAB FINISHES

- .1 Finish concrete in accordance with CSA-A23.1, supplemented with the following sentences.
- .2 Tops of floor slabs, including slabs on grade, are to be brought to an even, level or sloping surface as indicated, ready to receive the specified finish.
- .3 Finish concrete floors to a hard steel trowelled, or wood trowel finish on sloping surfaces, finish unless otherwise indicated. Place, strike off, consolidate, level and float to the indicated elevation. Begin trowelling after surface has received a float finish. Slab drying must proceed naturally and must not be hastened by the dusting on of dry cement or sand. Lightly tool edges at construction joints, slab edges must not be depressed along bulkheads during finishing operations, particularly hand trowelling. Provide standard trowel finish to sub-slabs.
- .4 Interior floor slab to be uniformly finished under all interior walls within 3 mm of the stated finished floor slab elevation.
- .5 Interior floor slab to be continuously graded from interior and exterior walls to floor drains to prevent any surface ponding in unintended surface depressions. In no case will surfaces sloping towards walls be permitted.
- .6 Floor drains finished elevations are to be individually set to maintain finished floor surface slopes between 1 % - 5 % from the fixed finished floor elevation at interior and exterior wall towards the floor drains. This will require a variation between finished drain elevations.
- .7 Obtain written permission from the Departmental Representative before finishing the interior floor slab less than 1 % or greater than 5% slope towards drains.
- .8 Floor slab grade transitions are to be rounded to hide the visibility of grading transitions and reduce tripping hazards.
- .9 If slabs-on-grade "curl" at edges, grind edges to maintain finish tolerances.
- .10 Depress floor slabs where shown and as required for floor finishes where indicated.
- .11 House keeping pads: slope away from adjacent walls between 1 – 3%.
- .12 Exterior sidewalks, slabs, and aprons to be non-slip (broom finish) with edges steel trowelled and control joints installed at junctions with other materials. Refer to drawings for control joint pattern. Edge trowel across walks at a distance equal to the width of the walks.

### 3.4 APPLICATION

- .1 Apply concrete sealer and hardener in accordance with sealer manufacturer's written instructions.
- .2 After floor treatment is dry, seal control joints and joints at junction with vertical surfaces with sealant.
  - .1 Sealants: In accordance with manufacturer's written instructions and Section 07 92 00.
- .3 Clean over spray. Clean sealant from adjacent surfaces.

**3.5 CLEANING**

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

**3.6 PROTECTION**

- .1 Protect finished installation in accordance with manufacturer's instructions.

**END OF SECTION**

**Part 1            General**

**1.1            SECTION INCLUDES**

- .1    Section includes, but is not limited to:
  - .1       Z-girt framing in wall assemblies.

**1.2            RELATED REQUIREMENTS**

- .1    Section 07 21 13 - Board Insulation
- .2    Section 07 27 00 - Air Barriers
- .3    Section 07 42 46 - Fibre Reinforced Cementitious Wall Panels
- .4    Section 07 62 00 - Sheet Metal Flashing and Trim

**1.3            REFERENCE STANDARDS**

- .1    ASTM International
  - .1       ASTM A123/A123M-15, Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products.
  - .2       ASTM A653/A653M-15e1, Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.
  - .3       ASTM A792/A792M-10 (2015), Standard Specification for Steel Sheet, 55% Aluminum-Zinc Alloy-Coated by the Hot-Dip Process.
- .2    CSA Group
  - .1       CSA W47.1-09R (2014), Certification of Companies for Fusion Welding of Steel Structures.
  - .2       CSA W55.3-08 (R2013), Certification of Companies for Resistance Welding of Steel and Aluminum.
  - .3       CSA W59-13, Welded Steel Construction (Metal Arc Welding) Metric.
  - .4       CAN/CSA S136-12 Package, North American Specification for the Design of Cold Formed Steel Structural Members.
- .3    Canadian Sheet Steel Building Institute (CSSBI)
  - .1       CSSBI 51-06, Lightweight Steel Framing Design Manual.
  - .2       CSSBI Fact Sheet #3 February 2006, Care and Maintenance of Prefinished Sheet Steel Building Products.
  - .3       CSSBI Technical Bulletin Vol. 7, No. 2 September 2011, Changing Standard Thicknesses for Canadian Lightweight Steel Framing Applications.
  - .4       CSSBI S5-11, Guide Specification for Wind Bearing Steel Studs.
- .4    Master Painters Institute (MPI)
  - .1       Architectural Painting Specification Manual - current edition.

**1.4            ACTION AND INFORMATIONAL SUBMITTALS**

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

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- .2 Product Data:
    - .1 Submit manufacturer's instructions, printed product literature, data sheets, and mill reports for structural metal studs and include product characteristics, performance criteria, physical size, finish, and limitations.
    - .2 Submit electronic copy of WHMIS SDS.
  - .3 Shop Drawings:
    - .1 Submit drawings stamped and signed by professional engineer registered or licensed in Alberta, Canada.
    - .2 Indicate design loads, member sizes, materials, design thickness exclusive of coatings, coating specifications, connection and bracing details, screw sizes and spacing, and anchors.
    - .3 Indicate locations, dimensions, openings, and requirements of related work.
    - .4 Indicate welds by welding symbols as defined in CSA W59.

## **1.5 QUALITY ASSURANCE**

- .1 Engage a professional structural engineer registered in the Province of Alberta qualified and experienced in the design of structural steel studs to be responsible for the design of the structural steel studs and connection of the top and bottom track to the supporting structure, and to prepare, seal, and sign shop drawings and to perform field reviews.
- .2 Contractor's Professional Engineer responsible for this work is to inspect the fabrication and erection of steel studs and components.
- .3 Fire Test Response Characteristics: where indicated, provide structural metal stud framing identical to that of assemblies tested for fire resistance per CAN/ULC S101 by a testing and inspection agency acceptable to authorities having jurisdiction.
- .4 Test Reports: submit certified test reports showing compliance with specified performance characteristics and physical properties.
- .5 Certificates: submit product certificates signed by manufacturer certifying materials comply with specified performance characteristics and criteria and physical requirements.

## **1.6 DELIVERY, STORAGE AND HANDLING**

- .1 Deliver, store and handle materials in accordance with Section 01 61 00 - Common Product Requirements and with manufacturer's written instructions.
- .2 Storage and Handling Requirements:
  - .1 Store materials off ground, in dry location, and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.
  - .2 Store and protect structural metal studs from nicks, scratches, and blemishes.
  - .3 Protect steel studs during transportation, site storage and installation in accordance with CSSBI Sheet Steel Facts #3.
  - .4 Handle and protect galvanized materials from damage to zinc coating.
  - .5 Replace defective or damaged materials with new.

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**Part 2            Products**

**2.1                SYSTEMS**

- .1      Design z-girt framing to resist wind loads for the Banff area using building code climatic data: 1 in 50 year loads for strength and 1 in 50 year loads for deflection.
- .2      Design z-girt framing in accordance with CAN/CGSB 7.1 and CSA S136, limit states design principles using factored loads and resistances, to support loads and forces indicated on the drawings and as specified.
- .3      Calculate loads and load factors in accordance with the NBC(AE).
- .4      Determine resistances and resistance factors in accordance with the NBC(AE) and CSA S136.
- .5      Design system to accommodate construction tolerances, deflection of building structural members and clearances of intended openings.
- .6      Design bridging to prevent rotation and translation and provide structural integrity.
- .7      Design systems to provide a maximum deflection of L/600 in accordance with CSA S136. Limit free play and movement in connections perpendicular to the plane of the framing to 2 mm relative to the building structure.
- .8      Z-girt framing widths are as indicated. Adjust z-girt framing thickness and spacing or both as required by design criteria. Use greater or less widths only if reviewed by the Consultant.
- .9      Design system and attachments to accommodate the range of tolerances permitted in adjoining materials.
- .10     Provide for differential in floor to head height.
- .11     Take into account local loadings due to anchorage of cladding and exterior wall mounted fixtures where indicated.

**2.2                MATERIALS**

- .1      Steel: to CAN/CSA S136, fabricated from ASTM A653/A653M, Grade 340 steel.
- .2      Zinc coated steel sheet: quality to ASTM A653/A653M, with Z275 designation coating.
- .3      Aluminum-zinc alloy coated steel sheet: quality to ASTM A792/A792M, with AZM180 designation coating.
- .4      Welding materials: to CSAW59 and certified by Canadian Welding Bureau.
- .5      Screws: hex, pan or wafer head; self-drilling, self-tapping sheet metal screws, 400 series stainless steel fasteners coated with zinc or cadmium and dichromate conversion coating or corrosion protected with minimum zinc coating thickness of 0.008 mm, length 10 mm.
- .6      Anchors: concrete expansion anchors or other suitable drilled type fasteners. 400 series stainless steel coated with zinc and dichromate conversion coating. Power actuated fasteners are not permitted.
- .7      Bolts, nuts, washers:
  - .1      Hot dipped galvanized to ASTM A123/A123M, 600 g/m<sup>2</sup> zinc coating.

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.2 To ASTM A307.

.8 Touch up primer: zinc rich, to CAN/CGSB-1.181 or MPI #18.

.9 Thermal Insulation: in accordance with Section 07 21 13 - Board Insulation.

## **2.3 METAL FRAMING**

.1 Z-girts: minimum 1.092 mm base metal thickness, Z275 galvanized Z girts of sizes as indicated. Fabricate all horizontal Z girts with a 2% slope to the exterior to allow water to drain off the Z-girt surfaces.

## **2.4 SOURCE QUALITY CONTROL**

.1 Mill reports for material properties submitted per 1.4.2.1 Product Data and included with engineer reports as specified in 3.4 FIELD QUALITY CONTROL.

# **Part 3 Execution**

## **3.1 EXAMINATION**

.1 Verification of Conditions: verify conditions of substrate previously installed under other Sections or Contracts acceptable for structural metal stud in accordance with manufacturer's written instructions.

.1 Visually inspect substrate.

.2 Inform Consultant of unacceptable conditions immediately upon discovery.

.3 Proceed with installation only after unacceptable conditions remedied.

## **3.2 GENERAL**

.1 Weld in accordance with CSA W59.

.2 Certification of companies: to CSA W47.1 for fusion welding and CSA W55.3 for resistance welding.

.3 Do structural metal stud framing work to CSSBI S5.

## **3.3 Z-GIRT FRAMING**

.1 Install Z girt framing to locations indicated. Coordinate with installation of air barriers specified in Section 07 27 00 and insulation specified in Section 07 21 13.

.2 Notch back of horizontal Z girts, to allow for drainage.

.3 Install Z girt framing around openings, and at ends to provide support for cladding systems.

.4 Fasten Z girts securely using corrosion resistant fasteners. Ends of Z girts must occur over firm bearing.

## **3.4 FIELD QUALITY CONTROL**

.1 Engineer responsible for design of the structural metal stud framing system and preparation of shop drawings, must review the Work in progress at the site, regularly during construction and submit field reports to the Consultant for each visit.

- .2 Include in these field reviews, review of mill test reports, member sizes and material thickness, coating thicknesses, screwed connections, erection tolerances, and field cutting, including cutting and patching for other trades.

### **3.5 ENGINEER'S CONFIRMATION LETTER**

- .1 At the completion of work, provide to the Consultant, a letter from the Contractor's Engineer confirming that:
  - .1 Structural metal stud framing systems and components are fabricated and erected in conformance with their design.
  - .2 Structural metal stud framing systems are capable of supporting the loads specified or indicated on the reviewed shop drawings.
  - .3 Structural metal stud systems have been designed and installed to conform to the seismic restraint requirements of the NBC(AE).
  - .4 Components are fabricated and erected in accordance with the reviewed shop drawings.

### **3.6 CLEANING**

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

### **3.7 PROTECTION**

- .1 Protect installed products and components from damage during construction.
- .2 Repair damage to adjacent materials caused by structural metal stud installation.

**END OF SECTION**

**Part 1            General**

**1.1            SECTION INCLUDES**

- .1    Section includes, but is not limited to:
  - .1       Miscellaneous wood blocking and strapping.
  - .2       Miscellaneous wood blocking for flashing.
  - .3       Miscellaneous wood blocking and backing for washroom accessories and accessories to be installed in the future, other wall or ceiling mounted equipment.
  - .4       Recycled plastic lumber.
  - .5       Preservative treatment for wood members.
  - .6       Communications and walls in Mechanical Room.

**1.2            RELATED REQUIREMENTS**

- .1    Section 07 26 00 - Vapour Retarders
- .2    Section 07 27 00 - Air Barriers
- .3    Section 07 62 00 - Sheet Metal Flashing and Trim
- .4    Section 07 92 00 - Joint Sealants
- .5    Section 08 11 00 - Metal Doors And Frames
- .6    Section 09 21 16 - Gypsum Board Assemblies
- .7    Section 10 28 10 - Toilet and Bath Accessories

**1.3            REFERENCE STANDARDS**

- .1    ASTM International (ASTM)
  - .1       ASTM A123/A123M-13, Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products.
  - .2       ASTM A153/A153M-09, Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware.
  - .3       ASTM A307-14 Standard Specification for Carbon Steel Bolts, Studs, and Threaded Rod 60000 PSI Tensile Strength. Not referenced in Section, include if required.
  - .4       ASTM A480/A480M-15 Standard Specification for General Requirements for Flat-Rolled Stainless and Heat-Resisting Steel Plate, Sheet and Strip.
  - .5       ASTM A653/A653M13, Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.
  - .6       ASTM F1667-13, Standard Specification for Driven Fasteners: Nails, Spikes and Staples.
  - .7       ASTM F2329/F2329M-15 Standard Specification for Zinc Coating, Hot-Dip, Requirements for Application to Carbon and Alloy Steel Bolts, Screws, Washers, Nuts, and Special Threaded Fasteners.
- .2    American Wood-Preservers' Association (AWPA)

- .1 AWP M2-15, Standard for Inspection of Treated Wood Products. Typically, all references have been removed, include only for specialized applications.
- .2 AWP M4-11, Standard for the Care of Preservative-Treated Wood Products.
- .3 CSA Group (CSA)
  - .1 CSA O80 Series-08, Wood Preservation.
  - .2 CSA O86-14, Engineered Design in Wood
  - .3 CSA O112.9-10, Evaluation of Adhesives for Structural Wood Products (Exterior Exposure).
  - .4 CSA O121-08(R2013), Douglas Fir Plywood.
  - .5 CSA O141-05(R2014), Softwood Lumber.
  - .6 CSA O325-07(R2012), Construction Sheathing.
- .4 National Lumber Grades Authority (NLGA)
  - .1 Standard Grading Rules for Canadian Lumber 2014.
- .5 National Research Council Canada (NRC)
  - .1 National Building Code -2019 Alberta Edition (NBC(AE)).

#### **1.4 ACTION AND INFORMATIONAL SUBMITTALS**

- .1 Submit in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Product Data:
  - .1 Submit manufacturer's instructions, printed product literature and data sheets for wood products, treated wood products, recycled plastic lumber, and accessories and include product characteristics, performance criteria, physical size, finish and limitations.
  - .2 Submit manufacturer's installation instructions.
- .3 Products treated with fire-retardant by pressure impregnation:
  - .1 Submit the following information certified by authorized signing officer of treatment plant:
    - .1 Information listed in AWP M2 and revisions specified in CSA O80 Series, Supplementary Requirement to AWP M2 applicable to specified treatment.
    - .2 Moisture content after drying following treatment with fire-retardant.
    - .3 Acceptable types of paint, stain, and clear finishes that may be used over treated materials to be finished after treatment.
  - .2 Manufacturers recommended metal connector and fastener materials and corrosion protection.
  - .3 Product recommendation for field treatment.
  - .4 Submit manufacturer's installation instructions.
- .4 Shop Drawings:
  - .1 For structural applications, submit drawings stamped and signed by professional engineer registered or licensed in the Province of Alberta, Canada.
  - .2 Include on drawings:

- .1 Indicate configuration and spacing of joists, hanger and connector types, fasteners, locations and design values; bearing details.
- .2 Submit stress diagrams or print out of computer design indicating design loads for members. Indicate allowable load and stress increase.

## **1.5 QUALITY ASSURANCE**

- .1 Materials meeting applicable requirements of the NBC(AE).
- .2 Lumber identifications: by grade stamp of an agency certified by Canadian Lumber Standards Accreditation Board.
- .3 Plywood, OSB and wood based composite panels in accordance with CSA and ANSI standards.
- .4 Plywood identification: by grade mark in accordance with applicable CSA standards.
- .5 Instead of grade stamping exposed to view lumber and plywood, submit manufacturer's certificate certifying that products are in accordance with specified requirements.

## **1.6 DELIVERY, STORAGE, AND HANDLING**

- .1 Deliver, store and handle materials in accordance with Section 01 61 00 - Common Product Requirements and with manufacturer's written instructions.
- .2 Delivery and Acceptance Requirements: deliver materials to site in original factory packaging, labelled with manufacturer's name and address.
- .3 Storage and Handling Requirements:
  - .1 Store materials in dry location and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.
  - .2 Store materials a minimum of 150 mm above the ground or surface on raised supports, with moisture barrier at ground level and as a cover forming a well-ventilated enclosure, with drainage to prevent standing water.
  - .3 Do not store seasoned materials in wet or damp areas.
  - .4 Store and protect from nicks, scratches, and blemishes.
  - .5 Replace defective or damaged materials with new.
  - .6 Store separated reusable wood waste convenient to cutting station and work areas.
- .4 Additional requirements for products treated with fire-retardant by pressure impregnation:
  - .1 Deliver, store and handle materials in accordance with AWP4 M4.
  - .2 Store separated reusable treated wood waste convenient to cutting station and work areas.

## **Part 2 Products**

### **2.1 BOTTOM WALL PLATE FOR INTERIOR WALLS**

- .1 Bottom wall plate for interior walls:
  - .1 Recycled plastic lumber: 100% recycled plastic. Acceptable products:

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- .2 3.5 x 3.5 Plastic Lumber, as manufactured by Full Circle Plastics.
    - .1 Lengths to suit.
    - .2 Fasteners: in accordance with manufactures recommendations for application.
  - .3 Other preapproved alternate.

## **2.2 FURRING AND BLOCKING**

- .1 Furring, blocking, nailing strips, grounds, rough bucks:
  - .1 S4S is acceptable.
  - .2 Board sizes: "Standard" or better grade.
  - .3 Dimension sizes: "Standard" light framing or better grade.
  - .4 Post and timbers sizes: "Standard" or better grade.
- .2 Where indicated, provide pressure treated materials for furring, blocking, nailing strips, grounds, rough bucks, and fascia, as specified herein.

## **2.3 PANEL MATERIALS AND APPLICATION**

- .1 Panel Materials:
  - .1 Douglas fir plywood (DFP): to CSA O121, standard construction.
  - .2 Plywood, OSB and wood based composite panels: to CAN/CSA-O325.
    - .1 Plywood backing plates to be minimum 19 mm thick unless otherwise approved in writing by the Departmental Representative.
- .2 Telephone and electrical equipment mounting boards:
  - .1 Plywood, square edge, 19 mm thick, installed on 19 x 38 mm furring around perimeter and intermediate furring at 300 mm maximum.
    - .1 Secure plywood and furring with fasteners suitable for substrate and corrosion protect as specified.
  - .2 Fire retardant treat materials as specified herein.

## **2.4 PRESERVATIVE AND FIRE-RETARDANT TREATED MATERIALS**

- .1 Wood Preservative:
  - .1 Treat materials indicated on drawings as specified.
  - .2 Preservative and Coating: in accordance with manufacturer's recommendations for surface conditions.
  - .3 Preservative: VOC limit 350 g/L maximum.
  - .4 Coatings: VOC limit 100 g/L maximum.
  - .5 Surface-applied wood preservative: coloured or clear, copper naphthenate or 5% pentachlorophenol solution, water repellent preservative.
  - .6 Pressure Treated Wood Preservative:
    - .1 Treat components in accordance with CSA-O80 Series-08, using ACQ water borne for preservative treatment and borate preservative treatment for above ground interior construction in a dry environment.
      - 1. Dry waterborne preservative treatment to a maximum moisture content of 19%.

- .2 Structures built with wood treated with pentachlorophenol and inorganic arsenicals must not be used for storing food nor should the wood come in contact with drinking water.
- .3 Fire Retardant Treated Wood:
  - .1 Treat components in accordance with CSA-O80 Series-08 to provide flame spread rating and smoke developed ratio to meet NBC(AE) requirements, and as required by the Authority Having Jurisdiction.
  - .2 Interior locations: "Dricon" Fire Retardant Treated Wood as manufactured by a licensed producer of Kopper Building Products Ltd.
  - .3 Exterior locations: "FRX" as manufactured by Chemco Inc.
    - .1 Other preapproved alternate.
  - .4 Kiln dry fire retardant treated products after treatment to the following moisture contents:
    - .1 Plywood: 15%.
    - .2 Lumber: 19%.
- .4 Corrosion Protection for Connectors and Fasteners for Use with Treated Wood:
  - .1 Proprietary corrosion resistant fasteners for pressure-preservative and fire-retardant treated lumber: as recommended by manufacturer for material and service conditions.
  - .2 Connectors: Fabricated from Type 304/316 stainless steel sheet to ASTM A480 for materials treated with ACQ.
  - .3 Fasteners: Hot dip galvanized to ASTM A153/A153M Class C and D or ASTM F2329/F2329M, and Type 304/316 stainless steel to ASTM A480 for materials treated with ACQ.

## 2.5 ACCESSORIES

- .1 General purpose adhesive: to CSA O112.9.
- .2 Sealants: in accordance with Section 07 92 00 - Joint Sealants.
- .3 Air Seal Caulking: gunnable butly rubber sealant, or acoustical sealant to ASTM C919.
- .4 Sealants: VOC limit 250g/L maximum.
- .5 Vapour Retarders: in accordance with Section 07 26 00 - Vapour Retarders.
- .6 Fire Stopping - in accordance with Section 07 84 00 - Fire Stopping.
- .7 Bolts: 12.5 mm diameter unless indicated otherwise, complete with nuts and washers.
- .8 Driven fasteners: nails, spikes, and staples to ASTM F1667.
- .9 Proprietary fasteners: toggle bolts, expansion shields and lag bolts, screws and lead or inorganic fibre plugs, recommended for purpose by manufacturer.
- .10 Fastener Finishes:
  - .1 Galvanizing: to ASTM A123/A123M or ASTM A653, use galvanized fasteners for exterior work interior highly humid areas.
  - .2 Stainless steel: use stainless steel where indicated for treated materials.
  - .3 Plated finish: use cadmium plated fasteners for interior work.

**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.
  - .2          Inform Consultant of unacceptable conditions immediately upon discovery.
  - .3          Proceed with installation only after unacceptable conditions have been remedied.

**3.2                        SYSTEMS INTEGRATION**

- .1      Install vapour retarders around framing members to provide continuity of protection and to lap and seal to main sheets in accordance with  
Section 07 26 00 - Vapour Retarders.
- .2      Install insulation in exterior wall framing cavities that will not be accessible after completion of framing.
- .3      Incorporate treated wood products into construction as indicated and as specified.
  - .1          Use connectors and fasteners with specified corrosion protection in all construction with treated wood products.

**3.3                        ROUGH CARPENTRY WORK**

- .1      Comply with requirements of NBC(AE), supplemented by the following paragraphs.
- .2      Accurately frame and properly assemble rough carpentry work, include necessary fasteners or other connectors.
- .3      Construct continuous members from pieces of longest practical length.
- .4      Install members true to line, levels and elevations, square and plumb, spaced uniformly, with tight joints.
  - .1          Provide for erection stresses and sufficient temporary bracing to maintain structure safe, plumb, and in true alignment until completion of erection and permanently fixed and held in structure.
- .5      Select individual pieces so that knots and obvious defect will not interfere with fasteners or connectors and will allow proper connections to be made.
- .6      Consult with other trades before installation to minimize cutting and penetrating through materials for pipes, conduit, and similar penetrations. Cutting and penetrations limited to the manufacturer's requirements and NBC(AE).
- .7      Cut out and discard materials with defects rendering them unsuitable for their intended use.
- .8      Erection tolerances:
  - .1          Surface flatness of floor: maximum 2 mm / m and 12 mm in 9000 mm.
  - .2          Align and plumb faces of furring and blocking true to line to 1 mm in 600 mm.

- .9 Installed materials may be rejected by Consultant for excess warp, twist, bow, crook, for mildew, fungus, or mould, and for improper cutting and fitting.

- .10 Install fire stopping in accordance with Section 07 84 00 - Fire Stopping.

### **3.4 PRESERVATIVE AND FIRE RETARDANT TREATED MATERIALS**

- .1 Apply treatment in accordance with manufacturers instructions, supplemented with the following paragraphs.
- .2 Preparation of preservative treated materials:
  - .1 Treat surfaces of material with wood preservative before installation.
  - .2 Apply preservative by dipping or by brush to completely saturate and maintain wet film on surface for minimum three-minute soak on lumber and one-minute soak on plywood.
- .3 Pressure treat or preservative treat materials: in accordance with CSA-O80, supplemented as follows:
  - .1 Locations indicated on the drawings and in the following locations:
    - .1 Wood curbs, fascia backing, and associated with roofing and flashing.
    - .2 Do not pressure treat, or preservative treat any wood in contact with roofing membranes, air and vapour barrier membrane or other membranes.
    - .3 Pressure treated, or preservative treated wood in contact with polyethylene film is permissible.
  - .2 Fire retardant treated materials:
    - .1 Locations indicated on the drawings, where required by Authority Having Jurisdiction, and in the following locations:
    - .2 Backboards for mounting telephone and electrical equipment.
    - .3 Field Treatment:
      - 1. Re-treat surfaces exposed by cutting, trimming or boring in accordance with manufacturers recommendations preservative before installation.

### **3.5 FASTENING, CONNECTING, AND ATTACHMENT**

- .1 Fasten, connect, and attach materials in accordance with NBC(AE) conforming to the Tables in Part 9, minimize splitting by staggering nails in the direction of the grain and keeping the away from the edges.
- .2 Use galvanized fasteners except as required for treated materials, space fasteners visible in finished work evenly and in a straight line.
- .3 Do not use explosive actuated fasteners when attaching wood to wood.
- .4 Fastening wood to concrete:
  - .1 Nail into the back of the material and cast into concrete.
  - .2 Cast anchor bolts into the concrete, predrill the materials, and attach using washer and nut.
  - .3 Predrill the concrete and secure materials using lag bolts, 450 mm on centre.

- .5 Fasten wood to metal using self drilling screws. Size, quality and pattern to be determined by Consultant, minimum 300 mm on centre each way.
- .6 Countersink or recess flush fasteners to be covered by finish materials, and to provide clearance for other work.

### **3.6 FRAMING INSTALLATION**

- .1 Bottom wall plate for interior walls: install and anchor recycled plastic lumber in accordance with manufacturer's recommendations.
- .2 Coordinate and install specified panel product for each application.

### **3.7 FURRING AND BLOCKING**

- .1 Install furring, blocking, and plywood backing plates as required to space-out and support washroom accessories, change tables and grab bars, wall mounted fixtures, wall and ceiling finishes, equipment, items to be installed as part of the project in the future or by the Owner, and other work as required.
- .2 Notch blocking and plywood backing plates to allow materials to sit flush with face of stud.
- .3 Install blocking behind sheathing and gypsum board joints and edges, except for gypsum board.
- .4 Install furring to support exterior finishes and where sheathing is not suitable for direct nailing.
- .5 Install rough bucks, nailers and linings to rough openings as required to provide backing for frames and other work.
- .6 Install wood backing, nailers, and other wood supports as required and secure using galvanized or stainless steel fasteners suitable for materials being fastened.
- .7 Shim furring, blocking, and strapping out plumb and true to line.
- .8 Space members at 400 mm on centre, unless otherwise indicated.

### **3.8 CLEANING**

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

### **3.9 WASTE MANAGEMENT**

- .1 Re-use scrap lumber to the greatest extent possible. Separate scrap lumber for use on site as accessory components, including: shims, bracing, and blocking.
- .2 Do not leave any wood, shavings, sawdust, etc. on the ground or buried in fill. Prevent saw dust and wood shavings from entering the storm drainage system.
- .3 Do not burn scrap lumber that has been pressure treated.
- .4 Do not send lumber treated with pentachlorophenol, CCA, or ACA to co-generation facilities or "waste-to-energy" facilities.

**3.10 PROTECTION**

- .1 Protect installed products and components from damage during construction.
- .2 Repair damage to adjacent materials caused by rough carpentry installation.

**END OF SECTION**

**Part 1            General**

**1.1            SECTION INCLUDES**

- .1    Section includes, but is not limited to:
  - .1       Shop-fabricated stainless steel countertops.

**1.2            RELATED REQUIREMENTS**

- .1    Section 06 10 53 - Miscellaneous Rough Carpentry
- .2    Section 07 92 00 - Joint Sealants
- .3    Section 09 21 16 - Gypsum Board Assemblies
- .4    Section 09 91 00.08 - Painting For Minor Works

**1.3            REFERENCE STANDARDS**

- .1    American National Standards Institute (ANSI)
  - .1       ANSI/ASME 18.6.1 1981 (R2012) Wood Screws (Inch Series).
  - .2       ANSI/BHMA A156.18-2012, Materials and Finishes.
  - .3       ANSI/HPVA HP-1-10, Standard for Hardwood and Decorative Plywood.
- .2    Architectural Woodwork Manufacturers Association of Canada (AWMAC)
  - .1       Architectural Woodwork Standards (AWMAC AWS), 2017.
- .3    ASTM International
  - .1       ASTM A153/A153M-16, Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware.
  - .2       ASTM E 1333-14, Standard Test Method for Determining Formaldehyde Concentrations in Air and Emission Rates From Wood Products Using a Large Chamber.
  - .3       ASTM F1667-13, Standard Specification for Driven Fasteners: Nails, Spikes and Staples.
- .4    Canadian General Standards Board (CGSB)
  - .1       CAN/CGSB-11.3-M87, Hardboard.
  - .2       CAN/CGSB-71.20-M88, Adhesive, Contact, Brushable.
  - .3       CAN/CGSB-71.19-M88, Adhesive, Contact, Sprayable.
- .5    CSA Group (CSA)
  - .1       CSA B111-74(R2003), Wire Nails, Spikes and Staples.
  - .2       CSA O112.10-08, Evaluation of Adhesives for Structural Wood Products (Limited Moisture Exposure).
  - .3       CSA O121-08, Douglas Fir Plywood.
  - .4       CSA O141-05(R2009), Softwood Lumber.
  - .5       CSA O151-09, Canadian Softwood Plywood.
- .6    Health Canada/Workplace Hazardous Materials Information System (WHMIS)

- .1 Material Safety Data Sheets (MSDS).
- .7 National Lumber Grades Authority (NLGA)
  - .1 Standard Grading Rules for Canadian Lumber 2010.
- .8 National Electrical Manufacturers Association (NEMA)
  - .1 ANSI/NEMA LD-3-05, High-Pressure Decorative Laminates (HPDL).

#### **1.4 PRE-INSTALLATION MEETING**

- .1 Before enclosing framing, convene a meeting of contractor, casework fabricator, casework installer, framing subcontractor and Consultant.
  - .1 Review locations of backing required for casework installation as shown on shop drawings and as necessary for installation.
  - .2 Review method of attachment for backing to wall system.
  - .3 Review coordination with other impacted sections.

#### **1.5 ACTION AND INFORMATIONAL SUBMITTALS**

- .1 Submit in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Product Data:
  - .1 Prepare and submit material list in accordance with AWMAC AWS, cross-referenced to specifications.
  - .2 Include manufacturer's instructions, printed product literature, data sheets and catalogue pages for all materials and products to be incorporated into architectural wood casework and include product characteristics, performance criteria, dimensions and profiles, finish and limitations on use.
  - .3 Submit electronic copies of WHMIS MSDS.
- .3 Shop Drawings:
  - .1 Prepare and submit shop drawings in accordance with AWMAC AWS and as follows
    - .1 Submit electronic sets of shop drawings for initial review in accordance with requirements of Section 01 33 00 - Submittal Procedures. Revise as directed, submit electronic copies for final review and distribution.
    - .2 Indicate details of construction, profiles, jointing, fastening and other related details.
      - 1. Scales: profiles full size, details half full size.
    - .3 Include schedule or key plan.
    - .4 Indicate materials, thicknesses, finishes, integral sinks, and hardware.
    - .5 Indicate locations of typical and special installation conditions, and connections, attachments, anchorage and location of exposed fastenings.
    - .6 Show location on casework elevations of backing required in supporting structure for attachment of casework.
    - .7 Indicate AWMAC AWS quality grade where different from predominant grade specified.

- .8 Include color schedule of all casework items, including all countertop, exposed, and semi-exposed cabinet finishes, finish material manufacturer, pattern, and color.
- .4 Samples:
  - .1 Finishes: as indicated.
  - .2 Prepare and submit samples in accordance with AWMAC AWS and as follows:
  - .3 Submit duplicate samples of each type of countertop material and duplicate samples of each colour.
  - .4 Samples will not be returned for incorporation into the work.
- .5 Certifications: submit certificates signed by manufacturer certifying that materials comply with specified performance characteristics and physical properties.
- .6 Submit statement of experience and qualifications of architectural wood casework fabricator.

## 1.6 QUALITY ASSURANCE

- .1 Perform Work of this Section by single architectural wood casework fabricator with minimum 5 years of current architectural casework production experience and having completed minimum one project in the past 5 years with value within 20% of the cost of the work of this Section.
- .2 Mock-ups:
  - .1 Construct mock-ups.
  - .2 Shop prepare one shelving unit, countertop, complete with hardware, shop applied finishes, and install where directed by Consultant.
  - .3 Coordinate construction of mock-up with regular site meetings for review of mock-up before proceeding with work.
  - .4 When reviewed, mock-up will demonstrate minimum standard for Work.
  - .5 Do not proceed with work before receipt of written review of mock-up by Consultant.
  - .6 Reviewed mock-up may remain as part of finished work.
- .3 Lumber by grade stamp of an agency certified by Canadian Lumber Standards Accreditation Board.
- .4 Plywood and wood based composite panels to CSA and ANSI.

## 1.7 DELIVERY, STORAGE AND HANDLING

- .1 Deliver, store and handle materials in accordance with Section 01 61 00 - Common Product Requirements and with manufacturer's written instructions.
- .2 Deliver wood casework only when area of work is enclosed, plaster and concrete work is dry, and area is broom clean and site environmental conditions are acceptable for installation.
- .3 Protect millwork against dampness and damage during and after delivery.

- .4 Store millwork in ventilated areas, protected from extreme changes of temperature and humidity, and within range recommended by AWMAC AWS for location of project.
- .5 Store materials indoors, in dry location, and in clean, dry, well-ventilated area.
- .6 Protect architectural woodwork and hardware from nicks, scratches, and blemishes.
- .7 Replace defective or damaged materials with new.

## **Part 2 Products**

### **2.1 QUALITY GRADE**

- .1 Provide all materials and perform all fabrication in accordance with AWMAC AWS Premium Grade and as follows, except where specified otherwise.
- .2 In case of conflict between Contract Documents and AWMAC AWS grade requirements, Contract Documents govern.

### **2.2 MATERIALS**

- .1 Softwood lumber: S4S, moisture content 7% or less in accordance with following standards:
  - .1 CSA O141.
  - .2 NLGA Standard Grading Rules for Canadian Lumber.
  - .3 AWMAC premium grade, moisture content as specified.
  - .4 Machine stress-rated lumber is acceptable.
- .2 Panel Material: urea-formaldehyde free:
  - .1 Hardwood plywood: to AWI/AWMAC/WI premium grade and Canadian Hardwood Plywood Association (CHPA) and ANSI/HPVA HP-1.
  - .2 Canadian softwood plywood (CSP): to CSA O151, standard construction.
  - .3 Adhesives: CSA O112 Series-M1977 (R2006); nationally recognized brands, suitable for intended application, water resistant, with acceptable low level emissions as follows:
    - .1 Total VOC concentration less than 50 g/L.
    - .2 Formaldehyde: must be less than 1 part per billion (1 PPB).
    - .3 4 Phenylcyclohexane (4-PCH): must be less than 1 part per billion (1-PPB).

### **2.3 CASEWORK FABRICATION - GENERAL**

- .1 Fabricate casework of specified core and surface finish materials to specified AWMAC AWS quality grade.
  - .1 Construction type: as indicated.

### **2.4 FINISHES**

- .1 Finish grade to match grade of product to be finished.
- .2 For unexposed surfaces not covered: NEMA GPO2.
  - .1 Underside of front edges of countertops; if core material is exposed.

- .2 All surfaces and all edges not covered with other finish.
- .3 Shop applied finish system component materials in accordance with manufacturer's instructions.

## 2.5 FABRICATION

- .1 Set nails and countersink screws apply plain, stainable-wood filler to indentations, sand smooth and leave ready to receive finish. Conceal fasteners where exposed when possible using applied gable ends and concealed joints construction.
- .2 Shop assemble work for delivery to site in size easily handled and to permit passage through building openings.
- .3 Obtain governing dimensions before fabricating items which are to accommodate or abut appliances, equipment and other materials.
- .4 Adjacent parts of continuous laminate work to match in colour and pattern.

## 2.6 STAINLESS STEEL COUNTERTOPS

- .1 Substrate to stainless steel counter tops and back splashes: marine grade plywood or with softwood plywood of Douglas fir plywood to CSA O151 and CSA O121 respectively, 19 mm thickness unless indicated otherwise.
  - .1 Veneer stainless steel to core material in accordance with adhesive manufacturer's instructions. Core and veneer profiles must coincide to provide continuous support and bond over entire surface. Use continuous lengths up to 3000 mm. Keep joints 600 mm from sink cutouts.
- .2 Stainless Steel Countertops:
  - .1 General Purpose Laminate Product (Flatwork):
  - .2 Provide 1.52 mm (16 ga), type 316 stainless steel with No. 4 finish, laminated to marine grade plywood core, 6 mm marine edge with return, and as follows:
    - .1 Form edges of exposed tops into a 25 mm thick (overall 32 mm thick with edge) channel shape with wood inserts on four edges of underside of top to facilitate anchoring.
    - .2 Form curbs from the same stainless steel sheet as top; form top edges of curbs into a channel shape.
    - .3 Form tops having built-in integral sinks, 500 mm wide x 400 mm deep with a basin depth of 250 mm, radiused corners, weld stainless steel sinks to form an integral part of top, welds ground smooth and polished to a uniform satin finish over the entire top and sink assembly, coat underside of tops and sinks with plastic sound deadener. Coordinate water supply and drain components with Drawing M1.0A.
    - .4 Form tops with integral backsplash, joints between counter and backsplash will not be accepted.
    - .5 Form backsplash extension of same material and construction as tops, height as indicated.
    - .6 Perform welding without discolouration and grind, polish and passivate to blend harmoniously with the work surface finish.
    - .7 Soldering of the sinks and curbs will not be permitted.

- .8 Form mechanical or filed joints to tight butt joint to top surfaces, reinforced and held in alignment with steel reinforcements.
- .9 Protect the surface of the tops with strippable plastic coating to protect the tops during shipment and installation.

## **2.7 ACCESSORIES**

- .1 Wood screws: steel, stainless steel, plain, type and size to suit application.
- .2 Nails and staples: to CSA B111 and ASTM F1667.
- .3 Splines: wood.
- .4 Sealant: in accordance with Section 07 92 00 - Joint Sealants.

## **Part 3 Execution**

### **3.1 EXAMINATION**

- .1 Verification of Conditions: verify conditions of substrates previously installed under other Sections or Contracts are acceptable for architectural woodwork installation in accordance with manufacturer's instructions.
  - .1 Visually inspect substrate.
    - .1 Examine substrates and conditions, with countertop fabricator present for compliance with requirements for installation tolerances and other conditions impacting performance of work.
    - .2 Verify actual site dimensions and location of adjacent materials before commencing work.
  - .2 Inform Consultant of unacceptable conditions immediately upon discovery.
  - .3 Proceed with installation only after unacceptable conditions have been remedied.

### **3.2 INSTALLATION**

- .1 Install architectural wood casework in accordance with AWMAC AWS grade for respective items.
- .2 In case of conflict between Contract Documents and AWMAC AWS grade requirements, Contract Documents govern.
- .3 Materials for interior installation to be installed only in areas with a constant and minimum temperature of 15°C, with interior relative humidity conditions within design values.
- .4 Install backing, locations and quantities as indicated.
- .5 Install prefinished millwork at locations shown on drawings.
  - .1 Position accurately, level, plumb straight.
- .6 Fasten and anchor millwork securely.
  - .1 Supply and install heavy duty fixture attachments for wall mounted cabinets.
- .7 Countersink mechanical fasteners at exposed and semi-exposed surfaces, excluding installation attachment screws and screws securing cabinets end to end.

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- .8 Use draw bolts in countertop joints.
  - .9 Scribe and cut as required to fit abutting walls and to fit properly into recesses and to accommodate piping, columns, fixtures, outlets or other projecting, intersecting or penetrating objects.
  - .10 Stainless Steel Countertops:
    - .1 Shop apply stainless steel countertop as indicated.
    - .2 Install stainless steel counter tops, with integral sinks and backsplashes, as indicated on the drawings and reviewed shop drawings.
    - .3 Use as long lengths as possible with as few joints as possible. Locate joints where indicated on the reviewed shop drawings. Except for counter tops, joints to hairline joints and flush.
    - .4 Joints in counter tops are to be welded and finished to match adjacent stainless steel and are to be rendered so that they are undistinguishable from adjacent stainless steel.
    - .5 Coordinate installation of sinks mechanical fittings with Drawing M1.0A.

### **3.3 CLEANING**

- .1 Progress Cleaning: clean in accordance with Section 01 74 11 - Final Cleaning.
  - .1 Leave Work area clean at end of each day.
  - .2 Upon completion remove surplus materials, rubbish, tools and equipment
  - .3 Clean outside surfaces, millwork, cabinet work, inside cupboards and drawers.
  - .4 Remove excess glue, pencil and ink marks from surfaces.

### **3.4 PROTECTION**

- .1 Protect cabinet work and millwork from damage until final review.
- .2 Protect countertops with non-staining sheet covering.
- .3 Protect installed products and components from damage during construction.
- .4 Repair damage to adjacent materials caused by architectural woodwork installation.

**END OF SECTION**

**Part 1 General**

**1.1 SUMMARY**

- .1 Section includes, but is not limited to:
  - .1 Fluid applied bituminous dampproofing, adhesive or mastic and termination materials, and drainage board assembly for vertical applications.
- .2 Section does not include:
  - .1 Fluid applied waterproofing, adhesive or mastic and termination materials, and drainage board assembly for horizontal applications.

**1.2 RELATED REQUIREMENTS**

- .1 Section 07 21 13 - Board Insulation
- .2 Section 07 27 00 - Air Barriers
- .3 Section 07 62 00 - Sheet Metal Flashing and Trim
- .4 Section 07 92 00 - Joint Sealants
- .5 Drawings S100 and S100

**1.3 REFERENCE STANDARDS**

- .1 ASTM International (ASTM)
  - .1 ASTM D41/D41M-11(2016), Standard Specification for Asphalt Primer Used in Roofing, Dampproofing, and Waterproofing.
  - .2 ASTM D1227/D1227M-95, Standard Specification for Emulsified Asphalt Used as a Protective Coating for Roofing.
  - .3 ASTM D1621-16, Standard Test Method for Compressive Properties of Rigid Cellular Plastics.
  - .4 ASTM D1777-96(2019), Standard Test Method for Thickness of Textile Materials.
  - .5 ASTM D4479/D4779M-07(2012)e1, Standard Specification for Asphalt Roof Coatings- Asbestos Free.
  - .6 ASTM D4491/D4491M-17, Standard Test Methods for Water Permeability of Geotextiles by Permittivity.
  - .7 ASTM E96/E96M-13, Standard Test Methods for Water Vapor Transmission of Materials.
- .2 Health Canada
  - .1 Workplace Hazardous Materials Information System (WHMIS)
    - .1 Material Safety Data Sheets (MSDS).

**1.4 ACTION AND INFORMATIONAL SUBMITTALS**

- .1 Submit in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Product Data:

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- .1 Submit manufacturer's instructions, printed product literature and data sheets for bituminous dampproofing application and include product characteristics, performance criteria, physical size, finish and limitations.
  - .2 Submit electronic copies of WHMIS MSDS.
  - .3 Manufacturer's Instructions: provide to indicate special handling criteria, installation sequence, standard details, and cleaning procedures.
    - .1 Provide additional written instructions for cold weather preparation and application in temperatures below 5 degrees C.

## **1.5 QUALITY ASSURANCE**

- .1 Mock-ups:
  - .1 Construct mock-ups in accordance with Section 01 45 00 - Quality Control.
  - .2 Construct mock-up 3 m<sup>2</sup> minimum size showing typical lap joint, one inside corner, and one outside corner.
  - .3 Mock-up will be used:
    - .1 To judge quality of work, substrate preparation, operation of equipment, material application, and connection with adjacent materials.
  - .4 Coordinate construction of mock-up with regular site meetings for review of mock-up before proceeding with work.
  - .5 Remove and replace non-conforming materials and installation and repeat preparation of mock-up at no additional cost.
  - .6 Review and acceptance of mock-ups does not constitute approval of deviations from the Contract Documents. Accepted modifications are to be confirmed in writing by Consultant and incorporated into the Record Documents.
  - .7 When accepted, mock-up will demonstrate minimum standard of quality required for this Work.
  - .8 Reviewed mock-up may remain part of finished Work.

## **1.6 DELIVERY, STORAGE AND HANDLING**

- .1 Deliver, store and handle materials in accordance with Section 01 61 00 - Common Product Requirements and manufacturer's written instructions.
- .2 Delivery and Acceptance Requirements: deliver materials to site in original factory packaging, labelled with manufacturer's name and address.
- .3 Storage and Handling Requirements:
  - .1 Store materials off ground, in a dry well ventilated location or covered with weatherproof flame resistant sheeting or tarpaulin.
    - .1 Refer to applicable data including but not limited to MSDS sheets, Product Data sheets, product labels, and specific instructions for personal protection.
    - .2 Store role materials on end in original packaging, protect rolls from direct sunlight until ready for use.
    - .3 Store fluid applied bituminous dampproofing in closed containers, outdoors, and away from open flame or excessive heat.

- .4 Store adhesives and primers at temperatures of 5 degrees C and above to facilitate handling.
- .2 Replace defective or damaged materials with new.

## 1.7 SITE CONDITIONS

- .1 Ambient Conditions: temperature, relative humidity, moisture content.
  - .1 Apply dampproofing materials only when surfaces and ambient temperatures are within manufacturers' prescribed limits.
  - .2 Do not proceed with Work when wind chill effect would tend to set bitumen before proper curing takes place.
  - .3 Maintain air temperature and substrate temperature at dampproofing installation area above 5 degrees C for 24 hours before, during and 48 hours after installation.
  - .4 Do not apply dampproofing in wet weather.
- .2 Safety: comply with requirements of Workplace Hazardous Materials Information System (WHMIS) regarding use, handling, storage, and disposal of asphalt, sealing compounds, primers and caulking materials.
- .3 Ventilation:
  - .1 Ventilate enclosed or confined spaces.

## Part 2 Products

### 2.1 MATERIALS

- .1 Dampproofing:
  - .1 Use bituminous dampproofing materials and components throughout, as manufactured by one manufacturer.
  - .2 Primer: to ASTM D41, for cold-applied dampproofing. Acceptable products:
    - .1 910-01 Penetrating Asphalt Primer, as manufactured by Henry Company.
    - .2 Sealmastic Spray-Mastic with Trowel-Mastic (two coat system), as manufactured by W. R. Meadows.
    - .3 Other preapproved alternate.
  - .3 Liquid Applied Bituminous Dampproofing: to ASTM D1127, Type III, Class I. Acceptable products:
    - .1 710-11 Dampproofing and Waterproofing Asphalt Coating, as manufactured by Henry Company.
    - .2 Sealmastic Type I Spray-grade, as manufactured by W. R. Meadows.
    - .3 Other preapproved alternate.
  - .4 Drainage Board: composite two-part prefabricated geo-composite dimple raised drain board consisting of a formed polystyrene core covered on one side with a non-woven polypropylene filter fabric.
    - .1 Performance Characteristics:
      - 1. Flow Rate: to ASTM D4491, minimum 6113 l/min/m<sup>2</sup>.
      - 2. Compressive Strength: to ASTM D1621, minimum 718 kN/m<sup>2</sup>.

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- 3. Thickness: to ASTM D1117, 10 - 11 mm.
  - .2 Acceptable products:
    - 1. Bakor DB 6000, as manufactured by Henry Company.
    - 2. Mel-Drain 5035, as manufactured by W. R. Meadows.
    - 3. Other preapproved alternate.
  - .5 Accessories: adhesives or mastics and termination materials: in accordance with manufacturers recommendations.

## **Part 3 Execution**

### **3.1 EXAMINATION**

- .1 Verification of Conditions: verify that conditions of substrate previously installed under other Sections or Contracts are acceptable for bituminous dampproofing installation in accordance with manufacturer's written instructions.
  - .1 Visually inspect substrate and adjacent surfaces for conditions impacting installation.
  - .2 Inform Consultant of unacceptable conditions immediately upon discovery.
  - .3 Proceed with installation only after unacceptable conditions have been remedied.
  - .4 Commencement of installation means acceptance of existing conditions and acceptance of responsibility for satisfactory performance.

### **3.2 PREPARATION**

- .1 Maintain the area of dampproofing installation free of water.
- .2 Surface must be clean and dry, free of ice, snow, frost, dust, dirt, oil, grease, cracks, projections and depressions, loose particles and debris detrimental to the performance of the materials applied.
- .3 Before applying dampproofing install sealing compound, mastic, or rubber asphalt caulking in accordance with manufacturers recommendations to:
  - .1 Seal exterior joints between foundation walls and footings, joints between concrete floor slab and foundation, and cracks which the materials are not capable of bridging.
  - .2 Seal sleeves, pipes, conduits, reinforcing rods, inserts or anchors, snap ties, and other items and services occurring on, recessed in, or passing through dampproofing.
- .4 Protect adjacent surfaces and other work from overspray and damage resulting from Work of this section. Make good such damage at no additional cost to the Owner.
- .5 Verify conformance with Site Conditions specified in Part 1 before proceeding with installation. Do not install materials when surfaces and ambient temperatures are outside of manufacturers' prescribed limits
- .6 Dampen surfaces immediately before application of bituminous dampproofing materials.

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### 3.3 APPLICATION

- .1 Apply in accordance with the manufacturer's recommendations, supplemented with the following paragraphs.
- .2 Primer: application rates will vary with porosity of surface.
  - .1 Apply 910-01 Penetrating Asphalt Primer at a rate of 2-8 m<sup>2</sup>/l.
  - .2 Apply Sealmastic Spray-Mastic primer at a rate of 1.71-2.4 m<sup>2</sup>/l, allow coat to dry to tacky to touch and then apply Trowel-Mastic at a rate of 0.5-0.6 m<sup>2</sup>/l.
- .3 Dampproofing: after primer is dry:
  - .1 Apply 710-11 Dampproofing and Waterproofing Asphalt Coating at a rate of 1.5 l/m<sup>2</sup>.
  - .2 Apply Sealmastic Type I Spray-grade at a rate of 1.71-2.45 m<sup>2</sup>/l.
  - .3 Dampproofing membrane is not designed for permanent UV exposure, install drainage board within 14 days of dampproofing application.
- .4 Drainage Board Installation: attach drainage board to surface using manufacturers recommended adhesive or mastic, supplemented as follows:
  - .1 Unroll drainage board with flat, core side against the dampproofing membrane and fabric side outwards.
  - .2 Fasten drainage board at the top side with termination bars as recommended by the manufacturer, including compatible mechanical fasteners designed for the substrate.
  - .3 Vertical Application:
    - .1 Adhere the remainder of drainage board with adhesive or mastic, compatible with the dampproofing.
    - .2 Overlap the flat side core lip with second sheet of drainage board to provide a continuous drainage layer (shingle fashion).
  - .4 Horizontal Application:
    - .1 Apply from high point to low point, overlap so that water runs with the overlap.
    - .2 Adhere the remainder of drainage board with adhesive or mastic, compatible with the dampproofing.
    - .3 Bottom panel should be placed behind the discharge pipe.
    - .4 Add appropriate ballast as needed to hold down drainage board.
- .5 Overlaps:
  - .1 Pull back loose fabric to expose drain core.
  - .2 Position core of second panel over the overlap flange of first panel.
  - .3 Overlap in direction of water flow and adhere the overlapped fabric with adhesive or mastic necessary to prevent soils or debris from entering the drainage layer during application.
  - .4 Tuck fabric behind core at all outside edges.
- .6 Corners:
  - .1 Bend drain to make inside corners.

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- .2 For outside corners, cut drainage board to reach corner and provide 100 mm of extra fabric to wrap around corner. Attach drain to wall and overlap fabric at joint.

### **3.4 SCHEDULE**

- .1 Apply continuous, uniform coatings to exterior side of foundation walls and locations indicated, from finished grade down to and including the top of the footing , and down the vertical face of the footing.
- .2 Apply two additional coats of dampproofing to vertical corners and construction joints for a minimum width of 230 mm on each side, and all around and for 230 mm along pipes passing through walls.

### **3.5 CLEANING**

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

### **3.6 PROTECTION**

- .1 Protect installed products and components from damage during construction.
- .2 Repair damage to adjacent materials caused by dampproofing application.

**END OF SECTION**

**Part 1            General**

**1.1            SECTION INCLUDES**

- .1    Section includes, but is not limited to:
  - .1       Rigid, extruded polystyrene (faced and unfaced), adhesives, accessories, and installation for vertical and horizontal applications.
  - .2       Rigid, expanded polystyrene for use in void forms.

**1.2            RELATED REQUIREMENTS**

- .1    Section 05 41 00 - Structural Metal Stud Framing

**1.3            REFERENCE STANDARDS**

- .1    ASTM International
  - .1       ASTM C518-15, Standard Test Method for Steady-State Thermal Transmission Properties by Means of the Heat Flow Meter Apparatus
  - .2       ASTM C1126-15, Standard Specification for Faced or Unfaced Rigid Cellular Phenolic Thermal Insulation.
  - .3       ASTM E96/E96M-15, Standard Test Methods for Water Vapour Transmission of Materials.
- .2    Canadian General Standards Board (CGSB)
  - .1       CGSB 71-GP-24M-AMEND-77(R1983), Adhesive, Flexible, for Bonding Cellular polystyrene Insulation.
- .3    CSA Group
  - .1       CSA B149 PACKAGE-10, Consists of B149.1, Natural Gas and Propane Installation Code and B149.2, Propane Storage and Handling Code.
- .4    Health Canada/Workplace Hazardous Materials Information System (WHMIS)
  - .1       Material Safety Data Sheets (MSDS).
- .5    Underwriters Laboratories of Canada (ULC)
  - .1       CAN/ULC-S101-14, Standard Method of Fire Endurance Test of Building Construction and Materials.
  - .2       CAN/ULC-S102-10, Standard Method of Test for Surface Burning Characteristics of Building Materials and Assemblies.
  - .3       CAN/ULC-S114-05, Standard Method of Test for Determination of Non-Combustible Surface Burning Characteristics of Building Materials and Assemblies.
  - .4       CAN/ULC-S604-M91, Standard for Factory Built Type A Chimneys.
  - .5       CAN/ULC-S701-11, Standard for Thermal Insulation, Polystyrene, Boards and Pipe Coverings.
  - .6       CAN/ULC-S702-14, Standard for Thermal Insulation, Mineral Fibre, for Buildings.

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#### **1.4 ACTION AND INFORMATIONAL SUBMITTALS**

- .1 Submit in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Product Data:
  - .1 Submit manufacturer's instructions, printed product literature and data sheets for board insulation and include product characteristics, performance criteria, physical size, finish and limitations.
  - .2 Submit two copies of WHMIS MSDS.
- .3 Certificates:
  - .1 Submit product certificates signed by manufacturer certifying materials comply with specified performance characteristics and criteria and physical requirements.
- .4 Test Reports:
  - .1 Submit certified test reports showing compliance with specified performance characteristics and physical properties.
- .5 Fire-Test-Response Characteristics: provide insulation and related materials with the fire-test-response characteristics indicated, as determined by testing identical products per test method indicated below by ULC or another testing and inspection agency acceptable to the Authority Having Jurisdiction. Identify materials with appropriated markings of applicable testing and inspections agency.
  - .1 Test Reports: Submit copies of fire test reports from ULC of product and assembly indicating conformance to:
    - .1 CAN/ULC-S101 for fire resistance rating.
    - .2 CAN/ULC- S102 for surface burning characteristics.
    - .3 CAN/ULC-S114 for non-combustibility.
- .6 Manufacturer's Instructions:
  - .1 Submit manufacturer's installation instructions.

#### **1.5 QUALITY ASSURANCE**

- .1 Mock-ups:
  - .1 Construct mock-ups.
    - .1 Provide mock up of one side of doorway opening for review by Departmental Representative before proceeding with all other installations.
    - .2 Provide mock up of one outside corner of concrete faced insulations for review by Departmental Representative before proceeding with all other installations.
  - .2 Coordinate construction of mock-up with regular site meetings for review of mock-up before proceeding with work.
  - .3 When reviewed, mock-up will demonstrate minimum standard for Work.
  - .4 Do not proceed with work before receipt of written review of mock-up by Consultant.
  - .5 Reviewed mock-ups may remain as part of finished work.

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## **1.6 DELIVERY, STORAGE AND HANDLING**

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

## **Part 2 Products**

### **2.1 INSULATION**

- .1 Extruded polystyrene (XPS): to CAN/ULC-S701.
  - .1 Unfaced and faced as indicated on drawings.
  - .2 Insulation:
    - .1 Type: 4.
    - .2 Thermal resistance: RSI 0.88 per 25.4 mm (R 5 per inch), ASTM C518.
    - .3 Compressive strength: 210 kPa in accordance with ASTM D1621.
    - .4 Water absorption: ASTM D2842: <0.7 % by volume.
    - .5 Water vapour permeance: 0.8 perms in accordance with ASTM E96.
    - .6 Thickness: as indicated on drawings.
    - .7 Size: 610 mm x 1220 mm.
    - .8 Edges: Tongue and groove along longitudinal foam edges, butt joints on lateral edges.
    - .9 Acceptable Materials:
      - 1. Dow Styrofoam SM.
      - 2. Owens-Corning Foamular C-300.
      - 3. Other preapproved product.
  - .3 Facing: Concrete faced insulation (to exposed parts of foundations above grade)
    - .1 Concrete: Latex modified concrete mix, 8 mm thick, with control joint score at mid-length.
    - .2 Surface finish: Textured broom finish; grey colour, may be coated.
    - .3 Corners: fabricated in one continuous piece.
    - .4 Acceptable Materials:
      - 1. Dow Styrofoam SM Insulation as described in item 2.2.1 above, except with factory applied 8 mm thick latex modified concrete facing.
      - 2. Concrete Faced Insulated (CFI) Wall Panels, as manufactured by Tech Crete Processors Ltd.

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3. Other preapproved product.

- .2 Expanded polystyrene (EPS): to CAN/ULC-S701, for use in void forms.
  - .1 Type: 2.
  - .2 Compressive strength: 70 kPa.
  - .3 Thickness: as indicated.
  - .4 Size: 610 mm x 1220 mm.
  - .5 Edges: Tongue and groove along longitudinal foam edges, butt joints on lateral edges.
- .3 Mineral fibre board: to CAN/ULC-S702, and ASTM C612
  - .1 Type: 1, made from natural basalt rock and minimum 40% recycled content.
  - .2 Density: 128 kg/m<sup>3</sup> in accordance with ASTM C612
  - .3 Thermal resistance: RSI 0.70 per 25.4 mm (R 4 per inch), ASTM C518.
  - .4 Surfaces: unsurfaced.
  - .5 Thickness: as indicated on drawings.
  - .6 Size: 610 mm x 1220 mm.

**2.2 ADHESIVE**

- .1 Adhesive (for polystyrene): to CGSB 71-GP-24M: Type 1, Class A, adhesive must not contain solvents and must be compatible with hot rubberized asphalt waterproofing and insulation.
- .2 Adhesive in accordance with insulation manufacturers written recommendations.

**2.3 ACCESSORIES**

- .1 Fasteners: Mechanical fasteners in accordance with insulation manufacturers written recommendations.
- .2 Screwed fasteners: 6.4 mm diameter, drilled self tapping galvanized or stainless steel "tapcon" screw anchors complete with PVC or galvanized steel discs 38 mm diameter. Screws to be long enough to penetrate through insulation, air and vapour barrier and sheathing into wood framing or into concrete back-up minimum 32 mm. Securely anchor system into place and to withstand all super-imposed loads.
- .3 Insulation clips: impale type, perforated 50 x 50 mm cold rolled carbon steel 0.8 mm thick, adhesive back, spindle of 2.5 mm diameter annealed steel, length to suit insulation, 25 mm diameter washers of self-locking type.

**Part 3 Execution**

**3.1 EXAMINATION**

- .1 Verification of Conditions: verify that conditions of substrate previously installed under other Sections or Contracts are acceptable for board insulation application in accordance with manufacturer's written instructions.
  - .1 Visually inspect substrate.
  - .2 Inform Consultant of unacceptable conditions immediately upon discovery.

- .3 Proceed with installation only after unacceptable conditions have been remedied.
- .2 Before commencement of work verify:
  - .1 Substrates are firm, straight, smooth, dry, free of snow, ice or frost, and clean of dust and debris.
  - .2 For unfaced and faced XPS boards, if the lowest substrate surface is not level to receive panels, create a level surface with a galvanized steel ledger angle, and secure level.

### **3.2 MANUFACTURER'S INSTRUCTIONS**

- .1 Compliance: comply with manufacturer's written data, including product technical bulletins, product catalogue installation instructions, product carton installation instructions, and data sheets.

### **3.3 INSTALLATION**

- .1 Install insulation after building substrate materials are dry.
- .2 Install insulation to maintain continuity of thermal protection to building elements and spaces.
- .3 Fit insulation tight around electrical boxes, plumbing and heating pipes and ducts, around exterior doors and windows and other protrusions.
- .4 Keep insulation minimum 75 mm from heat emitting devices such as recessed light fixtures, and minimum 50 mm from sidewalls of CAN/ULC-S604 Type A chimneys CAN/CGA-B149.1 and CAN/CGA-B149.2 Type B and L vents.
- .5 Cut and trim insulation neatly to fit spaces. Butt joints tightly, offset vertical joints. Use only insulation boards free from chipped or broken edges. Use largest possible dimensions to reduce number of joints.
- .6 Offset both vertical and horizontal joints in multiple layer applications.
- .7 Do not enclose insulation until it has been reviewed by Consultant.

### **3.4 WORKMANSHIP**

- .1 Follow the instructions for use of materials of insulation and accessory manufacturers.
- .2 Install insulation to maintain continuous and complete thermal protection for building spaces and elements.
- .3 Verify all surfaces which are to receive insulation are clean, free from deleterious matter and are sufficiently level to allow the proper installation of insulation.
- .4 Use insulation free from broken or chipped edges.
- .5 Butt ends and edges of boards tightly together to form a complete thermal barrier. Install tightly against dry substrate.
- .6 Cut and trim insulation to fit spaces around corners and penetrations. Do not cut sheet membrane air and vapour seal. Cut and fit insulation tight around all cladding anchors and supports, against mechanical, electrical and other items which protrude through the plane of insulation.
- .7 Use largest possible dimensions to reduce the number of joints.

- .8 Offset both vertical and horizontal joints in multiple layer applications.
- .9 Where insulation is installed between Z girt framing, install to fit tightly between framing members. Mechanically fasten insulation between Z girt framing as specified herein.
- .10 Press insulation tightly in place so that it abutts the air/vapour barrier membrane or waterproofing.

### **3.5 PERIMETER FOUNDATION INSULATION**

- .1 Exterior application: extend faced XPS boards from underside of exterior finish to 1000 mm below finished grade. Install on exterior face of perimeter foundation wall in accordance with manufactures recommendations.
- .2 Install concrete faced insulation at doorways to prevent exposed foam at doorway opening.
  - .1 Provide extended rigid doorway sill plate to cover rigid foam insulation on floor.
- .3 Provide snug fit between panel tongue and grooves, and lateral butt joints.
- .4 Stagger all vertical joints on insulation except free ends or line of expansion/control joints.
- .5 Use manufacturer's fasteners. Maintain neat appearance.
- .6 Coordinate installation of insulation with:
  - .1 Z-girt framing, per Section 05 41 00.
- .7 Cover exposed insulation at corners and top of perimeter insulation with prefinished flashing as specified in Section 07 62 00.
  - .1 Outside corners on concrete faced insulation are to be secured to prevent separating between perpendicular concrete faces and mitigate the vulnerability to damage which will expose foam interior.
- .8 Where concrete flatwork or asphalt is to be laid adjacent to faced XPS boards, provide an isolation joint to protect mortar surface from differential movement.
- .9 Polystyrene to be covered reasonably promptly after installing it.

### **3.6 CAVITY WALL INSTALLATION**

- .1 Install mineral fibre insulation boards on outer surface of inner wythe of wall cavity over impaling clips, as indicated.
- .2 Where insulation is installed between Z girt framing, install to fit tightly between framing members. Mechanically fasten insulation between Z girt framing as specified.
- .3 Press insulation tightly in place so that it abuts the air and vapour barrier membrane or waterproofing.

### **3.7 FASTENER INSTALLATION**

- .1 Install insulation to all locations above grade, including between framing members using screw-on type fasteners using minimum 6 fasteners per board and not less than 75 mm from all ends and edges.
- .2 Fasteners to be installed into studs or solid backing.

**3.8            CLEANING**

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

**END OF SECTION**

**Part 1            General**

**1.1            SECTION INCLUDES**

- .1    Section includes, but is not limited to:
  - .1      Thermal batt and blanket mineral fibre and blanket insulation.
  - .2      Insulation for acoustical and fire stopping installation.

**1.2            RELATED REQUIREMENTS**

- .1    Section 07 21 29 - Spray Applied Polyurethane Foam Insulation

**1.3            REFERENCE STANDARDS**

- .1    ASTM International
  - .1      ASTM C665-12, Standard Specification for Mineral-Fiber Blanket Thermal Insulation for Light Frame Construction and Manufactured Housing.
  - .2      ASTM C1320-10, Standard Practice for Installation of Mineral Fiber Batt and Blanket Thermal Insulation for Light Frame Construction.
- .2    Underwriters Laboratories of Canada (ULC)
  - .1      CAN/ULC-S604-2012, Standard for Factory-Built Type A Chimneys.
  - .2      CAN/ULC-S702-2012, Standard for Mineral Fibre Insulation for Buildings.

**1.4            ACTION AND INFORMATIONAL SUBMITTALS**

- .1    Submit in accordance with Section 01 33 00- Submittal Procedures.
- .2    Product Data:
  - .1      Submit manufacturer's instructions, printed product literature and data sheets for blanket insulation and acoustical putty, including product characteristics, performance criteria, physical size, finishes, and limitations.
- .3    Certificates:
  - .1      Submit product certificates signed by manufacturer certifying materials comply with specified performance characteristics and criteria and physical requirements.
- .4    Test Reports:
  - .1      Submit certified test reports showing compliance with specified performance characteristics and physical properties.

**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 in dry location, indoors, off ground, and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.
- .2 Store and protect specified materials from nicks, scratches, and blemishes.
- .4 Replace defective or damaged materials with new.

## **Part 2 Products**

### **2.1 INSULATION**

- .1 Thermal batt and blanket mineral fibre: to CAN/ULC-S702 and ASTM C665.
  - .1 Batt insulation for parapet assemblies, and as indicated on drawings
    - .1 Fire performance:
      - 1. Non-combustibility: To CAN/ULC S114.
        - 1. Surface Burning Characteristics: To CAN/ULC S102.
          - 1. Flame spread: 0.
          - 2. Smoke developed: 0.
      - 2. Thermal resistance:
        - 1. RSI value/25.4 mm at 24° C: 0.76 m<sup>2</sup> K/W to ASTM C518.
      - 3. Water vapour permeance: 1555 ng/Pa.s.m<sup>2</sup>.
      - 4. Moisture sorption: 1 % maximum to ASTM C1104/C1104M.
      - 5. Fungi resistance: Zero mould growth to ASTM C1338.
      - 6. Corrosive resistance:
        - 1. Steel to ASTM C665: Pass.
        - 2. Stainless steel to ASTM C795: Pass.
      - 7. Acoustical performance sound absorption co-efficients to ASTM C423.
    - .2 Materials:
      - .1 Non-combustible, lightweight, water repellent, rigid insulation board with rigid upper surface to ASTM C612 Type IVB.
        - 1. Size: to suit framing x 1219 mm.
        - 2. Thickness: as indicated.
        - 3. Thicknesses below 50 mm Density:
          - 1. 70 kg/m<sup>3</sup> to ASTM C303.
        - 4. Thicknesses 65 mm and above Density:
          - 1. Outer layer: 100 kg/m<sup>3</sup> to ASTM C303.
          - 2. Inner layer: 60 kg/m<sup>3</sup> to ASTM C303.
      - .2 Acceptable Product:
        - 1. CAVITYROCK®, as manufactured by ROCKWOOL.
        - 2. Other preapproved alternate.

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- .2 Acoustical and fire stopping installations: to CAN/ULC S702, Type 1
    - .1 Acoustical and fire batt insulation for walls:
      - .1 Fire performance:
        - 1. Non-combustibility: To CAN/ULC S114.
        - 2. Surface Burning Characteristics: To CAN/ULC S102.
          - 1. Flame spread: 0.
          - 2. Smoke developed: 0
          - 3. Smoulder resistance: 0.09% to CAN/ULC S129.
      - .2 Acoustical Performance:
        - 1. Airborne sound transmission loss: To ASTM E90.
        - 2. Rating sound insulation: To ASTM E413.
        - 3. Sound absorption co-efficients: To ASTM C423.
        - 4. Impedence and absorption of acoustic materials: To ASTM E1050.
        - 5. Air erosion velocity: 5.08 m/s maximum to UL 181.
        - 6. Thermal resistance: To ASTM C518.
        - 7. Corrosive resistance: To ASTM C665, Corrosive to steel - Pass.
        - 8. Stainless steel stress corrosion: To ASTM C795.
        - 9. Thicknesses below 76.2 mm Density:
          - 1. 40 kg/m<sup>3</sup>.
        - 10. Thicknesses 76.2 mm and above Density:
          - 1. 45 kg/m<sup>3</sup>.
    - .2 Materials
      - .1 Non-combustible, lightweight, mineral wool batt insulation to CAN/ULC S702, Type 1, that provides fire resistance to ASTM E136 and a sound control to ASTM E90 and ASTM E423.
        - 1. Size: to suit framing x 1219 mm.
        - 2. Thickness: as indicated.
      - .2 Acceptable Product:
        - 1. AFB®, as manufactured by ROCKWOOL.
        - 2. Other preapproved alternate.
  - .3 Thermal batt and blanket mineral fibre insulation: to CAN/ULC-S702 and
  - .4 ASTM C665.
    - .1 Thermal batt insulation:
      - .1 For exterior walls, floors, roofs, and as indicated on drawings: to CAN/ULC S702, Type 1.
        - 1. Fire performance:
          - 1. Non-combustibility: to CAN/ULC S114.
          - 2. Surface Burning Characteristics: to CAN/ULC S102.
            - 1. Flame spread: maximum 25.

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- 2. Smoke developed: maximum 50.
      - 2. Thermal resistance: RSI 0.55 per 25.4 mm (R 3.3 per inch).
      - 3. Thickness: as indicated on drawings.
    - .2 Acceptable Product:
      - 1. EcoTouch Pink Fibreglas, as manufactured by Owens Corning.
      - 2. Other preapproved product.
  - .2 Thermal mineral fibre insulation:
    - .1 For exterior walls, floors, roofs, and as indicated on drawings:
      - 1. Fire performance:
        - 1. Non-combustibility: To CAN/ULC S114.
        - 2. Surface Burning Characteristics: to CAN/ULC S102.
          - 1. Flame spread: 0.
          - 2. Smoke developed: 0.
      - 2. Thermal resistance: RSI value/25.4 mm at 24° C: 0.76 m<sup>2</sup> K/W to ASTM C518.
      - 3. Water vapour permeance: 1555 ng/Pa.s.m<sup>2</sup>.
      - 4. Moisture sorption: 1 % maximum to ASTM C1104/C1104M.
      - 5. Fungi resistance: Zero mould growth to ASTM C1338.
      - 6. Corrosive resistance:
        - 1. Steel to ASTM C665: Pass.
        - 2. Stainless steel to ASTM C795: Pass.
      - 7. Acoustical performance sound absorption co-efficient to ASTM C423.
    - .2 Materials:
      - 1. Non-combustible, lightweight, water repellent, rigid insulation board with rigid upper surface to ASTM C612 Type IVB.
        - 1. Size: to suit framing x 1219 mm.
        - 2. Thickness: as indicated.
        - 3. Thicknesses below 50 mm Density:
          - 1. 70 kg/m<sup>3</sup> to ASTM C303.
        - 4. Thicknesses 65 mm and above Density:
          - 1. Outer layer: 100 kg/m<sup>3</sup> to ASTM C303.
          - 2. Inner layer: 60 kg/m<sup>3</sup> to ASTM C303.
      - 2. Acceptable Product:
        - 1. CAVITYROCK, as manufactured by ROCKWOOL.
        - 2. Other preapproved alternate.
  - .5 Acoustical mineral fibre, batt, and fire stopping insulation: to CAN/ULC S702, Type 1.
    - .1 Acoustical batt insulation: to ASTM C655, Type 1.
      - .1 Acoustical and fire batt insulation for interior walls:
        - 1. Fire performance

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1. Non-combustibility: to CAN/ULC-S114.
      2. Surface Burning Characteristics: to ASTM E84
        1. Flame spread: maximum 25.
        2. Smoke developed: maximum 50
    2. Thickness: as indicated on drawings.
    3. Acceptable Product:
      1. EcoTouch Pink Fibreglas, as manufactured by Owens Corning.
      2. Other preapproved product.
  - .2 Acoustical mineral fibre insulation:
    - .1 Acoustical and fire mineral fibre insulation for interior walls:
      1. Fire performance:
        1. Non-combustibility: to CAN/ULC S114.
        2. Surface Burning Characteristics: to CAN/ULC S102.
          1. Flame spread: 0.
          2. Smoke developed: 0
          3. Smoulder resistance: 0.09% to CAN/ULC S129.
      2. Acoustical Performance:
        1. Airborne sound transmission loss: to ASTM E90.
        2. Rating sound insulation: to ASTM E413.
        3. Sound absorption co-efficient: To ASTM C423.
        4. Impedence and absorption of acoustic materials: to ASTM E1050.
        5. Air erosion velocity: 5.08 m/s maximum to UL 181.
        6. Thermal resistance: to ASTM C518.
        7. Corrosive resistance: to ASTM C665, Corrosive to steel - Pass.
        8. Stainless steel stress corrosion: to ASTM C795.
        9. Thicknesses below 76.2 mm Density:
          1. 40 kg/m3.
        10. Thicknesses 76.2 mm and above Density:
          1. 45 kg/m3.
    - .2 Materials
      1. Non-combustible, lightweight, mineral wool batt insulation to CAN/ULC S702, Type 1, that provides fire resistance to ASTM E136 and a sound control to ASTM E90 and ASTM E423.
        1. Size: to suit framing x 1219 mm.
        2. Thickness: as indicated.
      2. Acceptable Product:

1. AFB, as manufactured by ROCKWOOL.
2. Other preapproved alternate.

## **2.2 ACCESSORIES**

- .1 Fasteners: Mechanical fasteners in accordance with insulation manufacturers written recommendations.

## **Part 3 Execution**

### **3.1 EXAMINATION**

- .1 Verification of Conditions: verify that conditions of substrate previously installed under other Sections or Contracts are acceptable for blanket insulation and acoustical putty application in accordance with manufacturer's written instructions.
  - .1 Visually inspect substrate.
  - .2 Inform Consultant of unacceptable conditions immediately upon discovery.
  - .3 Proceed with installation only after unacceptable conditions have been remedied.

### **3.2 MANUFACTURER'S INSTRUCTIONS**

- .1 Compliance: comply with manufacturer's written data, including product technical bulletins, product catalogue installation instructions, product carton installation instructions, and data sheets.

### **3.3 INSULATION INSTALLATION**

- .1 Install insulation to maintain continuity of thermal protection to building elements and spaces and to ASTM C1320.
- .2 Coordinate installation of firestopping with Section 07 84 00 - Firestopping.
- .3 Fit insulation closely around electrical boxes, pipes, ducts, frames and other objects in or passing through insulation.
- .4 Do not compress insulation to fit into spaces.
- .5 Keep insulation minimum 75 mm from heat emitting devices such as recessed light fixtures, and minimum 50 mm from sidewalls of CAN/ULC-S604 Type A chimneys CSA B149.1 and CSA B149.2 Type B and L vents.
- .6 Do not enclose insulation until it has been observed by Consultant.

### **3.4 CLEANING**

- .1 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            SECTION INCLUDES**

- .1    Section includes, but is not lime to:
  - .1        Foamed-in-place two component, fast cure polyurethane foam that fills cavities, penetrations, and cracks, and to locations indicated intended to function as an insulation and air barrier.
  - .2        Foamed-in-place urethane insulation not contained within a cavity or other restricted space. Assemblies incorporating spray in place urethane insulation to conform to applicable fire protection requirements, local authorities having jurisdiction, Fire Commissioner for Canada and Government Department directives.

**1.2            RELATED REQUIREMENTS**

- .1    Section 06 10 53 - Miscellaneous Rough Carpentry

**1.3            REFERENCE STANDARDS**

- .1    ASTM International
  - .1        ASTM C411-05 - Standard Test Method for Hot-Surface Performance of High-Temperature Thermal Insulation.
  - .2        ASTM C518-10 - Standard Test Method for Steady-State Thermal Transmission Properties by Means of the Heat Flow Meter Apparatus.
  - .3        ASTM C1338-08 - Standard Test Method for Determining Fungi Resistance of Insulation Materials and Facings.
  - .4        ASTM D1621-10 - Standard Test Method for Compressive Properties Of Rigid Cellular Plastics.
  - .5        ASTM D1622-08 - Standard Test Method for Apparent Density of Rigid Cellular Plastics.
  - .6        ASTM D1623-09 - Standard Test Method for Tensile and Tensile Adhesion Properties of Rigid Cellular Plastics (Type C sample).
  - .7        ASTM D2126-09 - Standard Test Method for Response of Rigid Cellular Plastics to Thermal and Humid Aging ASTM D2369-10, Standard Test Method for Volatile Content of Coatings.
  - .8        ASTM D2842-06 - Standard Test Method for Water Absorption of Rigid Cellular Plastics.
  - .9        ASTM D6226 - Standard Test Method for Open Cell Content of Rigid Cellular Plastics.
  - .10       ASTM E96/E96M-10 - Standard Test Methods for Water Vapor Transmission of Materials.
  - .11       ASTM E136-11, Standard Test Method for Assessing Combustibility of Materials Using a Vertical Tube Furnace at 750°C.
- .2    Canadian Construction Materials Centre (CCMC)

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- .1 Canadian Construction Materials Centre (CCMC) Evaluation Report CCMC 13074-L.
  - .2 Canadian Construction Materials Centre (CCMC) Evaluation Report CCMC 13447-L.
  - .3 Canadian Construction Materials Centre (CCMC) Evaluation Report CCMC 13588-L.
  - .4 Canadian Construction Materials Centre (CCMC) Evaluation Report CCMC 13074-L.
  - .5 Canadian Construction Materials Centre (CCMC) Evaluation Report CCMC 13659-R.
  - .6 Canadian Construction Materials Centre (CCMC) Technical Guide, Air Barrier Systems for Exterior Walls of Low-Rise Buildings.
- .3 Underwriters Laboratories of Canada (ULC)
- .1 CAN/ULC S102-10 - Standard Method of Test for Surface Burning Characteristics of Building Materials and Assemblies.
  - .2 CAN/ULC S705.1-01, including amendment 1 & 2 - Standard for Thermal Insulation - Spray Applied Rigid Polyurethane Foam, Medium Density - Material – Specification.
  - .3 CAN/ULC S705.2-05 - Standard for Thermal Insulation - Spray Applied Rigid Polyurethane Foam, Medium Density - Application.
  - .4 CAN/ULC S710.1-2019, Standard For Bead-Applied One Component Polyurethane Air Sealant Foam, Part 1: Material Specification.
  - .5 CAN/ULC S770-09 - Standard Test Method for Determination of Long-term Thermal Resistance of Closed-Cell Thermal Insulating Foams.
  - .6 CAN/ULC S774-03 - Standard Laboratory Guide for the Determination of Volatile Organic Compound Emissions from Polyurethane Foam.

#### **1.4 ACTION AND INFORMATIONAL SUBMITTALS**

- .1 Submit in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Product Data:
  - .1 Submit manufacturer's instructions, printed product literature and data sheets for foamed-in-place insulation and include product characteristics, performance criteria, insulation properties, preparation requirements, overcoat properties, and limitations.
- .3 Submit electronic copies of SDS.
- .4 Test Reports:
  - .1 Submit certified test reports indicating that Products comply with specified performance characteristics and physical properties as evidenced by a current CCMC Evaluation Report certifying the polyurethane foam product for use as an air barrier component is in accordance with the National Building Code of Canada 2015.
  - .2 Submit test reports in accordance with CAN/ULC-S102 for surface burning characteristics.
- .5 Manufacturer's Instructions:

- .1 Submit manufacturer's installation instructions and special handling criteria, perimeter conditions requiring special attention, installation sequence, cleaning and procedures.

## **1.5 CLOSEOUT SUBMITTALS**

- .1 Submission procedures for products not reviewed in an initial submission or where changes were made, apply.

## **1.6 QUALITY ASSURANCE**

- .1 Applicators to conform to CUFCA Quality Assurance Program.
- .2 Products of this section, excluding non-combustible spray insulation:
  - .1 Listed with Canadian Construction Materials Centre (CCMC).
- .3 Regulatory Requirements:
  - .1 Conform to applicable code for protection of foamed plastics.
- .4 Qualifications:
  - .1 Manufacturer: company with specializing in manufacturing material used for work of this section, with sufficient production capacity to produce and deliver required units without causing delay in work with minimum twenty-five years documented experience.
  - .2 Installer:
    - .1 Person specializing in foamed-in-place installations with minimum five years documented experience and approved by manufacturer.
- .5 On-Site Documentation:
  - .1 Maintain a copy of the manufacturer's technical manual on site during application.
- .6 Health and Safety Requirements: worker protection:
  - .1 Protect workers as recommended by CAN/ULC-S705.2 and manufacturer's recommendations:
    - .1 Workers must wear eye protection, gloves, dust masks, long sleeved clothing, protective clothing, and respirators when applying foam insulation.
    - .2 Workers must not eat, drink, or smoke while applying foam insulation.

## **1.7 DELIVERY, STORAGE AND HANDLING**

- .1 Deliver, store and handle materials in accordance with Section with manufacturer's written instructions and 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.
  - .1 Storage and Handling Requirements:
  - .2 Store materials in dry location, off ground, indoors, and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.
  - .3 Store and protect specified materials from nicks, scratches, and blemishes.

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- .3 Replace defective or damaged materials with new.

## **1.8 SITE CONDITIONS**

- .1 Ambient Conditions:
  - .1 Apply foamed-in-place insulation materials only when surfaces and ambient temperatures are within manufacturers' prescribed limits.
  - .2 Do not proceed with work when ambient temperature is outside -10°C to +40°C.
- .2 Ventilate area to receive spray polyurethane foam insulation in accordance with CAN/ULC-S774, introducing fresh air and exhausting air continuously following delivery of minimum 0.3 air changes per hour during and for 24 hours after application to maintain non-toxic, unpolluted, safe working conditions.
- .3 Provide temporary enclosures to prevent spray and noxious vapours from contaminating air beyond application area.
- .4 Protect adjacent surfaces and equipment from damage by overspray, fall-out, and dusting of insulation materials.

## **Part 2 Products**

### **2.1 COMPATIBILITY**

- .1 Components of system and adjacent materials to be compatible. Provide written declaration to Consultant stating that materials and components, as assembled in system, meet this requirement.:

### **2.2 MATERIALS**

- .1 Foamed-in-place insulation acting as an air barrier system: bead-applied one component polyurethane air sealant, 1/2 lb density, to CAN/ULC S710.1. Acceptable products:
  - .1 Great Stuff, as manufactured by Du Point, to CCMC 13074-L.
  - .2 HandiFoam, as manufactured by ICP, to CCMC 13626-L

### **2.3 COMPONENTS**

- .1 Primers: in accordance with manufacturers recommendations, to CAN/ULC S705.2..
- .2 Sealant: mastic, synthetic rubber compound required by manufacturer to suit environmental conditions at time of application:

### **2.4 EQUIPMENT**

- .1 Comply with CAN/ULC S705.2 and the equipment manufacturer's recommendations for specific type of application.

## **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 spray polyurethane foam insulation application in accordance with manufacturer's written instructions.
  - .1          Visually inspect substrate.
    - .1            Verify work within construction spaces or crevices is complete before insulation application.
    - .2            Verify work by other trades that may penetrate through spray polyurethane foam insulation are in place and complete.
  - .2          Inform Consultant of unacceptable conditions immediately upon discovery.
  - .3          Proceed with installation only after unacceptable conditions have been remedied.

### **3.2                PREPARATION**

- .1      Mask and protect adjacent surfaces from over spray or dusting.
- .2      Where required for adhesion, apply primer in accordance with manufacturer's written instructions.
  - .1          Prime metal and non-porous surfaces when required by polyurethane foam manufacturer's written instructions.
- .3      Remove any dust, dirt, foreign material, loose paint, and similar deleterious materials which could otherwise create a false bond or staining of insulation on surfaces to receive non-combustible spray insulation. Clean and seal as required.
  - .1          Verify bond requirements and compatibility of all surfaces to receive thermal insulation materials.
  - .2          Coordinate and apply non-combustible spray insulation before positioning and installing ducts, piping, equipment, or other items, which would interfere with non-combustible spray insulation.

### **3.3                APPLICATION**

- .1      Apply insulation to clean surfaces in accordance with manufacturer's printed instructions and CAN/ULC-S705.2.
- .2      Apply insulation by spray method, to a uniform monolithic density without voids, in lifts not exceeding 50 mm thickness in a single pass.
- .3      Apply to a minimum cured thickness as indicated or thickness as required to achieve indicated thermal value.
- .4      Finished surface of foam to be free of voids and imbedded foreign objects.
- .5      Shave down to thickness indicated where overspray or expansion has occurred.
- .6      Remove masking materials and over spray from adjacent areas immediately after foam surface has hardened.
- .7      Repair damaged areas in accordance with manufacturer's application guidelines for insulation in an air barrier.

- .8 Patching: original installer to perform all patching and repairing of sprayed insulation due to cutting by other subcontractors.

### **3.4 CLEANING**

- .1 Progress Cleaning: clean in accordance with Section 01 74 11 - Cleaning.
  - .1 Leave Work area clean at end of each day.
- .2 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment in accordance with Section 01 74 11 - Cleaning.
  - .1 Remove insulation material spilled during installation and leave work area ready for application of wall board.

### **3.5 PROTECTION OF FINISHED WORK**

- .1 Protection of finished work: in accordance with manufacturer's recommendations.
- .2 Do not permit subsequent construction work to disturb applied polyurethane foam.

**END OF SECTION**

**Part 1            General**

**1.1            RELATED REQUIREMENTS**

- .1      Section 06 10 53 - Miscellaneous Rough Carpentry
- .2      Section 07 21 16 - Fibrous Insulation
- .3      Section 07 21 29 - Spray Applied Polyurethane Foam Insulation
- .4      Section 07 27 00 - Air Barriers
- .5      Section 07 92 00 - Joint Sealants
- .6      Section 08 11 00 - Metal Doors And Frames
- .7      Section 09 21 16 - Gypsum Board Assemblies

**1.2            REFERENCE STANDARDS**

- .1      Canadian General Standards Board (CGSB)
  - .1      CAN/CGSB-51.34-M86, Vapour Barrier, Polyethylene Sheet, for Use in Building Construction.

**1.3            ACTION AND INFORMATIONAL SUBMITTALS**

- .1      Submit in accordance with Section 01 33 00 - Submittal Procedures.
- .1      Product Data:
  - .1      Submit manufacturer's instructions, printed product literature and data sheets for vapour retarders and include product characteristics, performance criteria, physical size, finish and limitations.
  - .2      Submit electronic copies of WHMIS MSDS.
- .2      Certificates:
  - .1      Submit product certificates signed by manufacturer certifying materials comply

**1.4            QUALITY ASSURANCE**

- .1      Mock-Ups:
  - .1      Submit mock-ups in accordance with Section 01 45 00 - Quality Control.
  - .2      Construct mock-up of sheet vapour barrier installation including one lap joint, one inside corner and at one electrical box. Mock-up may be part of finished work.
  - .3      Mock-up will be used to judge quality of work, substrate preparation, and material application.
  - .4      Locate where directed.
  - .5      Coordinate construction of mock-up with regular site meetings for review of mock-up before proceeding with work.
  - .6      When reviewed, mock-up will demonstrate minimum standard of quality required for this work. Reviewed mock-up may remain as part of finished work.

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## **1.5 DELIVERY, STORAGE AND HANDLING**

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

## **Part 2 Products**

### **2.1 SHEET VAPOUR BARRIER**

- .1 Polyethylene film: to CAN/CGSB-51.34, 0.254 mm (10 mil) thick.

### **2.2 ACCESSORIES**

- .1 Joint sealing tape: air resistant pressure sensitive adhesive tape, type recommended by vapour barrier manufacturer, 50 mm wide for lap joints and perimeter seals, 25 mm wide elsewhere.
- .2 Sealant: compatible with vapour retarder materials, as recommended by vapour retarder manufacturer, and to Section 07 92 00 - Joint Sealants.
- .3 Staples for wood framing: minimum 6 mm leg.
- .4 Moulded box vapour barrier: factory-moulded polyethylene box for use with recessed electric switch and outlet device boxes.

## **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 vapour retarder installation in accordance with manufacturer's written instructions.
  - .1 Visually inspect substrate.
  - .2 Inform Consultant of unacceptable conditions immediately upon discovery.
  - .3 Proceed with installation only after unacceptable conditions have been remedied.

### **3.2 INSTALLATION**

- .1 Verify services are installed and inspected before installation of retarder.
- .2 Install sheet vapour retarder on warm side of wall assemblies before installation of gypsum board to form continuous retarder.

- .3 Use sheets of largest practical size to minimize joints.
- .4 Inspect for continuity. Repair punctures and tears with sealing tape before work is concealed.

### **3.3 BETWEEN DOUBLE TOP PLATES BELOW ROOF JOISTS AND TRUSSES**

- .1 Seal sheet vapour barrier at top of walls as follows:
  - .1 Apply continuous bead of sealant to substrate of first (lower) top plate.
  - .2 Lap 480 mm wide sheet over sealant with 150 mm flap on the interior side and 150 mm flap on the exterior side of wall and press into sealant bead.
  - .3 Install second (upper) top plate securing the sheet vapour barrier in-between.
  - .4 After the exterior wall sheet vapour barrier is installed drape down the 150 mm flap on the interior side of the wall and lap over the adjacent sheet. Continuously seal in place to maintain the continuity of the vapour retarder.

### **3.4 EXTERIOR SURFACE OPENINGS**

- .1 Cut sheet vapour retarder to form openings and verify material is lapped and sealed to frame.

### **3.5 PERIMETER SEALS**

- .1 Seal perimeter of sheet vapour barrier as follows:
  - .1 Apply continuous bead of sealant to substrate at perimeter of sheets.
  - .2 Lap sheet over sealant and press into sealant bead.
  - .3 Install staples or alternate reviewed fasteners through lapped sheets at sealant bead into wood or metal substrate.
  - .4 Verify that no gaps exist in sealant bead. Smooth out folds and ripples occurring in sheet over sealant.

### **3.6 LAP JOINT SEALS**

- .1 Seal lap joints of sheet vapour barrier as follows:
  - .1 Attach first sheet to substrate.
  - .2 Apply continuous bead of sealant over solid backing at joint.
  - .3 Lap adjoining sheet minimum 150 mm and press into sealant bead.
  - .4 Install staples or alternate reviewed fasteners through lapped sheets at sealant bead into wood or metal substrate.
  - .5 Verify that no gaps exist in sealant bead. Smooth out folds and ripples occurring in sheet over sealant.

### **3.7 ELECTRICAL BOXES AND EXHAUST FANS**

- .1 Seal electrical switch and outlet device boxes, exhaust fans, and similar items that penetrate vapour barrier as follows:
  - .1 Install moulded box vapour barrier. Wrap boxes with film sheet providing minimum 300 mm perimeter lap flange.
  - .2 Apply sealant to seal edges of flange to main vapour barrier and seal wiring and duct penetrations through box cover.

### **3.8            CLEANING**

- .1      Progress Cleaning:
  - .1          Leave Work area clean at end of each day.
- .2      Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment in accordance with Section 01 74 11 - Final Cleaning.
  - .1          Remove insulation material spilled during installation and leave work area ready for application of gypsum board.

**END OF SECTION**

**Part 1            General**

**1.1            SECTION INCLUDES**

- .1    Section includes, but is not limited to:
  - .1       Vapour retarders used under slabs-on-grade.

**1.2            RELATED REQUIREMENTS**

- .1    Section 03 35 00 - Concrete Finishing
- .2    Section 07 11 13 - Bituminous Dampproofing
- .3    Section 07 21 13 - Board Insulation

**1.3            REFERENCES**

- .1    Canadian General Standards Board (CGSB)
  - .1       CAN/CGSB-19.13-M87, Sealing Compound, One Component, Elastomeric, Chemical Curing.
  - .2       CAN/CGSB-51.34-M86, Vapour Barrier, Polyethylene Sheet, for Use in Building Construction.

**1.4            ACTION AND INFORMATIONAL SUBMITTALS**

- .1    Submit in accordance with Section 01 33 00 - Submittal Procedures.
- .2    Product Data:
  - .1       Submit manufacturer's instructions, printed product literature and data sheets for under slab vapour retarders and include product characteristics, performance criteria, physical size, finish and limitations.
  - .2       Submit electronic copies of WHMIS MSDS.
- .3    Quality assurance submittals:
  - .1       Submit product certificates signed by manufacturer certifying materials comply with specified performance characteristics and criteria and physical requirements.
  - .2       Instructions: submit manufacturer's installation instructions and comply with written recommendations or specifications, including product technical bulletins, handling, storage and installation instructions, and datasheet.

**1.5            QUALITY ASSURANCE**

- .1    Mock-Ups:
  - .1       Submit mock-ups in accordance with Section 01 45 00 - Quality Control.
  - .2       Construct mock-up of sheet vapour barrier installation including one lap joint, one inside corner and at one electrical box. Mock-up may be part of finished work.
  - .3       Mock-up will be used to judge quality of work, substrate preparation, and material application.
  - .4       Locate where directed.

- .5 Coordinate construction of mock-up with regular site meetings for review of mock-up before proceeding with work.
- .6 When accepted, mock-up will demonstrate minimum standard of quality required for this work.
- .7 Reviewed mock-up may remain as part of finished work.

## **1.6 DELIVERY, STORAGE AND HANDLING**

- .1 Deliver, store and handle materials in accordance with Section 01 61 00 - Common Product Requirements.

## **Part 2 Products**

### **2.1 SHEET VAPOUR BARRIER**

- .1 Acceptable materials:
  - .1 Polyethylene film: to CAN/CGSB-51.34, 0.254 mm (10 mil) thick.

### **2.2 ACCESSORIES FOR POLYETHYLENE FILM**

- .1 Joint sealing tape: air resistant pressure sensitive adhesive tape, type recommended by vapour barrier manufacturer, 50 mm wide for lap joints and perimeter seals, 25 mm wide elsewhere.
- .2 Sealant: to CAN/CGSB-19.13-M87, compatible with vapour retarder materials, recommended by vapour retarder manufacturer. To Section 07 92 00 - Joint Sealants.  
Acceptable product:
  - .1 Dow Corning 795.
  - .2 Other preapproved alternate.
- .3 Termination Bars: as recommended by the manufacturer.

## **Part 3 Execution**

### **3.1 EXAMINATION**

- .1 Verification of Conditions: verify that conditions of substrate previously installed under other Sections or Contracts are acceptable for under slab vapour retarder installation in accordance with manufacturer's written instructions.
  - .1 Visually inspect substrate.
  - .2 Inform Consultant of unacceptable conditions immediately upon discovery.
  - .3 Proceed with installation only after unacceptable conditions have been remedied.

### **3.2 INSTALLATION**

- .1 Verify services are installed and inspected before installation of retarder.
- .2 Install sheet vapour barrier below all slab-on-grade concrete in accordance with NBC(AE) and manufactures recommendations.
- .3 Use sheets of largest practical size to minimize joints.

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- .4 Lap joints 150 mm and continuously seal with tape. Continue sheet vapour barrier up walls and adjacent surfaces minimum 100 mm. In accordance with manufacturer recommendations install termination bars.
  - .5 Continue sheet vapour barrier up mechanical and electrical penetrations and seal with tape.
  - .6 For interior forming applications, avoid the use of non-permanent stakes driven through vapour barrier.
  - .7 Protect sheet vapour barrier before and during concrete installation.
  - .8 Inspect for continuity. Repair punctures and tears with sealing tape before work is concealed.

### **3.3 CLEANING**

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

**END OF SECTION**

**Part 1            General**

**1.1            RELATED REQUIREMENTS**

- .1      Section 06 10 53 - Rough Carpentry
- .2      Section 07 21 29 - Spray Applied Polyurethane Foam Insulation
- .3      Section 07 62 00 - Sheet Metal Flashing and Trim
- .4      Section 07 92 00 - Joint Sealants
- .5      Section 08 11 00 - Metal Doors And Frames
- .6      Section 09 21 16 - Gypsum Board Assemblies

**1.2            REFERENCES**

- .1      National Building Code - 2019 Alberta Edition, Part 5, Environmental Separation.
- .2      American Society for Testing and Materials International (ASTM)
  - .1      ASTM E96/E96M-13, Standard Test Methods for Water Vapor Transmission of Materials.
  - .2      ASTM D4541-09e1, Standard Test Method for Pull-Off Strength of Coatings Using Portable Adhesion Testers.
  - .3      ASTM E283-04 (2012) , Standard Test Method for Determining Rate of Air Leakage Through Exterior Windows, Curtain Walls, and Doors Under Specified Pressure Differences Across the Specimen
  - .4      ASTM E330-14, Standard Test Method for Structural Performance of Exterior Windows, Doors, Skylights and Curtain Walls, by Uniform Static Air Pressure Difference.
  - .5      ASTM E783-02 (2010), Standard Test Method for Field Measurement of Air Leakage Through Installed Exterior Windows and Doors.
  - .6      ASTM E1186-03(2009), Standard Practices for Air Leakage Site Detection in Building Envelope and Air Retarder Systems.
  - .7      ASTM E2178-13, Standard Test Method for Air Permeance of Building Materials.
  - .8      ASTM E2357-11, Standard Test Method for Determining Air Leakage Rate of Air Barrier Assemblies.
- .3      Canadian Construction Materials Centre CCMC Technical Guide 07273 Air Barrier Materials.
  - .1      Canadian General Standards Board (CGSB)
  - .2      CAN/CGSB-19.13-M87-withdrawn, Sealing Compound, One Component, Elastomeric Chemical Curing.
  - .3      CAN/CGSB-19.24-M90-withdrawn, Multi-Component, Chemical Curing Sealing Compound.
  - .4      CGSB 19-GP-14-M84-withdrawn, Sealing Compound, One Component, Butyl-Polyisobutylene Polymer Base, Solvent Curing.
  - .5      CAN/CGSB-51.32-M77-withdrawn, Sheathing, Membrane, Breather Type

- .4 Sealant and Waterproofer's Institute - Sealant and Caulking Guide Specification.
- .5 Underwriters Laboratories of Canada
  - .1 CAN/ULC-S741-08, Standard for Air Barrier Materials – Specification

### **1.3 PERFORMANCE REQUIREMENTS**

- .1 Select and install wall and roof components and assemblies to resist air leakage caused by static air pressure across exterior wall, soffits and roof assemblies, including windows, glass, doors, roof hatches and other interruptions to integrity of wall and roof systems; to maximum air leakage rate of 0.20 L/s.m<sup>2</sup> when subjected to pressure differential of 75 Pa as measured in accordance with ASTM E283.

### **1.4 ACTION AND INFORMATIONAL SUBMITTALS**

- .1 Submit in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Product Data:
  - .1 Submit manufacturer's instructions, printed product literature and data sheets for polyurethane foam sprayed insulation and include product characteristics, performance criteria, physical size, finishes, and limitations.
  - .2 Submit electronic copies of WHMIS SDS.
- .3 Quality Assurance Submittals: submit following in accordance with Section 01 45 00 - Quality Control.
  - .1 Certificates: submit certificates signed by manufacturer certifying that materials comply with specified performance characteristics and physical properties.
  - .2 Manufacturer's Instructions: submit manufacturer's installation instructions and special handling criteria, installation sequence, and cleaning procedures.
  - .3 Manufacturer's Field Reports: submit manufacturer's written reports within three days of review, verifying compliance of Work, as described in PART 3 - FIELD QUALITY CONTROL.

### **1.5 QUALITY ASSURANCE**

- .1 Qualifications:
  - .1 Applicator: company specializing in performing work of this section with minimum five years' experience with installation of air/vapour barrier systems.
    - .1 Completed installation must be approved by the material manufacturer.
  - .2 Currently licensed by National Air Barrier Association or Canadian Urethane Foam Contractor's Association.
  - .3 Must maintain their license throughout the duration of the project.
- .2 Mock-Up:
  - .1 Construct mock-up in accordance with Section 01 45 00 - Quality Control.
  - .2 Construct typical exterior wall panel, incorporating window frame and sill, insulation, building corner condition, junction with roof system; illustrating materials interface and seals for both vapour permeable and non-permeable air and vapour barriers.
  - .3 Locate where directed.

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- .4 Mock-up may remain as part of finished work.
  - .5 Coordinate construction of mock-up with regular site meetings for review of mock-up before proceeding with work.
  - .3 Site Meetings: as part of Manufacturer's Services described in PART 3 - FIELD QUALITY CONTROL, schedule site visits, to review Work, at stages listed.
    - .1 After delivery and storage of products, and when preparatory Work is complete, but before installation begins.
    - .2 Twice during progress of Work at 25% and 60% complete.
    - .3 Upon completion of Work, after cleaning is carried out.

## **1.6 DELIVERY, STORAGE AND HANDLING**

- .1 Deliver, store and handle materials in accordance with Section 01 61 00 - Common Product Requirements and with manufacturer's written instructions.
- .2 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, off ground, indoors, and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.
  - .2 Store and protect specified materials from nicks, scratches, and blemishes.
  - .3 Replace defective or damaged materials with new.

## **1.7 PROJECT ENVIRONMENTAL REQUIREMENTS**

- .1 Temperature, relative humidity, moisture content.
  - .1 Apply membranes only when surfaces and ambient temperatures are within manufacturers' prescribed limits.
  - .2 Do not install membrane when air and substrate temperature remain below 5 degrees C, or when wind chill gives equivalent cooling effect.
  - .3 Install membrane on dry substrate, free of snow and ice, use only dry materials and apply only during weather that will not introduce moisture into system.
- .2 Install solvent curing sealants and vapour release adhesive materials in open spaces with ventilation.
- .3 Ventilate enclosed spaces.

## **1.8 SEQUENCING**

- .1 Sequence work to permit installation of materials in conjunction with related materials and seals.

## **1.9 WARRANTY**

- .1 Warranty: include coverage of installed sealant and sheet materials which:
  - .1 Fail to achieve airtight and watertight seal or vapour permeable seal.
  - .2 Exhibit loss of adhesion or cohesion.
  - .3 Do not cure.

## **Part 2 Products**

### **2.1 MATERIALS**

- .1 Materials: as required to achieve specified performance criteria; functionally compatible with adjacent materials and components.

### **2.2 SHEET MATERIALS**

- .1 Sheet Seal: pliable, self-adhesive, cold applied composite sheet membrane of high strength, high density cross-laminated to high-density polyethylene film.
  - .1 Acceptable products:
    - .1 Air and Vapour Barrier 3015 as manufactured by 3M.
    - .2 Perm-A-Barrier Wall Membrane as manufactured by Grace (GCP Applied Technologies).
    - .3 Sopraseal Stick 1100 T as manufactured by Soprema.
    - .4 Blueskin SA LT as manufactured by Henry.
    - .5 Other preapproved alternate.
  - .2 Vapour Permeable Sheet Seal: pliable, self-adhesive, cold applied composite sheet membrane.
    - .1 Acceptable products:
      - .1 Vapour Permeable Air Barrier 3015VP as manufactured by 3M.
      - .2 Perm-A-Barrier VPS as manufactured by Grace (GCP Applied Technologies).
      - .3 Sopraseal Stick VP as manufactured by Soprema.
      - .4 Blueskin VP 160 as manufactured by Henry.
      - .5 Other preapproved alternate.

### **2.3 SEALANTS**

- .1 Sealants in accordance with Section 07 92 00 - Joint Sealants or as recommended by manufacturer.
- .2 Primer: recommended by sealant manufacturer and appropriate to application.
- .3 Substrate Cleaner: non-corrosive type recommended by sealant manufacturer and compatible with adjacent materials.

### **2.4 ACCESSORIES**

- .1 Thinner and cleaner for materials: as recommended by material manufacturer.

## **Part 3 Execution**

### **3.1 MANUFACTURER'S INSTRUCTIONS**

- .1 Compliance: comply with manufacturer's written recommendations or specifications, including product technical bulletins, handling, storage and installation instructions, and datasheets.

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### **3.2 GENERAL**

- .1 Perform Work in accordance with Sealant and Waterproofer's Institute - Sealant and Caulking Guide Specification requirements for materials and installation.
- .2 Perform Work in accordance with National Air Barrier Association - Professional Contractor Quality Assurance Program and requirements for materials and installation.
- .3 Perform Work in accordance with Canadian Urethane Foam Contractor's Association - Professional Contractor Quality Assurance Program and requirements for materials and installation.

### **3.3 SUBSTRATE EXAMINATION**

- .1 Verification of Conditions: verify that conditions of substrate previously installed under other Sections or Contracts are acceptable in accordance with manufacturer's written instructions.
  - .1 Visually inspect substrate.
  - .2 Inform Consultant of unacceptable conditions immediately upon discovery.
  - .3 Proceed with installation only after unacceptable conditions have been remedied.
- .2 Before start of Work make sure:
  - .1 Substrates are firm, straight, smooth, dry, and free of snow, ice or frost, contamination and swept clean of dust and debris.
  - .2 Curbs have been built.
  - .3 Sleeves, vents, pipes, and other items passing through substrates receiving work of this Section are properly and rigidly installed.
  - .4 Plywood and lumber nailer plates have been installed to walls and parapets as indicated.

### **3.4 PREPARATION**

- .1 Remove loose or foreign matter, which might impair adhesion of materials.
- .2 Substrates to be clean of oil or excess dust; masonry joints struck flush, and open joints filled; and concrete surfaces free of large voids, spalled areas or sharp protrusions.
- .3 Substrates are free of surface moisture before application of self-adhesive and fluid-applied membrane and primer.
- .4 Metal closures are free of sharp edges and burrs.
- .5 Prime substrate surfaces to receive adhesive and sealants in accordance with manufacturer's instructions.

### **3.5 INSTALLATION**

- .1 Install materials in accordance with manufacturer's instructions. Positive lap seal over firm bearing and install sealant to provide complete seal.
- .2 Apply sealant within recommended application temperature ranges.
  - .1 Consult manufacturer when sealant cannot be applied within these temperature ranges.

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- .3 Install materials for complete installation and to withstand wind loads (positive and negative) based on 1/100 year wind loads as outlined in the NBC(AE) for the Banff area.

### **3.6 FIELD QUALITY CONTROL**

- .1 Manufacturer's Field Services:
  - .1 Obtain written report from manufacturer verifying compliance of Work, in handling, installing, applying, protecting and cleaning of product and submit Manufacturer's Field Reports as described in PART 1 - SUBMITTALS.
  - .2 Provide manufacturer's field services consisting of product use recommendations and periodic site visits for inspection of product installation in accordance with manufacturer's instructions.
  - .3 Schedule site visits, to review Work, as directed in PART 1 - QUALITY ASSURANCE.

### **3.7 CLEANING**

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

### **3.8 PROTECTION OF WORK**

- .1 Protect finished work in accordance with Section 01 61 00 - Common Product Requirements.
- .2 Do not permit adjacent work to damage work of this section.
- .3 Finished work to be protected from climatic conditions.

**END OF SECTION**

**Part 1            General**

**1.1            RELATED REQUIREMENTS**

- .1    Section 06 10 53 - Miscellaneous Rough Carpentry
- .2    Section 07 21 13 - Board Insulation
- .3    Section 07 27 00 - Air Barriers
- .4    Section 07 62 00 - Sheet Metal Flashing and Trim
- .5    Section 07 92 00 - Joint Sealants
- .6    Section 08 11 00 - Metal Doors And Frames

**1.2            REFERENCE STANDARDS**

- .1    ASTM International
  - .1    ASTM E96/E96M-15, Standard Test Methods for Water Vapor Transmission of Materials.
  - .2    ASTM C1186-08(2012), Standard Specification for Flat Fiber-Cement Sheets.
  - .3    ASTM E136-16 Standard Test Method for Behaviour of Materials in a Vertical Tube Furnace at 750°C.
  - .4    ASTM C666/C666M-15, Standard Test Method for Resistance of Concrete to Rapid Freezing and Thawing.
  - .5    ASTM F1667 Standard Specification for Driven Fasteners: Nails, Spikes, and Staples.
  - .6    ASTM E84-15b, Standard Test Method for Surface Burning Characteristics of Building Materials.
- .2    Canadian General Standards Board (CGSB)
  - .1    CGSB 41-GP-6M-83, Sheets, Thermosetting Polyester Plastics, Glass Fibre Reinforced.
- .3    Green Seal Environmental Standards (GS)
  - .1    GS-11-11 , Standard for Paints and Coatings.
  - .2    GS-36-2013 , Standard for Commercial Adhesives.
- .4    Health Canada/Workplace Hazardous Materials Information System (WHMIS)
  - .1    Material Safety Data Sheets (MSDS).
- .5    The Master Painters Institute (MPI)
  - .1    Architectural Painting Specification Manual - current edition.
    - .1    MPI EXT 5.1C.
- .6    Underwriters Laboratories' of Canada (ULC)
  - .1    CAN/ULC-S701-11, Standard for Thermal Insulation, Polystyrene, Boards and Pipe Covering.
  - .2    CAN/ULC-S702-14, Standard for Thermal Insulation, Mineral Fibre for Buildings.

- .3 CAN/ULC-S704-2011, Standard for Thermal Insulation, Polyurethane and Polyisocyanurate Boards, Faced.
- .4 CAN/ULC-S706-09, Standard for Wood Fibre Insulating Boards for Buildings.

### **1.3 ACTION AND INFORMATIONAL SUBMITTALS**

- .1 Submit in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Product Data:
  - .1 Submit manufacturer's instructions, printed product literature and data sheets for cementitious materials, support system, fasteners, adhesives and accessories. Include product characteristics, performance criteria, physical size, finish and limitations.
  - .2 Submit electronic copies of SDS.
- .3 Shop Drawings:
  - .1 Submit elevations and section details indicating panel types, dimensions, support system layout, fastener locations, end details, typical joint detail, wall openings, head, jamb, sill and mullion detail, inside and outside corners, parapet detail, transition details, substrate, air barrier and insulation, all materials and finishes, anchor details, compliance with design criteria and requirements of related work.
    - .1 Minimum scale 1:5.
- .4 Samples:
  - .1 Submit duplicate 150 x 150 mm samples of wall system and duplicate 300 mm long pieces of trim and other accessories representative of materials, finishes and custom or special colours per 2.2.1.10.

### **1.4 DELIVERY, STORAGE AND HANDLING**

- .1 Deliver, store and handle materials in accordance with Section 01 61 00 - Common Product Requirements and with manufacturer's written instructions.
- .2 Delivery and Acceptance Requirements: deliver materials to site in original factory packaging, labelled with manufacturer's name and address.
- .3 Storage and Handling Requirements:
  - .1 Store materials off ground, in dry location, and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.
  - .2 Store fibre cement siding and trim stacked on edge or laid flat on smooth level raised platform surfaces. Protect edges and corners from chipping or damage.
  - .3 Store materials on site to prevent deterioration, loss or impairment of structural or other essential properties. Cover with tarpaulins or polyethylene sheets. If material becomes wet, allow to dry thoroughly before installation.
    - .1 Protect stored materials from snow cover to prevent warping or potential for damage from snow loading.
  - .4 Replace defective or damaged materials with new.

## **1.5 ENVIRONMENTAL REQUIREMENTS**

- .1 Comply with requirements of Workplace Hazardous Materials Information System (WHMIS) regarding use, handling, storage, and disposal of hazardous materials; and regarding labelling and provision of material safety data sheets (SDS) acceptable to Labour Canada.

## **Part 2 Products**

### **2.1 MANUFACTURERS**

- .1 Acceptable manufacturers:
  - .1 James Hardie.
  - .2 Other preapproved manufacturer.

### **2.2 MATERIALS**

- .1 Fibre Cement Siding: conforming to ASTM 1186, Grade II, type A. Siding to have the following nominal physical or mechanical properties:
  - .1 Density average: 1453.5 kg/m<sup>3</sup>
  - .2 Water Absorption (%) (by Mass): 27.41%
  - .3 Dimensional Change (at 50 - 90% RH):
    - .1 MD: 0.10%
    - .2 XD: 0.19%
  - .4 Flexural Strength (MPa):
    - .1 MD: 21.62%
    - .2 XD: 12.53%
  - .5 Fastener Pull Resistance: 1482 N
  - .6 Freeze/Thaw Cycling (100 cycles per ASTM C666, method B): Passed
    - .1 MD: 40%
    - .2 XD: 30%
  - .7 Watertightness: No formation of drops of water on underside: Passed.
  - .8 Warm Water Resistance: Passed
    - .1 MD: 27% (loss)
    - .2 XD: 30% (gain)
  - .9 Rain Penetration Resistance: Prevent water entry into the innermost face of wall: passed.
  - .10 Colour: Parks Green; colour to match the Johnston Canyon Campground entry kiosk building siding. Colour may not be a standard readily available product offering and may require custom or special ordering.
- .2 Fibre Cement siding to be non-combustible when tested in accordance with ASTM method E136.
- .3 Surface burning characteristics when tested in accordance with ASTM E84:
  - .1 Class A (1) Flame Spread: 0

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- .2 Smoke Developed: 5
  - .4 Types:
    - .1 Fiber Cement Lap Siding: prefinished lap siding with a sloped top, beveled drip edge, and nailing line's. Location as indicated on drawing elevations.
      - .1 Select Cedarmill 210 mm (8-1/4 inches) with 178 mm (7 inches) exposure.
      - .2 Finish: factory applied finish, in a facility reviewed by the cementitious panel manufacturer, applied by a company with an automated coating application process for siding substrates.
        - 1. Factory Primer: provide factory applied universal primer, applied by manufacturer.
        - 2. Process:
          - 1. Factory applied finish by a semi-transparent coating applicator in a controlled environment with a multi-coat, heat cured finish within one manufacturing process.
          - 2. Each finish color must have a color match to delta E of 0.5 or better between product lines, manufacturing lots or production runs
        - 3. Protection: factory applied finish protection such as foam sheeting that is removed once siding is installed
        - 4. Accessories: complete finishing system includes pre-packaged touch-up kit provided by semi transparent coating manufacturer. Provide quantities as recommended by manufacturer.
        - 5. Finish: factory prefinished, custom or special colour per 2.2.1.10, 100% acrylic latex coating, over machine applied sealant, with 12 year limited coating warranty; colours as indicated.
    - .2 Fibre Cement Trims: prefinished trim, colour and facing to match adjacent panel siding in colour and finish, 5/4 boards of sizes and profiles as indicated on the drawings. Provide manufacturer's standard one piece outside corner trim as indicated. Provide manufacturer's standard corner trims as detailed on the drawings. Location as indicated on drawing elevations.
      - .1 Length: 3660 mm.
      - .2 Finish: factory prefinished top coat, applied over machine applied sealant; with 25 year limited coating warranty.
  - .5 Trim, Flashing and Accessories: manufacturer's standard trim, flashing and accessories as required to complete the work of this Section. Use manufacturer's standard profiles wherever possible. Where required due to job conditions, provide custom profiles to suit.
  - .6 Vertical rainscreen attachment and support framing system:
    - .1 Acceptable product:
      - .1 Knight Wall Systems, Thermazee.
        - 1. Spacing: Comply with manufacturer's Professional Engineers calculations.

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- 2. Vertical Girt: Vertical girt with pre-punched attachment holes, directly attached on top horizontal girt framing at regular spacing, with manufacturers engineered thermally isolated washer assembly and fasteners.
  - 3. Steel Thickness: Minimum 0.046-inch thick (18 gauge).
  - 4. Profile Depth: 19 mm.
  - 5. Girt Fastening Face, Width: 50 mm.
  - .2 Other preapproved alternate
  - .7 Nails (to wood framing): Hot dipped galvanized 6d common or 32 mm long roofing nails conforming to ASTM F1667.
  - .8 Vinyl accessories for electrical outlets and light fixtures: manufacturer's standard to suit application.

### **Part 3 Execution**

#### **3.1 EXAMINATION**

- .1 Verification of Conditions: verify that conditions of substrate previously installed under other Sections or Contracts are acceptable in accordance with manufacturer's written instructions.
  - .1 Visually inspect substrate.
  - .2 Inform Consultant of unacceptable conditions immediately upon discovery.
  - .3 Proceed with installation only after unacceptable conditions have been remedied
- .2 Coordinate work with work of other sections.
  - .1 Verify air and vapour barrier membrane, and structural metal stud framing required for fibre reinforced cementitious wall panels, and thermal batt insulation have been installed, and work has been reviewed by Consultant before proceeding with installation of fibre reinforced cementitious wall panels.

#### **3.2 INSTALLATION**

- .1 Install fibre cement siding, trim, trim system and transition trim accessories, flashing and accessories in accordance with manufacturer's recommendations and reviewed shop drawings. Install neatly and accurately installed, using as few joints as possible.
- .2 Locate fasteners to provide complete installation and to withstand wind loads (positive and negative) based on 1 in 100 year wind loads as outlined in the National Building Code - 2019 Alberta Edition for the Banff Area.
- .3 Vertical rainscreen attachment and support framing system
  - .1 Install vertical girts in vertical orientation in strict accordance with manufacturer's installation instructions.
  - .2 Do not use shims to plumb the wall between the vertical girt and insulation.
  - .3 Minimum length of installed cut girt is 610 mm and attached with a minimum of two fasteners.
  - .4 Check plumb of vertical girts both parallel and perpendicular to the structure.

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- .5 Tighten screws that attach vertical girt to horizontal girt to a snug tight condition and not stripped. Do not over-torque beyond manufacturer's recommendation. If installed using hand tools, verify for each installer at beginning of project using snug-tight criteria. Do not use stripped holes.
  - .6 Where obstructions are present and unavoidable (i.e. window openings), use laser or chalk line to restart girt.
  - .7 Locate vertical girt at jamb conditions and outside corner conditions.
  - .8 Use shearing instruments (i.e. snips, nibbler, etc.) for cutting metal framing components. Saws are not recommended, as the sparks produced during cutting will damage the anti-corrosion coating. If sparks are generated during cutting, be sure the portion of the component to be installed on the building is protected from sparks and that any stockpile near the cutting station is also protected.
  - .9 Do not cut system components while installed on the building, unless using a shearing instrument.
  - .10 Replace thermal isolator pieces that break during installation.
  - .11 Provide a 9 - 13 mm gap between girts for expansion when multiple lengths of vertical girts are installed.
  - .4 Install panels as follows:
    - .1 Verify that framing or trim system occurs on all edges of panels.
    - .2 Install fasteners no closer than 10 mm from panel edges and 50 mm from panel corners.
    - .3 Maintain clearance between panels and adjacent grade as indicated.
    - .4 Install as indicated on the drawings.
    - .5 Take care not to damage factory finish. Touch up minor scratches on site, to render damaged areas undetectable.

### **3.3 CLEANING**

- .1 Clean: in accordance with Section 01 74 11 - Cleaning.
  - .1 Wash down exposed exterior surfaces using solution of mild domestic detergent in warm water, applied with soft clean wiping cloths.
  - .2 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 - Final Cleaning.

### **3.4 SITE QUALITY CONTROL**

- .1 Arrange for manufacturer's technical representative to visit the site to review the work and verify that it is in conformance with manufacturer's recommendations. Submit reports to Consultant within three days of visit. Schedule visits as follows:
  - .1 Pre-installation meeting.
  - .2 Shortly after commencement of installation work.
  - .3 Periodically while installation work underway.
  - .4 At completion.

**3.5 PROTECTION**

- .1 Protect installed products and components from damage during construction.
- .2 Repair damage to adjacent materials caused by mineral fibre reinforced panel installation.

**END OF SECTION**

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**Part 1            General**

**1.1            RELATED REQUIREMENTS**

- .1        Section 06 10 53 - Miscellaneous Rough Carpentry

**1.2            ACTION AND INFORMATIONAL SUBMITTALS**

- .1        Submit in accordance with Section 01 33 00 - Submittal Procedures.
- .2        Submit complete shop drawings for review and acceptance before fabrication.
  - .1            Indicate dimensions, openings, details, plans and sections of each condition, materials, thicknesses and finish, anchor details, methods of installation, joints necessary to accommodate thermal movement, waterproofing membrane underlayment, clamp on snow fence system compliance with design criteria and requirements of related work.
  - .2            Indicate panel length, width, bow, camber and squareness tolerances.
- .3        Product Data:
  - .1            Submit manufacturer's instructions, printed product literature and data sheets for sheet metal roofing and include product characteristics, performance criteria, physical size, finish and limitations.
- .4        Samples:
  - .1            Submit 300 x 300 mm duplicate samples of each sheet metal material.

**1.3            QUALITY ASSURANCE**

- .1        Manufacturer's Qualifications:
  - .1            Fabricate job site manufactured metal roof panels by one manufacturer. Furnish proof of capacity and facilities to fabricate quality without delaying progress of the work and have at least five years' experience in the successful completion of projects of similar size and design.
- .2        Installers Qualifications:
  - .1            Erect roofing using erection forces permanently employed by the manufacturer or be an erection company franchised or approved by the manufacturer, and furnish written proof if requested by the Consultant.
  - .2            Have minimum of five years' experience in the installation of job site manufactured sheet metal roofing system specified in this Section.
- .3        Source Quality Control:
  - .1            Inspection to verify that the stock material is of proper thickness and type.
  - .2            Inspection to verify that the specified finishes meet applicable standards.
- .4        Field Quality Control:
  - .1            Inspect substrate before roofing system installation to verify substrate complies with shop drawings, layout and specified tolerances.
  - .2            Inspect panel product to verify that the material is properly packaged and undamaged.

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- .3 Final inspection to verify panel installation complies with shop drawings and specified tolerances.

#### 1.4 DESIGN CRITERIA

- .1 Design metal roofing to provide for thermal movement of component materials caused by ambient temperature range of 120 degrees C without causing buckling, failure of joint seals, undue stress on fasteners or other detrimental effects.
- .2 Include expansion joints to accommodate movement in roof system and between roof system and building structure, caused by structural movements, without permanent distortion, damage to infills, racking of joints, breakage of seals, or water penetration. Design system for concealed anchorage system.
- .3 Design members to withstand dead load and wind loads including wind uplift calculated in accordance with Building Code and other applicable local regulations, to maximum allowable deflection of 1/240th of span.
- .4 Provide for positive drainage of condensation occurring within construction and water entering at joints, to exterior face of roof in accordance with NRC "Rain Screen Principles". Control movement of water behind facing of roof cladding to ensure that water is not retained and that elements will not be strained, restrained or damaged by water and ice. Locate weepers, vents and drain holes in such position as not to contribute to staining, streaking or marking of the roof cladding or other exterior finishes.
- .5 Design metal cladding to be water tight and adequately ventilated to prevent ice damming and condensation buildup.
- .6 Design roof system to accommodate specified erection tolerances of structure.
- .7 Maintain following installation tolerances:
  - .1 Maximum variation from plane or location shown on reviewed shop drawings: 10 mm/10 m of length and up to 20 mm/100 m.
- .8 Appearance: Consider "Appearance" requirements of equal importance to "performance" requirements in the design and subsequent approval of the metal roof system.
- .9 Provide metal roof panels capable of being formed on the job site in continuous lengths. Horizontal lap joints not permitted.

#### 1.5 DELIVERY, STORAGE AND HANDLING

- .1 Deliver, store and handle materials in accordance with Section 01 61 00 - Common Product Requirements and with manufacturer's written instructions.
- .2 Deliver prefinished stock adequately protected from damage during shipment.
- .3 Handle with non-marring slings to prevent bending of panels and to avoid marring of exposed finishes.
- .4 Protect roof panels from work of other trades after installation. Where work is performed on or above roof after roofing has been installed, take all precautions necessary to protect roof from damage, scratches and the like. Scaffolding and staging must not be supported directly on roofing; provide protective blocking and sheathing to prevent damage. Cover all adjacent roofing as required to prevent splattering of materials onto roof surface.

- .5 Temporarily cover areas of roofing used for walking on, transportation of materials and the like, with 25 mm thick polystyrene sheets. Do not at any time walk or work directly on roof panels.
- .6 Use seaming machines with polyurethane or rubber wheels which will not scratch metal surface. Steel wheeled seaming machines are not acceptable.
- .7 Require workers who will be working and walking on roof to wear clean, softsoled work shoes that will not pick-up stones or other abrasive material which could damage panel surfaces.
- .8 Replace all roof panels which have been scratched, marred, dented or otherwise damaged.
- .9 Protect stored roofing material from wildlife walking over top. Keep inside fenced material storage area.

## **Part 2 Products**

### **2.1 SHEET METAL MATERIALS**

- .1 24-Gauge, Colour: Melchers Green (Parks Green). Acceptable product:
  - .1 Profile: Duraclad, as manufactured by Westform Metals.
  - .2 Other preapproved alternate.

### **2.2 COMPONENTS**

- .1 Underlay: in accordance with manufacturers recommendations to suit design requirements.  
Acceptable products:
  - .1 Stormtread XW, as manufactured by Roofnado.
    - .1 Adhesives and primers in accordance with manufacturers recommendations.
  - .2 LayLock PSU High Temperature, as manufactured by Roofnado.
    - .1 Adhesives and primers in accordance with manufacturers recommendations.
  - .3 Other preapproved alternate.
- .2 25 x 101 mm strapping, in accordance with manufacturers recommendations to meet design requirements.
- .3 Fasteners: exposed, designed to suit design requirements, and in accordance with manufacturers recommendations.
  - .1 Include manufacturers recommended gaskets for fastening.
- .4 Accessories: vented ridge closure, drip flashings, copings and closures, of same material and finish as roofing, brake formed to shape to match roofing.
  - .1 Venting Materials: acceptable product:
    - .1 Profile Vent: 75 x 7620 mm.
    - .2 Other preapproved alternate.

- .5 Snow Fence: C-1 clamp-on plates system, snow guard systems with additional ice guards, complete with 19 mm diameter pipe, powder coat finish to colour to match roofing. Acceptable Product:
  - .1 Tra-Mage Inc, C-1 clamp on system.
  - .2 Alternate product meeting performance requirements specified.
- .6 Primer for dissimilar materials: bituminous primer, as recommended by the membrane manufacturer.
- .7 Touch-up paint: as recommended by sheet metal roofing manufacturer.

### **Part 3 Execution**

#### **3.1 EXAMINATION**

- .1 Verification of Conditions: verify that conditions of substrate previously installed under other Sections or Contracts are acceptable for sheet metal roofing installation in accordance with manufacturer's written instructions.
  - .1 Visually inspect substrate.
  - .2 Inform Consultant of unacceptable conditions immediately upon discovery.
  - .3 Proceed with installation only after unacceptable conditions have been remedied.

#### **3.2 INSTALLATION**

- .1 Secure strapping, maximum 610 mm on centre, and in accordance with reviewed shop drawings.
- .2 Using exposed fasteners and gaskets, install sheet metal roof panels on strapping, in accordance with the reviewed shop drawings.
- .3 Flash roof penetrations with material matching roof panels and make watertight.
- .4 Install ridge venting and vented ridge closure in accordance with manufacturer's recommendations and reviewed shop drawings.
- .5 Install snow fence in accordance with manufacturer's recommendations and reviewed shop drawings.

#### **3.3 CLEANING**

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

#### **3.4 PROTECTION**

- .1 Protect installed products and components from damage during construction.
- .2 Repair damage to adjacent materials caused by sheet metal roofing installation.

**END OF SECTION**

**Part 1            General**

**1.1            RELATED REQUIREMENTS**

- .1    Section 06 10 53 - Miscellaneous Rough Carpentry
- .2    Section 07 21 13 - Board Insulation
- .3    Section 07 21 29 - Spray Applied Polyurethane Foam Insulation
- .4    Section 07 27 00 - Air Barriers
- .5    Section 07 92 00 - Joint Sealants
- .6    Section 08 11 00 - Metal Doors And Frames
- .7    Section 09 21 16 - Gypsum Board Assemblies

**1.2            REFERENCES**

- .1    The Aluminum Association Inc. (AAI)
  - .1    AAI-Aluminum Sheet Metal Work in Building Construction-2002.
  - .2    AAI DAF45-03, Designation System for Aluminum Finishes.
- .2    American Society for Testing and Materials International (ASTM)
  - .1    ASTM A167-99 (2009), Specification for Stainless and Heat-Resisting Chromium-Nickel Steel Plate, Sheet, and Strip.
  - .2    ASTM A240/A240M-15b, Standard Specification for Chromium and Chromium-Nickel Stainless Steel Plate, Sheet, and Strip for Pressure Vessels and for General Applications.
  - .3    ASTM A606-A606M-15, Standard Specification for Steel, Sheet and Strip, High-Strength, Low-Alloy, Hot-Rolled and Cold-Rolled, with Improved Atmospheric Corrosion Resistance.
  - .4    ASTM A653/A653M-15e1, Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.
  - .5    ASTM A792/A792M-10 (2015), Standard Specification for Steel Sheet, 55% Aluminum-Zinc Alloy-Coated by the Hot-Dip Process.
  - .6    ASTM B32-08 (2014), Standard Specification for Solder Metal.
  - .7    ASTM B370-12, Standard Specification for Copper Sheet and Strip for Building Construction.
  - .8    ASTM D523-14, Standard Test Method for Specular Gloss.
  - .9    ASTM D822/D822M-13, Standard Practice for Filtered Open-Flame Carbon-Arc Exposures of Paint and Related Coatings.
- .3    Canadian Roofing Contractors Association (CRCA)
  - .1    Roofing Specifications Manual 1997.
- .4    Canadian General Standards Board (CGSB)
  - .1    CAN/CGSB-51.32-M77, Sheathing, Membrane, Breather Type.
  - .2    CAN/CGSB-93.1-M85, Sheet Aluminum Alloy, Prefinished, Residential.

- .5 Canadian Standards Association (CSA International)
  - .1 CSA A123.3-05, Asphalt Saturated Organic Roofing Felt.
  - .2 AAMA/WDMA/CSA 101/I.S.2/A440-2008, Standard/Specification for Windows, Doors, and Unit Skylights.
  - .3 CSA B111-1974(R2003), Wire Nails, Spikes and Staples.
- .6 Health Canada/Workplace Hazardous Materials Information System (WHMIS)
  - .1 Material Safety Data Sheets (MSDS).

### **1.3 ACTION AND INFORMATIONAL SUBMITTALS**

- .1 Provide submittals in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Product Data:
  - .1 Submit manufacturer's printed product literature for sheet metal flashing systems materials, specifications and datasheet and include product characteristics, performance criteria, physical size, finish and limitations.
  - .2 Submit electronic copies WHMIS MSDS - Material Safety Data Sheets.
- .3 Shop Drawings:
  - .1 Indicate bending, folding, jointing, fastening installation details and materials, thickness, weight and finishes. Indicate profiles, shapes, seams and dimensions. Provide details of expansion joint covers.
- .4 Samples:
  - .1 Submit duplicate 50 x 50 mm samples of each type of sheet metal material and eaves trough cover, finishes and colours.
- .5 Quality assurance submittals: submit following in accordance with Section 01 45 00 - Quality Control.
  - .1 Manufacturer's Instructions: submit manufacturer's installation instructions and special handling criteria, installation sequence, and cleaning procedures.

### **1.4 QUALITY ASSURANCE**

- .1 Pre-Installation Meetings: coordinate pre-installation meeting with regular site meetings before beginning work of this Section, with contractor's representative to:
  - .1 Verify project requirements.
  - .2 Review installation and substrate conditions.
  - .3 Co-ordination with other building subtrades.
  - .4 Review manufacturer's installation instructions and warranty requirements.

### **1.5 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, indoors, in dry location, and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.
- .2 Store and protect metal building panels, hardware and accessories from nicks, scratches, and blemishes.
  - .1 Store within fenced area on site to prevent wildlife from walking on stored material.
- .3 Replace defective or damaged materials with new.

## **Part 2 Products**

### **2.1 PERFORMANCE REQUIREMENTS**

- .1 In accordance with Building Code requirements to withstand wind loads for the Banff area.
- .2 Provide sheet metal flashing and trim to create a rain screen assembly to the completed air, vapour, and roofing membrane termination details.
- .3 Install to withstand structural movement, thermally induced movement, and exposure to weather without failing, rattling, leaking and fastener disengagement preventing buckling, opening of joints, hole elongation, overstressing of components, failure of joint sealants, failure of connections, and other detrimental effects:
  - .1 Provide clips that resist rotation and avoid shear stress as a result of sheet metal and trim thermal movements.
  - .2 Base engineering calculations on surface temperatures of materials due to both solar heat gain and nighttime sky heat loss.
  - .3 Temperature change (range): 67°C ambient; 100°C material surfaces.
- .4 Install metal flashings on all surfaces indicated including but not limited to: roof edges, sleepers, parapets and cap type, wall junctions, through roof penetrations and the like, and as otherwise required to provide flashing type protection to details. Unless otherwise directed extend all flashings down and onto the horizontal portion of the roof. Install counter and base flashings unless otherwise directed by the Consultant.

### **2.2 SHEET METAL MATERIALS**

- .1 Zinc coated steel sheet (to unexposed locations): 0.61 mm thickness and 1.3 mm (16 gauge) thickness for scuppers and downpipes, commercial quality to ASTM A653/A653M, with Z275 designation zinc coating.

### **2.3 PREFINISHED STEEL SHEET**

- .1 Prefinished steel with factory applied silicone modified polyester.
  - .1 Colour selected by Consultant from manufacturer's extended range.
  - .2 Specular gloss: 30 units +/- 5 in accordance with ASTM D523.
  - .3 Coating thickness: not less than 25 micrometres.
  - .4 Resistance to accelerated weathering for chalk rating of 8, colour fade 5 units or less and erosion rate less than 20 % to ASTM D822 as follows:
    - .1 Outdoor exposure period 1000 hours.

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.2 Humidity resistance exposure period 1000 hours.

## **2.4 PREFINISHED ALUMINUM SHEET**

- .1 Finish: factory applied coating to CAN/CGSB-93.1 supplemented and amended as follows:
  - .1 Type 1.
  - .2 Class F1S or F2S. provide F2S in locations visible from the underside including, but not limited to: above doors, windows, louvers, through-wall flashings, and similar penetrations visible from exterior finished floor levels.
  - .3 Colour as selected by Consultant from manufacturer's extended range, provide for minimum three colours.
  - .4 Coating Thickness: 0.68 mm minimum thickness, clear anodized where indicated or factory precoated with Fluorocarbon Resin Kynar 500/Hylar 5000; For additional protection a wash coat of 0.3 - 0.4 mil dry film thickness is applied to the reverse side.
- .2 Thickness specified for prefinished aluminum sheet applies to base metal.

## **2.5 ACCESSORIES**

- .1 Isolation coating: alkali resistant bituminous paint.
- .2 Plastic cement: to CAN/CGSB 37.5.
- .3 Sealants: in accordance with Section 07 92 00.
  - .1 Colour as selected by Consultant.
- .4 Cleats: of same material, and temper as sheet metal, minimum 50 mm wide. Thickness same as sheet metal being secured.
- .5 Fasteners: of same material as sheet metal, to CSA B111, ring thread, flat head roofing nails of length and thickness suitable for metal flashing application.
- .6 Washers: of same material as sheet metal, 1 mm thick with rubber packings.
- .7 Touch-up paint: as recommended by prefinished material manufacturer.

## **2.6 FABRICATION**

- .1 Fabricate metal flashings and other sheet metal work in accordance with applicable CRCA 'FL' series details and as indicated.
- .2 Fabricate aluminum flashings and other sheet aluminum work in accordance with AAI-Aluminum Sheet Metal Work in Building Construction.
- .3 Form pieces in 2400 mm maximum lengths.
  - .1 Make allowance for expansion at joints.
- .4 Hem exposed edges on underside 12 mm.
  - .1 Mitre and seal corners with sealant.
- .5 Form sections square, true and accurate to size, free from distortion and other defects detrimental to appearance or performance.
- .6 Apply isolation coating to metal surfaces to be embedded in concrete or mortar.

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## **2.7 METAL FLASHINGS**

- .1 Form flashings, copings and fascia's to profiles indicated of 0.61 mm thick prefinished steel.

## **2.8 EAVESTROUGH AND DOWNPIPES**

- .1 Form eavestrough and downpipes from 1.3 mm (16 gauge) thick prefinished steel
  - .1 Sizes and profiles as indicated.
  - .2 Provide necessary fastenings.
- .2 Form 600 x 600 mm splash pans from 1.3 mm (16 gauge) thick prefinished steel.
- .3 Provide 1200 mm long concrete splash pads, locations as indicated.
- .4 Provide eaves trough covers to prevent pine needle accumulation inside gutters.
  - .1 Contractor to propose to the Departmental Representative a product to be used.

## **2.9 ALUMINUM FINISHES**

- .1 Finish exposed surfaces of aluminum components in accordance with AA DAF45.

## **Part 3 Execution**

### **3.1 MANUFACTURER'S INSTRUCTIONS**

- .1 Compliance: comply with manufacturer's written recommendations, including product technical bulletins, handling, storage and installation instructions, and datasheets.

### **3.2 INSTALLATION**

- .1 Install sheet metal work in accordance with AAI-Aluminum Sheet Metal Work in Building Construction, ARCA and SMACNA recommended practice
- .2 Use concealed fastenings except where reviewed before installation.
- .3 Lock end joints and caulk with sealant.
- .4 Install pans, where shown around items projecting through roof membrane.
- .5 Installation: to prevent oil canning from occurring on all sheet metal surfaces. Surfaces with oil canning are to be replaced at the Contractors cost.

### **3.3 EAVESTROUGH AND DOWNPIPES**

- .1 Install eavestrough as indicated.
- .2 Install downpipes and provide goosenecks back to wall.
  - .1 Secure downpipes to wall with straps at 1800 mm on centre; minimum two straps per downpipe.
- .3 Install concrete splash pads as indicated.

### **3.4 CLEANING**

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

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- .2 On completion and verification of performance of installation, remove surplus materials, excess materials, rubbish, tools and equipment.
  - .3 Leave work areas clean, free from grease, finger marks and stains.

**END OF SECTION**

**Part 1            General**

**1.1            SECTION INCLUDES**

- .1    Section includes, but is not limited to:
  - .1       Fire stopping and smoke seals to:
    - .1           Fire rated assemblies as indicated.

**1.2            RELATED REQUIREMENTS**

- .1    Section 06 10 53 - Miscellaneous Rough Carpentry
- .2    Section 09 21 16 - Gypsum Board Assemblies

**1.3            REFERENCES**

- .1    Health Canada/Workplace Hazardous Materials Information System (WHMIS)
  - .1       Material Safety Data Sheets (MSDS).
- .2    Underwriter's Laboratories of Canada (ULC)
  - .1       ULC: List of Equipment and Materials, Fire stop systems and components (current edition).
  - .2       ULC-S-101-14, Standard Method of Fire Endurance Tests of Building Construction and Materials
  - .3       ULC-S-102-10, Standard Method of Test for Surface Burning Characteristics of Building Materials and Assemblies
  - .4       ULC-S115-11, Fire Tests of Fire stop Systems.
  - .5       Underwriter's Laboratories of Canada (ULC): ULC-FS-14 Firestop Systems and Components 2014 Edition, (2 Volumes - Volumes 1 and 2).
- .3    Warnock Hersey (WH) Certification Listings, current edition.

**1.4            DEFINITIONS**

- .1    Fire Stop Material: device intended to close off opening or penetration during fire or materials that fill openings in wall assembly where penetration is by cables, cable trays, conduits, ducts and pipes and poke-through termination devices, including electrical outlet boxes along with their means of support through wall openings.
- .2    Single Component Fire Stop System: fire stop material that has Listed Systems Design and is used individually without use of high temperature insulation or other materials to create fire stop system.
- .3    Multiple Component Fire Stop System: exact group of fire stop materials that are identified within Listed Systems Design to create on site fire stop system.
- .4    Tightly Fitted; (ref: NBC Part 3.1.9.1.1 and 9.10.9.6.1): penetrating items that are cast in place in buildings of noncombustible construction or have "0" annular space in buildings of combustible construction.
  - .1       Words "tightly fitted" means that integrity of fire separation is such that it prevents passage of smoke and hot gases to unexposed side of fire separation.

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## **1.5 ACTION AND INFORMATIONAL SUBMITTALS**

- .1 Provide submittals in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Product Data:
  - .1 Submit manufacturer's printed product literature, specifications and datasheet and include product characteristics, performance criteria, physical size, finish and limitations.
  - .2 Submit electronic copies of WHMIS MSDS - Material Safety Data Sheets.
- .3 Shop Drawings:
  - .1 Submit shop drawings to show location, proposed material, reinforcement, anchorage, fastenings and method of installation.
  - .2 Construction details should accurately reflect actual job conditions.
- .4 Quality assurance submittals: submit following in accordance with Section 01 45 00 - Quality Control.
  - .1 Test reports: in accordance with CAN-ULC-S101 for fire endurance and CAN-ULC-S102 for surface burning characteristics.
    - .1 Submit certified test reports from approved independent testing laboratories, indicating compliance of applied fire stopping with specifications for specified performance characteristics and physical properties.
  - .2 Certificates: submit certificates signed by manufacturer certifying that materials comply with specified performance characteristics and physical properties.
  - .3 Provide list of cUL/ULC listings or Engineering Judgements used for fire stopping and smoke seal for this project.
  - .4 Fill out Fire Stop Test Design Summary sheets as required by the authority having jurisdiction, and submit to the authority having jurisdiction and to the Consultant.
  - .5 Provide signed and sealed letters of assurance as required by the Authority Having Jurisdiction, taking responsibility for the fire stopping and smoke seal. Provide these letters of assurance sealed by a registered professional engineer, registered in the Province of Alberta, for the fire stopping and smoke seals. "Assurance of Professional design and commitment for field review" as well as "Assurance of Professional field review and compliance".
  - .6 For non-standard applications where no cUL/ULC tested systems exist, submit manufacturer's Engineering Judgement drawings. Required Engineering Judgments to be made by a qualified Fire Protection Engineer, and must abide by the International Fire stop Council (IFC) guidelines. All drawings must indicate the "Tested" cUL/ULC system upon which the judgement is based so as to assess the relevance of the judgement to some known performance. Engineering Judgements to include the project and Contractor name, and be acceptable to the Consultant and the Authority Having Jurisdiction, before installation.
  - .7 Manufacturer's Instructions: submit manufacturer's installation instructions and special handling criteria, installation sequence, and cleaning procedures.

## **1.6 QUALITY ASSURANCE**

- .1 Qualifications:

- .1 Installer: company specializing in fire stopping installations approved by manufacturer, with five years documented experience.
- .2 Pre-Installation Meetings: coordinate pre-installation meeting with regular site meetings before beginning work of this Section, with contractor's representative to:
  - .1 Verify project requirements.
  - .2 Review installation and substrate conditions.
  - .3 Co-ordination with other building subtrades.
  - .4 Review manufacturer's installation instructions and warranty requirements.

## **1.7 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.
  - .3 Deliver materials to the site in undamaged condition and in original unopened containers, marked to indicate brand name, manufacturer, and ULC markings.
- .2 Storage and Protection:
  - .1 Store materials indoors, in dry location, and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.
- .3 Replace defective or damaged materials with new.

## **1.8 SITE CONDITIONS**

- .1 Ambient Conditions:
  - .1 Proceed with installation of fire stopping when:
    - .1 Ambient and substrate conditions are within manufacturer's recommended temperatures, relative humidity and substrate moisture content for application and curing of fire stops and smoke seals.
  - .2 Where fire stopping and smoke seal is installed before the building envelope is closed in and made weather tight, protect fire stopping from water, freezing, or other elements which are detrimental to the fire stopping and smoke seal materials.

## **1.9 WARRANTY**

- .1 Contractor hereby warrants the Work, on fire stop and smoke seal installation, which includes, but is not limited to:
  - .1 Repairs and replacement of penetration seals which fail in joint adhesion, cohesion, abrasion resistance, weather resistance, extrusion resistance, migration resistance, stain resistance or general durability, or appear to deteriorate in another manner not clearly specified in submitted manufacturer's data as inherent quality of the materials for exposure indicated.

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## **Part 2            Products**

### **2.1            MATERIALS**

- .1 Fire stopping and smoke seal systems: in accordance with CAN-ULC-S115.
  - .1 Asbestos-free materials and systems capable of maintaining effective barrier against flame, smoke and gases in compliance with requirements of CAN-ULC-S115 and not to exceed opening sizes for which they are intended and conforming to specified special requirements described in PART 3.
  - .2 Fire stop system rating:
    - .1 Materials to provide a flame rating (F) to penetrations equal to the rating of the Fire Separation. A flame and temperature rating (FT) is required on penetrations in fire walls and assemblies. Construction joint fire stopping systems to provide a rating equal to the rating of the surrounding assemblies.
    - .2 Penetrating items to be rigidly supported in accordance with ULC and ULI guidelines.
    - .3 Fire stopping materials and systems to be intumescent where the burning or melting of combustible pipes, cable jacketing, or pipe insulation materials may occur.
    - .4 Notify the Consultant whenever the fire stopping system or assembly cannot meet this specification.
- .2 Service penetration assemblies: systems tested to CAN-ULC-S115.
- .3 Service penetration fire stop components: certified by test laboratory to CAN-ULC-S115.
- .4 Fire-resistance rating of installed fire stopping assembly in accordance with NBC.
- .5 Fire stopping and smoke seals at openings intended for ease of re-entry such as cables: elastomeric seal.
- .6 Fire stopping and smoke seals at openings around penetrations for pipes, ductwork and other mechanical items requiring sound and vibration control: elastomeric seal.
- .7 Primers: to manufacturer's recommendation for specific material, substrate, and end use.
- .8 Water (if applicable): potable, clean and free from injurious amounts of deleterious substances.
- .9 Damming and backup materials, supports and anchoring devices: to manufacturer's recommendations, and in accordance with tested assembly being installed as acceptable to authorities having jurisdiction.
- .10 Sealants for vertical joints: non-sagging.
- .11 Provide fire stopping between slab edges and back side of curtain wall in accordance with firestop system tested to ASTM E2307. Perimeter firestop system is to be capable of withstanding up to 16mm vertical movement between slab and curtain wall. Provide engineering judgement as required.

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- .12 Provide one of the following fire stopping material/system. Use fire stopping materials throughout, as manufactured by one manufacturer, to the maximum extent possible. Where more than one product is required in an assembly, confirm products are compatible and from the same manufacturer. Confirm the following systems are ULC listed and Factory Mutual (FM) approved:
- .1 3M Fire Barrier.
  - .2 Tremco Fire stopping system.
  - .3 Hilti FS-ONE and CP 601 Fire stopping System.
  - .4 Other preapproved alternate.

### **Part 3 Execution**

#### **3.1 MANUFACTURER'S INSTRUCTIONS**

- .1 Compliance: comply with manufacturer's written recommendations or specifications, including product technical bulletins, handling, storage and installation instructions, and datasheets.

#### **3.2 PREPARATION**

- .1 Examine sizes and conditions of voids to be filled to establish correct thicknesses and installation of materials.
  - .1 Substrates and surfaces to be clean, dry and frost free.
- .2 Prepare surfaces in contact with fire stopping materials and smoke seals to manufacturer's instructions.
- .3 Maintain insulation around pipes and ducts penetrating fire separation without interruption to vapour barrier.
- .4 Mask where necessary to avoid spillage and over coating onto adjoining surfaces; remove stains on adjacent surfaces.

#### **3.3 INSTALLATION**

- .1 Install fire stopping and smoke seal material and components in accordance with manufacturer's certified tested system listing.
- .2 Seal holes or voids made by through penetrations, poke-through termination devices, and unpenetrated openings or joints to maintain continuity and integrity of fire separation.
- .3 Provide temporary forming as required and remove forming only after materials have gained sufficient strength and after initial curing.
- .4 Tool or trowel exposed surfaces to neat finish.
- .5 Remove excess compound promptly as work progresses and upon completion.

#### **3.4 SPECIAL REQUIREMENTS**

- .1 Where two outlet boxes must be located on opposite sides of a fire rated partition within the same stud cavity, apply firestop putty pad to back of each outlet to restore fire ratings.

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### **3.5 SEQUENCES OF OPERATION**

- .1 Proceed with installation only when submittals have been reviewed by Consultant.
- .2 Install floor fire stopping before interior partition erections.
- .3 Mechanical pipe insulation: certified fire stop system component.
  - .1 Pipe insulation installation to precede fire stopping.

### **3.6 FIELD QUALITY CONTROL**

- .1 Reviews: notify Consultant when ready for review and before concealing or enclosing fire stopping materials and service penetration assemblies.
- .2 Provide letter certifying that fire stopping installation is complete, installed in accordance with the tested assembly, meeting the requirements of the Building Code, and to the satisfaction of the Authority Having Jurisdiction.

### **3.7 CLEANING**

- .1 Proceed in accordance with Section 01 74 11 - Cleaning.
- .2 On completion and verification of performance of installation, remove surplus materials, excess materials, rubbish, tools, and equipment.
- .3 Remove temporary dams after initial set of fire stopping and smoke seal materials.

### **3.8 SCHEDULE**

- .1 Fire stop and smoke seal at locations indicated on Drawings A110, supplemented with the following:
  - .1 Penetrations through fire-resistance rated gypsum board partitions and walls.
  - .2 Top of fire-resistance rated gypsum board partitions.
  - .3 Intersection of fire-resistance rated gypsum board partitions.
  - .4 Control and sway joints in fire-resistance rated gypsum board partitions and walls.
  - .5 Penetrations through fire-resistance rated ceilings.
  - .6 Openings and sleeves installed for future use through fire separations.
  - .7 Around mechanical and electrical assemblies penetrating fire separations.
  - .8 Rigid ducts: greater than 129 cm<sup>2</sup>: fire stopping to consist of bead of fire stopping material between retaining angle and fire separation and between retaining angle and duct, on each side of fire separation.

**END OF SECTION**

**Part 1            General**

**1.1            REFERENCES**

- .1    ASTM International
  - .1    ASTM C919-12, Standard Practice for Use of Sealants in Acoustical Applications.
  - .2    ASTM C1311-14, Standard Specification for Solvent Release Sealants.
- .2    Canadian General Standards Board (CGSB)
  - .1    CGSB 19-GP-5M-1984, Sealing Compound, One Component, Acrylic Base, Solvent Curing (Issue of 1976 reaffirmed, incorporating Amendment No. 1).
  - .2    CAN/CGSB-19.13-M87, Sealing Compound, One-component, Elastomeric, Chemical Curing.
  - .3    CGSB 19-GP-14M-1984, Sealing Compound, One Component, Butyl-Polyisobutylene Polymer Base, Solvent Curing (Reaffirmation of April 1976).
  - .4    CAN/CGSB-19.17-M90, One-Component Acrylic Emulsion Base Sealing Compound.
  - .5    CAN/CGSB-19.24-M90, Multi-component, Chemical Curing Sealing Compound.
- .3    Health Canada/Workplace Hazardous Materials Information System (WHMIS)
  - .1    Material Safety Data Sheets (MSDS).

**1.2            ACTION AND INFORMATIONAL SUBMITTALS**

- .1    Submit in accordance with Section 01 33 00 - Submittal Procedures.
- .2    Product Data:
  - .1    Submit manufacturer's instructions, printed product literature and data sheets for joint sealants and include product characteristics, performance criteria, physical size, finish and limitations.
  - .2    Manufacturer's product to describe:
    - .1    Caulking compound.
    - .2    Primers.
    - .3    Sealing compound, each type, including compatibility when different sealants are in contact with each other.
  - .3    Submit electronic copies of WHMIS MSDS.
- .3    Manufacturer's Instructions:
  - .1    Submit instructions to include installation instructions for each product used.

**1.3            CLOSEOUT SUBMITTALS**

- .1    Submit in accordance with Section 01 78 00 - Closeout Submittals.
- .2    Operation and Maintenance Data: submit operation and maintenance data for incorporation into manual.

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## **1.4 DELIVERY, STORAGE AND HANDLING**

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

## **1.5 SITE CONDITIONS**

- .1 Ambient Conditions:
  - .1 Proceed with installation of joint sealants only when:
    - .1 Ambient and substrate temperature conditions are within limits permitted by joint sealant manufacturer or are above 4.4 degrees C.
    - .2 Joint substrates are dry.
    - .3 Conform to manufacturer's recommended temperatures, relative humidity, and substrate moisture content for application and curing of sealants including special conditions governing use.
- .2 Joint-Width Conditions:
  - .1 Proceed with installation of joint sealants only where the joint width to depth ratios are allowed by joint sealant manufacturer for applications indicated.
- .3 Joint-Substrate Conditions:
  - .1 Proceed with installation of joint sealants only after contaminants capable of interfering with adhesion are removed from joint substrates.

## **1.6 ENVIRONMENTAL REQUIREMENTS**

- .1 Comply with requirements of Workplace Hazardous Materials Information System (WHMIS) regarding use, handling, storage, and disposal of hazardous materials; and regarding labelling and provision of Material Safety Data Sheets (MSDS) acceptable to Health Canada.
- .2 Ventilate area of work by use of approved portable supply and exhaust fans.

## **Part 2 Products**

### **2.1 SEALANT MATERIALS**

- .1 All sealants to have matte finish; high gloss finish will not be acceptable.
- .2 Do not use caulking that emits strong odours, contains toxic chemicals or is not certified as mould resistant in air handling units.

- .3 When low toxicity caulks are not possible, confine usage to areas which off gas to exterior, are contained behind air barriers, or are applied several months before occupancy to maximize off gas time.
- .4 Where sealants are qualified with primers use only these primers.

## 2.2 SEALANT MATERIAL DESIGNATIONS

- .1 Colour: as selected by Consultant from manufacturer's standard colour range.
- .2 Urethanes two part:
  - .1 Self-levelling: CAN/CGSB-19.24-M90, acceptable product:
    - .1 Sikaflex 2c SL.
    - .2 MasterSeal SL 2.
    - .3 ISO-Flex 880 GB.
    - .4 Other preapproved product.
  - .3 Urethanes two part:
    - .1 Non-sag: to CAN/CGSB-19.24, Type 2, Class B, acceptable product:
      - .1 Dymeric 240 FC by Tremco Ltd.
      - .2 Other preapproved product.
  - .4 Urethanes one part:
    - .1 Self-levelling: to CAN/CGSB-19.13, Type 1, acceptable product:
      - .1 Dy-Monic or Dy-Monic FC by Tremco Ltd.
      - .2 Other preapproved product.
  - .5 Urethanes one part:
    - .1 Non-sag: to CAN/CGSB-19.13, Type 2, MCG-2-25, acceptable product:
      - .1 Dy-Monic by Tremco Ltd.
      - .2 Spectrum 2 by Tremco Ltd.
      - .3 Other preapproved product.
  - .6 Silicones one part: to CAN/CGSB-19.13, acceptable product:
    - .1 Tremsil 200 by Tremco Ltd.
    - .2 Dow Corning 795
    - .3 Other preapproved product.
  - .7 Acrylics one part: to CGSB 19-GP-5M.
  - .8 Acrylic latex one part: to CAN/CGSB-19.17, acceptable product:
    - .1 Tremflex 834 by Tremco Ltd.
    - .2 Other preapproved product.
  - .9 Acoustical sealant: to ASTM C919, acceptable product:
    - .1 Tremco Acoustical Sealant by Tremco Ltd.
    - .2 Other preapproved product.
  - .10 Butyl: to CGSB 19-GP-14M or ASTM C1311, acceptable product:

- .1 Tremco Butyl Sealant, POLYshim II Tape, and 440 Butyl Architectural tape by Tremco Ltd.
- .2 Other preapproved product.
- .11 Back-up materials to be compatible with selected sealant and of type recommended by manufacturer. Preformed compressible and non-compressible back-up materials:
  - .1 Polyethylene, urethane, neoprene or vinyl foam:
    - .1 Extruded closed cell foam backer rod.
    - .2 Size: oversize 30 to 50 %.
  - .2 Neoprene or butyl rubber:
    - .1 Round solid rod, Shore A hardness 70.
  - .3 High density foam:
    - .1 Extruded closed cell polyvinyl chloride (PVC), extruded polyethylene, closed cell, Shore A hardness 20, tensile strength 140 to 200 kPa, extruded polyolefin foam, 32 kg/m<sup>3</sup> density, or neoprene foam backer, size as recommended by manufacturer.
  - .4 Bond breaker tape:
    - .1 Polyethylene bond breaker tape which will not bond to sealant.

## **2.3 SEALANT SELECTION**

- .1 Perimeters of exterior openings where frames meet exterior facade of building (i.e. brick): sealant type: urethane two part.
- .2 Coping joints and coping-to facade joints: sealant type: urethane two part.
- .3 Seal interior perimeters of exterior openings as detailed on drawings: sealant type: urethane one part.
- .4 Control and expansion joints on the interior of exterior poured-in place concrete walls: sealant type: urethane two part.
- .5 Interior control and expansion joints in floor surfaces: sealant type: urethane two part self leveling.
- .6 Perimeters of interior frames, as detailed and itemized: sealant type: acrylic latex.
- .7 Perimeter of bath fixtures (e.g. sinks, tubs, urinals, stools, water closets, basins, vanities): sealant type: silicone one part, mildew resistant.
- .8 Exposed interior control joints in gypsum board: sealant type: acrylic latex.
- .9 Acoustic rated partitions and separations with STC ratings 40 and above: acoustic sealant as indicated on the drawings and at all penetrations or interior piping.
- .10 Install butyl sealants and tapes in locations indicated in accordance with manufacturers recommendations.

## **2.4 JOINT CLEANER**

- .1 Non-corrosive and non-staining type, compatible with joint forming materials and sealant in accordance with sealant manufacturer's written recommendations.
- .2 Primer: in accordance with sealant manufacturer's written recommendations.

## **Part 3            Execution**

### **3.1                EXAMINATION**

- .1        Verification of Conditions: verify that conditions of substrate previously installed under other Sections or Contracts are acceptable for joint sealants installation in accordance with manufacturer's written instructions.
  - .1            Visually inspect substrate.
  - .2            Inform Consultant of unacceptable conditions immediately upon discovery.
  - .3            Proceed with installation only after unacceptable conditions have been remedied.

### **3.2                SURFACE PREPARATION**

- .1        Examine joint sizes and conditions to establish correct depth to width relationship for installation of backup materials and sealants.
- .2        Clean bonding joint surfaces of harmful matter substances including dust, rust, oil grease, and other matter which may impair Work.
- .3        Do not apply sealants to joint surfaces treated with sealer, curing compound, water repellent, or other coatings unless tests have been performed to ensure compatibility of materials. Remove coatings as required.
- .4        Verify joint surfaces are dry and frost free.
- .5        Prepare surfaces in accordance with manufacturer's directions.

### **3.3                PRIMING**

- .1        Where necessary to prevent staining, mask adjacent surfaces prior to priming and caulking.
- .2        Prime sides of joints in accordance with sealant manufacturer's instructions immediately before to caulking.

### **3.4                BACKUP MATERIAL**

- .1        Apply bond breaker tape where required to manufacturer's instructions.
- .2        Install joint filler to achieve correct joint depth and shape, with approximately 30% compression.

### **3.5                MIXING**

- .1        Mix materials in strict accordance with sealant manufacturer's instructions.

### **3.6                APPLICATION**

- .1        Sealant:
  - .1            Apply sealant in accordance with manufacturer's written instructions.
  - .2            Mask edges of joint where irregular surface or sensitive joint border exists to provide neat joint.
  - .3            Apply sealant in continuous beads.
  - .4            Apply sealant using gun with proper size nozzle.
  - .5            Use sufficient pressure to fill voids and joints solid.

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- .6 Form surface of sealant with full bead, smooth, free from ridges, wrinkles, sags, air pockets, embedded impurities.
  - .7 Tool exposed surfaces before skinning begins to give slightly concave shape.
  - .8 Remove excess compound promptly as work progresses and upon completion.
  - .2 Curing:
    - .1 Cure sealants in accordance with sealant manufacturer's instructions.
    - .2 Do not cover up sealants until proper curing has taken place.

### **3.7 CLEANING**

- .1 Progress Cleaning: clean in accordance with Section 01 74 11 - Cleaning.
  - .1 Leave Work area clean at end of each day.
  - .2 Clean adjacent surfaces immediately.
  - .3 Remove excess and droppings, using recommended cleaners as work progresses.
  - .4 Remove masking tape after initial set of sealant.
- .2 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment in accordance with Section 01 74 11 - Cleaning.

### **3.8 PROTECTION**

- .1 Protect installed products and components from damage during construction.
- .2 Repair damage to adjacent materials caused by joint sealants installation.

**END OF SECTION**

**Part 1            General**

**1.1            RELATED REQUIREMENTS**

- .1      Section 06 10 53 - Miscellaneous Rough Carpentry
- .2      Section 09 91 00.08 - Painting for Minor Works

**1.2            REFERENCE STANDARDS**

- .1      American Society for Testing and Materials International (ASTM)
  - .1          ASTM A653/A653M-15e1, Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.
- .2      Canadian General Standards Board (CGSB)
  - .1          CAN/CGSB-1.181-99, Ready-Mixed Organic Zinc-Rich Coating.
  - .2          CGSB 41-GP-19Ma-84, Rigid Vinyl Extrusions for Windows and Doors.
- .3      CSA Group (CSA)
  - .1          CSA-G40.20-13 /G40.21-13, General Requirements for Rolled or Welded Structural Quality Steel/Structural Quality Steel.
  - .2          CSA W59-13, Welded Steel Construction (Metal Arc Welding).
- .4      Canadian Steel Door Manufacturers' Association (CSDMA)
  - .1          CSDMA, Recommended Specifications for Commercial Steel Doors and Frames, 2009.
  - .2          CSDMA, Selection and Usage Guide for Commercial Steel Doors, 2009.
- .5      National Fire Protection Association (NFPA)
  - .1          NFPA 80-2016, Standard for Fire Doors and Fire Windows.
- .6      Underwriters' Laboratories of Canada (ULC)
  - .1          CAN/ULC-S701-11, Standard for Thermal Insulation, Polystyrene, Boards and Pipe Covering.
  - .2          CAN/ULC-S702-14, Standard for Thermal Insulation, Mineral Fibre, for Buildings.
  - .3          CAN/ULC-S704-11, Standard for Thermal Insulation, Polyurethane and Polyisocyanurate Boards, Faced.
  - .4          CAN4-S104-M80, Standard Method for Fire Tests of Door Assemblies.
  - .5          CAN4-S105-M85 (R1992), Standard Specification for Fire Door Frames Meeting the Performance Required by CAN4-S104.

**1.3            SYSTEM DESCRIPTION**

- .1      Design Requirements:
  - .1          Design exterior frame assembly to accommodate to expansion and contraction when subjected to minimum and maximum surface temperature of -35 degrees C to 35 degrees C.

- .2 Maximum deflection for exterior steel entrance screens under wind load of 1.2 kPa not to exceed 1/175th of span.
- .3 Steel fire rated doors and frames: labelled and listed by an organization accredited by Standards Council of Canada in conformance with CAN4-S104 for ratings specified or indicated.
- .4 Provide fire labelled frames for openings requiring fire protection ratings. Test products in conformance with CAN4-S104, and listed by nationally recognized agency having factory inspection services.

#### **1.4 ACTION AND INFORMATIONAL SUBMITTALS**

- .1 Provide submittals in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Provide product data: in accordance with Section 01 33 00 - Submittal Procedures.
- .3 Provide shop drawings: in accordance with Section 01 33 00 - Submittal Procedures.
  - .1 Indicate each type of door, material, steel core thicknesses, mortises, reinforcements, location of exposed fasteners, openings, glazed, arrangement of hardware, fire rating, and finishes.
  - .2 Indicate each type frame material, core thickness, reinforcements, glazing stops, location of anchors and exposed fastenings reinforcing, fire rating, and finishes.
  - .3 Include schedule identifying each unit, with door marks and numbers relating to numbering on drawings and door schedule.

#### **1.5 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, indoors, in dry location, and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.
  - .2 Store and protect specified materials from nicks, scratches, and blemishes.
- .4 Replace defective or damaged materials with new.

### **Part 2 Products**

#### **2.1 MATERIALS**

- .1 Hot dipped galvanized steel sheet: to ASTM A653M, ZF75, minimum base steel thickness in accordance with CSDMA Table 1 - Thickness for Component Parts.
- .2 Reinforcement channel: to CSA G40.20/G40.21, Type 44W, coating designation to ASTM A653M, ZF75.

#### **2.2 DOOR CORE MATERIALS**

- .1 Honeycomb construction:

- .1 Structural small cell, 24.5 mm maximum kraft paper 'honeycomb', weight: 36.3 kg per ream minimum, density: 16.5 kg/m
- .2 Stiffened: face sheets laminated, to honeycomb or insulated core.
  - .1 Fibreglass: to CAN/ULC-S702, semi-rigid, density 24 kg/m<sup>3</sup>.
  - .2 Expanded polystyrene: CAN/ULC-S701, density 16 to 32 kg/m<sup>3</sup>, laminated under pressure to surface sheets.
  - .3 Polyurethane: to CAN/ULC-S704 rigid, modified poly/isocyanurate, closed cell board. Density 32 kg/m
- .3 Temperature rise rated (TRR): core composition to limit temperature rise on unexposed side of door to 250 degrees C at 30 to 60 minutes. Core to be tested as part of a complete door assembly, in accordance with CAN4-S104, NFPA 252, ASTM E152, covering Standard Method of Tests of Door Assemblies and listed by nationally recognized testing agency having factory inspection service.

## 2.3 ADHESIVES

- .1 Honeycomb cores and steel components: heat resistant, spray grade, resin reinforced neoprene/rubber (polychloroprene) based, low viscosity, contact cement.
- .2 Polystyrene and polyurethane cores: heat resistant, epoxy resin based, low viscosity, contact cement.
- .3 Lock-seam doors: fire resistant, resin reinforced polychloroprene, high viscosity, sealant/adhesive.

## 2.4 PRIMER

- .1 Touch-up prime CAN/CGSB-1.181.

## 2.5 PAINT

- .1 Field paint steel doors and frames in accordance with Section 09 91 00.08 - Painting for Minor Works. Protect weatherstrips from paint. Provide final finish free of scratches or other blemishes.
- .2 Paint colour to be:
  - .1 Exterior door and doorway trim surfaces to be colour matched to the Parks Green building siding.
  - .2 Provide samples of finish in accordance with Section 09 91 00.08.

## 2.6 ACCESSORIES

- .1 Shims: use silicone/plastic shims to exterior hollow metal frames
- .2 Door silencers: single stud rubber/neoprene type.
- .3 Exterior, bottom (if no sweep is indicated), top, and interior caps: rigid polyvinylchloride extrusion conforming to CGSB 41-GP-19Ma.
- .4 Fabricate glazing stops as formed channel, minimum 16 mm height, accurately fitted, butted at corners and fastened to frame sections with counter-sunk oval head sheet metal screws.
- .5 Door bottom seal: fixed.

- .6 Metallic paste filler: to manufacturer's standard.
- .7 Fire labels: metal rivited.
- .8 Sealant: in accordance with Section 07 92 00 - Joint Sealants.
- .9 Glazing: in accordance with 08 80 00 - Glazing.
- .10 Make provisions for glazing as indicated and provide necessary glazing stops.
  - .1 Provide removable stainless steel glazing beads for dry glazing of snap-on type .
  - .2 Design exterior glazing stops to be tamperproof.

## **2.7 FRAMES FABRICATION GENERAL**

- .1 Fabricate frames in accordance with CSDMA specifications.
- .2 Fabricate frames to profiles and maximum face sizes as indicated.
- .3 Exterior frames: 1.6 mm welded type construction.
- .4 Interior frames: 1.6 mm welded type construction.
- .5 Blank, reinforce, drill and tap frames for mortised, templated hardware, and electronic hardware using templates provided by finish hardware supplier. Reinforce frames for surface mounted hardware.
- .6 Protect mortised cutouts with steel guard boxes.
- .7 Prepare frame for door silencers, 3 for single door, 2 at head for double door.
- .8 Manufacturer's nameplates on frames and screens are not permitted.
- .9 Conceal fastenings except where exposed fastenings are indicated.
- .10 Provide factory-applied touch up primer at areas where zinc coating has been removed during fabrication.
- .11 Insulate exterior frame components with polyurethane insulation.

## **2.8 FRAME ANCHORAGE**

- .1 Provide appropriate anchorage to floor and wall construction.
- .2 Locate each wall anchor immediately above or below each hinge reinforcement on hinge jamb and directly opposite on strike jamb.
- .3 Provide two anchors for rebate opening heights up to 1520 mm and one additional anchor for each additional 760 mm of height or fraction thereof.
- .4 Locate anchors for frames in existing openings not more than 150 mm from top and bottom of each jambs and intermediate at 660 mm on centre maximum.

## **2.9 FRAMES: WELDED TYPE**

- .1 Welding in accordance with CSA W59.
- .2 Accurately mitre or mechanically joint frame product and securely weld on inside of profile.

- .3 Cope accurately and securely weld butt joints of mullions, transom bars, centre rails and sills.
- .4 Grind welded joints and corners to a flat plane, fill with metallic paste and sand to uniform smooth finish.
- .5 Securely attach floor anchors to inside of each jamb profile.
- .6 Weld in 2 temporary jamb spreaders per frame to maintain proper alignment during shipment.

## **2.10 FRAMES: KNOCKED-DOWN TYPE**

- .1 Knocked-down type frames will not be accepted.

## **2.11 FRAMES: SLIP-ON TYPE**

- .1 Knocked-down type frames will not be accepted.

## **2.12 DOOR FABRICATION GENERAL**

- .1 Doors: swing type, flush, with provision for glass openings as indicated.
- .2 Exterior doors: insulated construction. Interior doors: honeycomb construction.
- .3 Fabricate doors with longitudinal edges welded . Seams: grind welded joints to a flat plane, fill with metallic paste filler and sand to a uniform smooth finish.
- .4 Doors: manufacturers' proprietary construction, tested and/or engineered as part of a fully operable assembly, including door, frame, gasketing and hardware in accordance with ASTM E330 .
- .5 Blank, reinforce, drill doors and tap for mortised, templated hardware , and electronic hardware .
- .6 Factory prepare holes 12.7 mm diameter and larger except mounting and through-bolt holes, on site, at time of hardware installation.
- .7 Reinforce doors where required, for surface mounted hardware. Provide flush PVC top caps to exterior doors. Provide inverted, recessed, spot welded channels to top and bottom of interior doors.
- .8 Provide factory-applied touch-up primer at areas where zinc coating has been removed during fabrication.
- .9 Provide fire labelled doors for those openings requiring fire protection ratings, as scheduled. Test such products in conformance with CAN4-S104 and list by nationally recognized agency having factory inspection service and construct as detailed in Follow-Up Service Procedures/Factory Inspection Manuals issued by listing agency to individual manufacturers.
- .10 Manufacturer's nameplates on doors are not permitted.

## **2.13 DOORS: HONEYCOMB CORE CONSTRUCTION**

- .1 Form face sheets for exterior doors from 1.6 mm sheet steel with polystyrene core laminated under pressure to face sheets.

- .2 Form face sheets for interior doors from 1.6 mm sheet steel with honeycomb or temperature rise rated core laminated under pressure to face sheets.

## **2.14 HOLLOW STEEL CONSTRUCTION**

- .1 Form face sheets for exterior doors from 1.6 mm sheet steel.
- .2 Form face sheets for interior doors from 1.6 sheet steel.
- .3 Reinforce doors with vertical stiffeners, securely welded to face sheets at 150 mm on centre maximum.
- .4 Fill voids between stiffeners of exterior doors with polystyrene core.
- .5 Fill voids between stiffeners of interior doors with honeycomb, temperature rise rated core.

## **2.15 THERMALLY BROKEN DOORS AND FRAMES**

- .1 Fabricate thermally broken doors by using insulated core and separating exterior parts from interior parts with continuous interlocking thermal break.
- .2 Thermal break: rigid polyvinylchloride extrusion conforming to CGSB 41-GP-19Ma.
- .3 Fabricate thermally broken frames separating exterior parts from interior parts with continuous interlocking thermal break.
- .4 Apply insulation.

## **Part 3 Execution**

### **3.1 MANUFACTURER'S INSTRUCTIONS**

- .1 Compliance: comply with manufacturer's written recommendations or specifications, including product technical bulletins, handling, storage and installation instructions, and datasheets.

### **3.2 INSTALLATION GENERAL**

- .1 Install labelled steel fire rated doors and frames to NFPA 80 except where specified otherwise.
- .2 Install doors and frames to CSDMA Installation Guide.

### **3.3 FRAME INSTALLATION**

- .1 Set frames plumb, square, level and at correct elevation.
- .2 Secure anchorages and connections of frames to adjacent construction including, but not limited to wood studs, metal studs, and concrete unit masonry.
- .3 Brace frames rigidly in position while building-in. Install temporary horizontal wood spreader at third points of door opening to maintain frame width. Provide vertical support at centre of head for openings over 1200 mm wide. Remove temporary spreaders after frames are built-in.

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- .4 Make allowances for deflection of structure to ensure structural loads are not transmitted to frames.
  - .5 Caulk perimeter of frames between frame and adjacent material .
  - .6 Maintain continuity of air barrier and vapour retarder.

### **3.4 DOOR INSTALLATION**

- .1 Install doors and hardware in accordance with hardware templates and manufacturer's instructions and Section 08 71 00 - Doors Hardware.
- .2 Provide even margins between doors and jambs and doors and finished floor and thresholds as follows.
  - .1 Hinge side: 1.0 mm.
  - .2 Latchside and head: 1.5 mm.
  - .3 Finished floor, non-combustible sill and thresholds: 13 mm.
- .3 Adjust operable parts for correct function.

### **3.5 FINISH REPAIRS**

- .1 Touch up with primer finishes damaged during installation.
- .2 Fill exposed frame anchors and surfaces with imperfections with metallic paste filler and sand to a uniform smooth finish.

### **3.6 GLAZING**

- .1 Install glazing for doors and frames in accordance with Section 08 80 00 - Glazing .

**END OF SECTION**

**Part 1            General**

**1.1            SECTION INCLUDES**

- .1    Section includes, but is not limited to:
  - .1    Architectural grade commercial aluminum windows: tubular profiles, thermal break, factory prefinished, glass, and field dry glazing.
  - .2    Operable awning and sliding windows.
  - .3    Air barriers and vapour retarders required to tie-into the adjacent building air barriers and vapour retarders.

**1.2            RELATED REQUIREMENTS**

- .1    Section 06 10 53 - Miscellaneous Rough Carpentry
- .2    Section 07 21 13 - Board Insulation
- .3    Section 07 21 16 - Fibrous Insulation
- .4    Section 07 26 00 - Vapour Retarders
- .5    Section 07 27 00 - Air Barriers
- .6    Section 07 62 00 - Sheet Metal Flashing And Trim
- .7    Section 07 92 00 - Joint Sealants
- .8    Section 08 80 00 - Glazing
- .9    Section 09 21 16 - Gypsum Board Assemblies

**1.3            REFERENCE STANDARDS**

- .1    Aluminum Association (AA)
- .2    American Architectural Manufacturers Association (AAMA)
  - .1    AAMA CW-10-04, Care and Handling of Architectural Aluminum From Shop to Site.
  - .2    AAMA CW-11-85, Design Wind Loads and Boundary Layer Wind Tunnel Testing.
  - .3    AAMA 501-05, Methods of Test for Exterior Walls.
  - .4    AAMA 2605-05, Voluntary Specification, Performance Requirements and Test Procedures for Superior Performing Organic Coatings on Aluminum Extrusions and Panels.
- .3    ASTM International (ASTM)
  - .1    ASTM B456-17, Standard Specification for Electrodeposited Coatings of Copper Plus Nickel Plus Chromium and Nickel Plus Chromium.
  - .2    ASTM B633-19, Standard Specification for Electrodeposited Coatings of Zinc on Iron and Steel.
  - .3    ASTM B864/B684M-19, Standard Specification for Corrugated Aluminum Box Culverts.

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- .4 ASTM E283/E283M-19, Standard Test Method for Determining Rate of Air Leakage Through Exterior Windows, Skylights, Curtain Walls, and Doors Under Specified Pressure Differences Across the Specimen.
  - .5 ASTM E330/E330M-14, Standard Test Method for Structural Performance of Exterior Windows, Doors, Skylights and Curtain Walls by Uniform Static Air Pressure Difference.
  - .6 ASTM E331-00(16), Standard Test Method for Water Penetration of Exterior Windows, Skylights, Doors, and Curtain Walls by Uniform Static Air Pressure Difference.
  - .7 ASTM E547-00(160), Standard Test Method for Water Penetration of Exterior Windows, Skylights, Doors, and Curtain Walls by Cyclic Static Air Pressure Difference.
  - .8 ASTM F588-17, Standard Test Methods for Measuring the Forced Entry Resistance of Window Assemblies, Excluding Glazing Impact.
  - .9 ASTM E783-02(2018), Standard Test Method for Field Measurement of Air Leakage Through Installed Exterior Windows and Doors.
  - .10 ASTM F842-17, Standard Test Methods for Measuring the Forced Entry Resistance of Sliding Door Assemblies, Excluding Glazing Impact.
  - .11 ASTM E1105-15, Standard Test Method for Field Determination of Water Penetration of Installed Exterior Windows, Skylights, Doors, and Curtain Walls, by Uniform or Cyclic Static Air Pressure Difference.
  - .12 ASTM E2068-00(2016), Standard Test Method for Determination of Opening Force of Sliding Windows and Doors.
  - .4 CSA Group (CSA)
    - .1 AAMA/WDMA/CSA 101/I.S.2/A440-11(R2016), NAFS - North American Fenestration Standard for Windows, Doors, and Skylights.
    - .2 CSA A440S1-09, Canadian Supplement to AAMA/WDMA/CSA 101/I.S.2/A440, NAFS - North American Fenestration Standard for Windows, Doors, and Skylights.
    - .3 CAN/CSA-A440.2-14/A440.3-14, Fenestration energy performance/User guide to CSA A440.2, Fenestration energy performance.
    - .4 CAN/CSA-A440.4-07(R2016), Window, Door, and Skylight Installation
    - .5 CAN/CSA-Z91-02(R2013), Health and Safety Code for Suspended Equipment Operations.
  - .5 Green Seal (GS)
    - .1 GS-11-11, Paints and Coatings.
  - .6 Master Painters Institute (MPI)
    - .1 Architectural Painting Specification Manual - current edition.
      - .1 MPI #79, Primer, Alkyd, Anti-Corrosive for Metal.

#### **1.4 ADMINISTRATIVE REQUIREMENTS**

- .1 Pre-Installation Meetings:
  - .1 Convene pre-installation meeting one week before beginning work of this Section, with Contractor's Representative and Consultant to:

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- .1 Verify project requirements.
  - .2 Review installation and substrate conditions.
  - .3 Co-ordination with other construction subtrades.
  - .4 Review manufacturer's written installation instructions and warranty requirements.

## **1.5 ACTION AND INFORMATIONAL SUBMITTALS**

- .1 Submit in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Product Data:
  - .1 Submit manufacturer's instructions, printed product literature and data sheets for windows including product characteristics, performance criteria, physical size, finish and limitations, construction details, material descriptions, fabrication methods, dimensions of individual components and profiles, hardware with finishes, and operating instructions for each type of window indicated.
    - .1 Hardware: Include for locking devices, do not include for cranks or similar mechanical devices.
  - .2 Submit electronic copies of SDS.
- .3 Shop Drawings:
  - .1 Submit drawings stamped and signed by professional engineer registered or licensed in Alberta, Canada.
  - .2 Verify each opening size before submitting shop drawings or beginning fabrication.
  - .3 Indicate materials and details in full size scale for head, jamb and sill, profiles of components, interior and exterior trim, elevations of unit, anchorage details, location of isolation coating, description of related components and exposed finishes, fasteners, hardware, and caulking.
  - .4 Indicate locations, dimensions, openings, and requirements of related work.
- .4 Samples:
  - .1 Submit duplicate samples for review of each unit.
    - .1 Samples will not be returned for inclusion into work.
    - .2 Include 300 mm sample of frame with specified surface finish.
- .5 Test and Evaluation Reports:
  - .1 Submit test reports from approved independent testing laboratories, certifying compliance with specifications.
  - .2 All test reports that reference the NAFS must include, on the first page, a summary of the results including, at minimum:
    - .1 The product manufacturer.
    - .2 The type of product.
    - .3 The model number/series number.
    - .4 The primary product designation.
    - .5 The secondary product designation.
      - 1. Positive design pressure.

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2. Negative design pressure.
  3. Water penetration resistance test pressure.
  4. Canadian air infiltration and exfiltration levels.
  - .6 The test completion date.
  - .3 The report will also contain the following information:
    - .1 Test dates.
    - .2 Report preparation dates.
    - .3 Test information retention period.
    - .4 Location of testing facilities.
    - .5 Full description of test samples, including:
      1. Anodized finish and weathering characteristics.
      2. Condensation resistance.
      3. Block operation - sliding windows only.
      4. Sash strength and stiffness.
      5. Forced entry resistance.
    - .6 Complete description of amendments, as applicable.
    - .7 Conclusion.
    - .8 Drawings signed by the testing laboratory, if provided.

## **1.6 CLOSEOUT SUBMITTALS**

- .1 Submit in accordance with Section 01 78 00 - Closeout Submittals.
- .2 Operation and Maintenance Data: submit operation and maintenance data for windows for incorporation into manual.
- .3 Warranty Documentation: submit warranty documents specified.

## **1.7 QUALITY ASSURANCE**

- .1 Certifications: product certificates signed by manufacturer certifying materials comply with specified performance characteristics and criteria and physical requirements.
- .2 Installer Qualifications: installer which has had successful experiences with installation of the same or similar units required for this project and other projects of similar size and scope.
- .3 Manufacturer Qualifications: manufacturer capable of fabricating windows that meet or exceed performance requirements indicated and of documenting this performance by inclusion of test reports, and calculations.
- .4 Mock-ups:
  - .1 Construct mock-ups in accordance with Section 01 45 00 - Quality Control.
  - .2 Supply mock-up including one complete window including frame and glazing.
    - .1 Assemble to illustrate component assembly including glazing materials, weep drainage system, attachments, anchors, and perimeter sealant.
  - .3 Locate mock-up where directed by Consultant.

- .4 Coordinate construction of mock-up with regular site meetings for observation of mock-up before proceeding with work.
- .5 When reviewed, mock-up will demonstrate minimum standard of quality and materials for work of this Section.
- .6 Mock-up may remain as part of finished work.

## **1.8 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 in dry location, off ground, and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.
  - .2 Store and protect windows from nicks, scratches, and blemishes.
  - .3 Replace defective or damaged materials with new.

## **1.9 AMBIENT CONDITIONS**

- .1 Install sealants when ambient and surface temperature is above 5 degrees C minimum.
- .2 Maintain this minimum temperature during and for 48 hours minimum after installation of sealants.

## **1.10 GLASS BREAKAGE**

- .1 Be responsible of glass broken because of faulty setting and replace same at no cost to the Owner.
- .2 Replace glass breakage during construction at no cost to the Owner.

## **Part 2 Products**

### **2.1 MANUFACTURERS**

- .1 Acceptable manufacturers:
  - .1 Windows: Kawneer.
    - .1 Kawneer Series AA 6500 Windows, 127 mm frame depth, with multi-modular strip, meeting the following performance requirements:
      - 1. Design components and assemblies based on the "Rain Screen Principle" as defined by the National Research Council of Canada.
      - 2. Design and size components to withstand dead and live loads caused by pressure and suction of wind, acting normal to plane of system as calculated in accordance with NBC (AE), measured to ASTM E330.
      - 3. Classification rating: to AAMA/WDMA/CSA 101/I.S.2/A440 NAFS.

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1. Primary designation: AW-PG70-FW.
  4. Uniform Load Deflection: minimum static air pressure difference of 3352 Pa, applied in the positive and negative direction in accordance with ASTM E330. No deflection in excess of L/175 of the span of any framing member. Test specimen meeting the C5 rating when tested in accordance with CAN/CSA-A440-00 Windows.
  5. Uniform Load Structural: minimum static air pressure difference of 5028 Pa, applied in the positive and negative direction in accordance with ASTM E330. Units evaluated after each load with permanent set not to exceed 0.2% of span length.
  6. Component Testing: window components tested in accordance with procedures described in AAMA/WDMA/CSA 101/I.S.2/A440 (NAFS) and AAMA 910.
  7. Condensation Resistance Factor (CRF): Provide windows tested for thermal performance according to AAMA 1503, with a minimum CRF of 70 (frame) and 67 (glass).
  8. Temperature Index (I): Provide windows tested for thermal performance according to CSA-A440 with a minimum Temperature Index (I) of not 73 (frame) and 66 (glass).
  9. Forced Entry Resistance: conforming to ASTM F588, Grade 10.
  10. Thermal Barrier Test: Thermal break, designed in accordance with AAMA TIR-A8 and tested in accordance with AAMA 505.
  - .2 Other preapproved alternate.

## 2.2 MATERIALS

- .1 Aluminum Extrusions:
  - .1 Alloy and temper recommended by aluminum window manufacturer for strength, corrosion resistance, and application of required finish and minimum 1.8 mm wall thickness at any location for the main frame and sash members.
  - .2 Window Thermal Barrier: manufacturers standard, consisting of two parallel glass fiber-reinforced nylon strips installed continuously and mechanically bonded to the aluminum.
  - .3 Fasteners: aluminum, nonmagnetic stainless steel or other materials to be non-corrosive and compatible with aluminum window members, trim, hardware, anchors, and other components.
  - .4 Anchors, Clips, and Accessories: aluminum, nonmagnetic stainless steel, or zinc-coated steel or iron complying with ASTM B633 for SC 3 severe service conditions; provide sufficient strength to withstand design pressure indicated.

- .5 Reinforcing Members: aluminum, nonmagnetic stainless steel, or nickel/chrome-plated steel complying with ASTM B456 for Type SC 3 severe service conditions, or zinc-coated steel or iron complying with ASTM B633 for SC 3 severe service conditions; provide sufficient strength to withstand design pressure indicated.
- .6 Sealant: for sealants required within fabricated windows, provide window manufacturer's standard, permanently elastic, non-shrinking, and non-migrating type recommended by sealant manufacturer for joint size and movement.

## 2.3 GLAZING

- .1 Glass and Glazing Materials: insulating glass units in accordance with Section 08 80 00 - Glazing.
- .2 Glazing System:
  - .1 Window glazing method: dry type in accordance with manufacturer's standards, exterior glazing to be TPE gasket.
- .3 Operable Windows: Manufacturers standard awning and sliding windows conforming to CAN/CSA-A440, and meeting the following:
  - .1 Air infiltration: A3 rating.
  - .2 Water infiltration: B7 rating and in accordance with ASTM E547.
  - .3 Wind load resistance: C4 rating for windows.
  - .4 Condensation resistance temperature index: I-50.2.
  - .5 Include insect screen.

## 2.4 ACCESSORIES

- .1 Windows:
  - .1 Spacers, Setting Blocks, Gaskets, and Bond Breakers: manufacturer's standard permanent, non-migrating types in hardness recommended by manufacturer, compatible with sealants, and suitable for system performance requirements.
  - .2 Framing system gaskets, sealants, and joint fillers as recommended by manufacturer for joint type.
  - .3 Interior Trims: extruded aluminum, 6063-T6 alloy and temper, extruded to profiles and details indicated.
    - .1 Interior Trims:
      - 1. Interior face trim: minimum wall thickness to be 1.57 mm.
      - 2. Face trim: to snap-fit onto concealed mounting clip.
        - 1. Exposed fasteners are not acceptable.
      - 3. Mounting clip: extruded aluminum of 6063-T6 alloy and temper, minimum wall thickness to be 1.57 mm. Trim clips: provided in 101.6 mm lengths and spaced a maximum of 457 mm centre to centre.
      - 4. Coupling Mullions: extruded aluminum of 6063-T6 alloy and temper, of profile and dimensions indicated on drawings.
      - 5. Mullions: provide structural properties to resist wind pressure required by performance criteria and standards.

- .2 Perimeter Anchors: When steel anchors are used, provide insulation between steel material and aluminum material to prevent galvanic action.

## 2.5 FABRICATION

- .1 Windows:
  - .1 Framing Members: fabricate components that, when assembled, have the following characteristics:
    - .1 Profiles that are sharp, straight, and free of defects or deformations.
    - .2 Accurately fit joints; make joints flush, hairline and weatherproof.
    - .3 Fabricate units square and true with maximum tolerance of plus or minus 1.5 mm for units with a diagonal measurement of 1800 mm or less, and plus or minus 3 mm for units with a diagonal measurement over 1800 mm.
    - .4 Brace frames to maintain squareness and rigidity during shipment and installation.
    - .5 Means to drain water passing joints, condensation within framing members, and moisture migrating within the system to exterior.
    - .6 Physical and thermal isolation of glazing from framing members.
    - .7 Accommodations for thermal and mechanical movements of glazing and framing to maintain required glazing edge clearances.
    - .8 Provisions for field replacement of glazing.
    - .9 Fasteners, anchors, and connection devices that are concealed from view to greatest extent possible.
  - .2 Window Framing: fabricate components for assembly using manufacture's standard installation instructions.
  - .3 After fabrication, clearly mark components to identify their locations in Project according to Shop Drawings.
  - .4 Thermally Improved Construction: fabricate window framing with an integral, concealed, low-conductance thermal barrier; located between exterior materials and window members exposed on interior side; in a manner that eliminates direct metal-to-metal contact. Design thermal barriers in accordance with AAMA TIR A8.
  - .5 Thermal Barrier: manufacturers standard, consisting of two parallel glass fiber-reinforced nylon strips installed continuously and mechanically bonded to the aluminum.

## 2.6 ALUMINUM FINISHES

- .1 Finish designations prefixed by AA comply with the system established by the Aluminum Association for designating aluminum finishes.
- .2 Finishes:
  - .1 Kawneer Permafluor (70% PVDF), AAMA 2605, Fluoropolymer Coating, colour: dark gray.
  - .2 Touch-up primer for galvanized steel surfaces: SSPC 20 Paint zinc rich.
  - .3 Concealed steel items: galvanized in accordance with ASTM A123, 600 gm/m2.

- .4 Apply two coats of bituminous paint to concealed aluminum and steel surfaces in contact with cementitious or dissimilar materials.

## **2.7 ISOLATION COATING**

- .1 Isolate aluminum from the following components, by means of isolation coating:
  - .1 Dissimilar metals except stainless steel, zinc, or white bronze of small area.
  - .2 Wood.

## **2.8 AIR BARRIER AND VAPOUR RETARDER**

- .1 Equip window frames with site installed air barrier and vapour retarder material for sealing to building air barrier and vapour retarder as follows:
  - .1 Material: identical to, or compatible with, building air barrier and vapour retarder materials to provide required air tightness and vapour diffusion control throughout exterior envelope assembly.
  - .2 Material width: adequate to provide required air tightness and vapour diffusion control to building air barrier and vapour retarder from interior with minimum 200 mm overlap.

## **Part 3 Execution**

### **3.1 EXAMINATION**

- .1 Verification of Conditions: verify conditions of substrates previously installed under other Sections or Contracts acceptable for product installation in accordance with manufacturer's written instructions.
  - .1 Visually inspect substrate.
    - .1 Examine openings, substrates, structural support, anchorage, and conditions, with installer present, for compliance with requirements for installation tolerances and other conditions impacting performance of work. Verify rough opening dimensions, levelness of sill plate and operational clearances. Examine wall flashings, vapour retarders, water and weather barriers, and other built-in components to verify a coordinated, weather tight installation.
    - .2 Masonry Surfaces: visibly dry and free of excess mortar, sand, and other construction debris.
    - .3 Wood Frame Walls: dry, clean, sound, well nailed, free of voids, and without offsets at joints. Verify that nail heads are driven flush with surfaces in opening and within 76 mm of opening.
    - .4 Metal Surfaces: dry; clean; free of grease, oil, dirt, rust, corrosion, and welding slag; without sharp edges or offsets at joints.
  - .2 Inform Consultant of unacceptable conditions immediately upon discovery.
  - .3 Proceed with installation only after unacceptable conditions have been remedied.

### **3.2 INSTALLATION**

- .1 Comply with drawings, reviewed shop drawings, and manufacturer's written instructions for installing windows, accessories, and other components.

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- .2 Install in accordance with AAMA/WDMA/CSA 101/I.S.2/A440.
  - .3 Install windows, plumb, square, true to line, without distortion or impeding thermal movement, anchored securely in place to structural support, and in proper relation to wall flashing and other adjacent construction.
  - .4 Set sill members in bed of sealant or with gaskets, as indicated, for weather tight construction.
  - .5 Install windows and components to drain condensation, water penetrating joints, and moisture migrating within system to the exterior.
  - .6 Separate aluminum from dissimilar materials to prevent corrosion or electrolytic action at points of contact.
  - .7 Remove and replace glass that has been broken, chipped, cracked, abraded, or damaged during construction period.
  - .8 Install glass panels in accordance with Section 08 80 00 - Glazing, glazing method as specified. Place sealant on the up-slope side of the pressure plate cover caps; finish the surface with a slope to encourage drainage over the cap. Cover caps to conceal screws and provide continuous sightline.
  - .9 Caulking:
    - .1 Seal joints between windows and sills with sealant. Bed sill expansion joint cover plates and drip deflectors in bedding compound. Caulk between sill upstand and frame. Caulk butt joints in continuous sills.
    - .2 Apply sealant in accordance with Section 07 92 00 - Joint Sealants. Conceal sealant within units except where exposed use is permitted by Consultant.

### **3.3 ADJUSTING**

- .1 Adjust operating sash for smooth operation.

### **3.4 FIELD QUALITY CONTROL**

- .1 Have manufacturer of products supplied under this Section review Work involved in handling, installation/application, protection and cleaning of its products, and submit written reports in acceptable format to verify compliance of Work with Contract.
- .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 completed, but before installation begins.
    - .1 Twice during progress of Work at 25% and 60% complete.
  - .2 Upon completion of Work, after cleaning carried out.
- .4 Obtain reports within three days of review and submit.

### **3.5 CLEANING**

- .1 Cleaning: clean in accordance with Section 01 74 11 - Cleaning.
  - .1 Leave Work area clean at end of each day.
    - .1 Clean aluminum surfaces immediately after installation. Avoid damaging protective coatings and finishes. Remove excess sealants, glazing materials, dirt, and other substances.
    - .2 Clean glass immediately after installation. Comply with manufacturer's written recommendations for final cleaning and maintenance. Remove nonpermanent labels, and clean surfaces.
  - .2 Upon completion remove surplus materials, rubbish, tools and equipment.

### **3.6 PROTECTION**

- .1 Protect installed products and components from damage during construction.
- .2 In addition, monitor window surfaces adjacent to and below exterior concrete and masonry surfaces during construction for presence of dirt, scum, alkaline deposits, stains, or other contaminants. If contaminating substances do contact window surfaces, remove contaminants immediately according to manufacturer's written recommendations.
- .3 Repair damage to adjacent materials caused by installation.

**END OF SECTION**

**Part 1            General**

**1.1            RELATED REQUIREMENTS**

- .1      Section 06 10 53 - Miscellaneous Rough Carpentry
- .2      Section 08 11 00 - Metal Doors And Frames

**1.2            REFERENCES**

- .1      American National Standards Institute (ANSI) / Builders Hardware Manufacturers Association (BHMA)
  - .1      ANSI/BHMA A156.1-2013, American National Standard for Butts and Hinges.
  - .2      ANSI/BHMA A156.2-2011, Bored and Preamsembled Locks and Latches.
  - .3      ANSI/BHMA A156.3-2008, Exit Devices.
  - .4      ANSI/BHMA A156.4-2008, Door Controls - Closers.
  - .5      ANSI/BHMA A156.5-2010, Auxiliary Locks and Associated Products.
  - .6      ANSI/BHMA A156.6-2010, Architectural Door Trim.
  - .7      ANSI/BHMA A156.8-2010, Door Controls - Overhead Stops and Holders.
  - .8      ANSI/BHMA A156.10-2005, Power Operated Pedestrian Doors.
  - .9      ANSI/BHMA A156.14-2013, Sliding and Folding Door Hardware.
  - .10     ANSI/BHMA A156.15-2011, Release Devices - Closer Holder, Electromagnetic and Electromechanical.
  - .11     ANSI/BHMA A156.16-2013, Auxiliary Hardware.
  - .12     ANSI/BHMA A156.17-2010, Self-closing Hinges and Pivots.
  - .13     ANSI/BHMA A156.18-2012, Materials and Finishes.
  - .14     ANSI/BHMA A156.19-2007, Power Assist and Low Energy Power - Operated Doors.
- .2      Canadian Steel Door and Frame Manufacturers' Association (CSDMA)
  - .1      CSDMA Recommended Dimensional Standards for Commercial Steel Doors and Frames - 2009.

**1.3            ACTION AND INFORMATIONAL SUBMITTALS**

- .1      Submit in accordance with Section 01 33 00 - Submittal Procedures.
- .2      Product Data:
  - .1      Submit manufacturer's instructions, printed product literature and data sheets for door hardware and include product characteristics, performance criteria, physical size, finish and limitations.
- .3      Samples:
  - .1      Submit for review and acceptance of each unit.
  - .2      Samples will not be returned for inclusion into work.
  - .3      Identify each sample by label indicating applicable specification paragraph number, brand name and number, finish and hardware package number.

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- .4 After acceptance samples will not be returned for incorporation in Work.
  - .4 Hardware List:
    - .1 Submit contract hardware list.
    - .2 Indicate specified hardware, including make, model, material, function, size, finish and other pertinent information.
  - .5 Test Reports: certified test reports showing compliance with specified performance characteristics and physical properties.
  - .6 Manufacturer's Instructions: submit manufacturer's installation instructions.
- 1.4 CLOSEOUT SUBMITTALS**
- .1 Submit in accordance with Section 01 78 00 - Closeout Submittals.
  - .2 Operation and Maintenance Data: submit operation and maintenance data for door hardware for incorporation into manual.
- 1.5 MAINTENANCE MATERIALS SUBMITTALS**
- .1 Extra Stock Materials:
    - .1 Supply maintenance materials in accordance with Section 01 78 00 - Closeout Submittals.
    - .2 Tools:
      - .1 Supply two sets of wrenches for door closers, locksets, and exit hardware.
- 1.6 QUALITY ASSURANCE**
- .1 Regulatory Requirements:
    - .1 Hardware for doors in fire separations and exit doors certified by a Canadian Certification Organization accredited by Standards Council of Canada.
  - .2 Employ an experienced hardware consultant who is a member of the Door and Hardware Institute and is an AHC, for scheduling, detailing, ordering, and coordinating hardware for this project.
- 1.7 COORDINATION**
- .1 Before furnishing any hardware, check drawings and specifications for hardware requirements, verifying door swings, check shop drawings with frame and door lists and notify Consultant in writing of discrepancies noted.
  - .2 Deliver templates required for shop fabrication of wood, hollow metal, and aluminum doors and frames in ample time so as not to impede the progress of the work.
- 1.8 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 Package items of hardware including fastenings, separately or in like groups of hardware, label each package as to item definition and location.
- .4 Storage and Handling Requirements:
  - .1 Store materials off ground, indoors, in dry location, and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.
  - .2 Store and protect door hardware from nicks, scratches, and blemishes.
  - .3 Protect prefinished surfaces with wrapping and strippable coating.
  - .4 Replace defective or damaged materials with new.

## **Part 2 Products**

### **2.1 HARDWARE ITEMS**

- .1 Use one manufacturer's products only for similar items.
- .2 Coordinate with Access and Intercom System, including supply and installation of electrified hardware components including, but not limited to: electric strikes, maglocks, electric lock and latch retention. Supplemented as follows:
  - .1 Electrified exterior doors to use electric latch retraction where an auto operator is also present.
    - .1 Power supply for doors with electric latch retraction devices to be provided under Section 08 71 00.
  - .2 Each door leaf with electrified hardware will require a power transfer by, hardware supplier.
  - .3 Coordinate the use of one power supply to power multiple devices and centrally locate the device.

### **2.2 DOOR HARDWARE**

- .1 Locks and latches:
  - .1 For exterior and interior doors: to ANSI/BHMA A156.2, series 4000, grade 1, designed for function and keyed as stated in Hardware Schedule. Acceptable product:
    - .1 Dorex GX1L42C26D.
      - 1. Verify part number with function before submitting shop drawings.
    - .2 Other preapproved alternate.
  - .2 Lever handles: plain design, as selected by Consultant.
  - .3 Escutcheons: round.
  - .4 Cores: Interchangeable, figure 8 Best Cylinders, 7 pin H-keyway. Similar to:
    - .1 Grade 1 - Best 9K Series, by Stanley.
    - .2 Grade 2 - Best 7K Series, by Stanley.
  - .5 Normal strikes: box type, lip projection not beyond jamb.
  - .6 Cylinders: key into keying system as directed. Keys: #68 Key.
  - .7 Finished to Satin Chrome, 626.

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- .2 Butts and hinges:
    - .1 Butts and hinges: to ANSI/BHMA A156.1, 5-knuckle, full-mortise, permanently lubricated non-detachable ball bearings, steel, Satin finished, with non-removable pins for out swinging doors. Hinges to be a minimum of 112 mm high and 100 mm wide; standard weight hinges to be supplied at doors where specified.
    - .2 Self-closing hinges and pivots: to ANSI/BHMA A156.17, fully adjustable, Satin finished. Provide two self-closing hinges on fire labelled doors.
  - .3 Exit devices: to ANSI/BHMA A156.3, grade 1, modern design, finish as selected by Consultant.
    - .1 Auxiliary items: door co-ordinator, type 21, for pairs of doors with overlapping astragals.
    - .2 Hardware Consultant to coordinate and select exit device suitable for each location:
      - .1 Hollow Metal Rim Exit Device: Acceptable product:
        - 1. 98 Series Exit Device, as manufactured by Von Duprin.
        - 2. Surface Rim (FL) 2100 Series, as manufactured by Stanley.
        - 3. Other preapproved alternate.
      - .2 Hollow Metal Surface Mounted Vertical Rod: less bottom rod. Acceptable product:
        - 1. 9827 Series Exit Device, as manufactured by Von Duprin.
        - 2. Surface Vertical Rod (FL) 2200 Series, as manufactured by Stanley.
        - 3. Other preapproved alternate.
  - .4 Door Closers and Accessories:
    - .1 Door controls (closers): to ANSI/BHMA A156.4, size in accordance with ANSI/BHMA A156.4, table A1, finished as selected by Consultant.
      - .1 Acceptable product:
        - 1. Dorex 1900 or 1900BF.
          - 1. Verify part number with function before submitting shop drawings.
        - 2. Other preapproved alternate.
    - .2 Door controls - overhead holders: to ANSI/BHMA A156.8, finished as selected by Consultant.
    - .3 Closer and holder release devices: to ANSI/BHMA A156.15, finished as selected by Consultant.
    - .4 Door co-ordinator: concealed for pairs of doors with overlapping astragal. Similar to: Stanley 3500 Series and 4500 Series.
  - .5 Door Operators:
    - .1 Power-operated pedestrian doors: to ANSI/BHMA A156.10.
    - .2 Power assist and low energy power operated doors: to ANSI/BHMA A156.19.
      - .1 Acceptable Products:
        - 1. LCN 4642, by Allegion.

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2. Series 4100, by Horton.
  3. 4900 Series, by Stanley.
  4. Other preapproved alternate.
- .3 Control boxes: complete with electric strike relay.
  - .4 Actuation of operators: in accordance Division 26.
  - .5 Electrical box and actuator: Hardwired low voltage actuator with stainless steel 114 mm round plate, engraved blue filled with handicap symbol. Box: 51 mm wide x 102 mm high x 50 mm deep single gang electrical box, flush mounted in wall, locations indicated.
  - .6 Supply switched line voltage to control box. Locate switch adjacent to box.
  - .7 Supply low voltage wiring to each actuator and 6 mm diameter air tubing to each operator.
  - .8 Mount control box in location as directed by Consultant.
- .6 Auxiliary locks and associated products: to ANSI/BHMA A156.5.
    - .1 Manual dead bolt. Key into keying system. Acceptable product:
      - .1 Schlage B663P 626.
        1. Verify part number with function before submitting shop drawings.
      - .2 Other preapproved alternate.
    - .2 Keyless touch dead bolt. Acceptable product:
      - .1 Schlage BE375-CEN Century Keyless Touch Deadbolt.
        1. Verify part number with function before submitting shop drawings.
      - .2 Other preapproved alternate.
    - .3 Cylinders: interchangeable.
- .7 Architectural door trim: to ANSI/BHMA A156.6.
    - .1 Door protection plates: kick plate, 1.27 mm thick stainless steel, 406 mm high x 813 mm wide, stainless-steel finish 630, hidden fastener installation. Acceptable product:
      - .1 Ives 8400.
        1. Verify part number with function before submitting shop drawings.
      - .2 Other preapproved alternate.
- .8 Auxiliary hardware: to ANSI/BHMA A156.16, as listed below, finished to 626 Satin Chrome.
    - .1 Lever extension flush bolt within doors.
    - .2 Door Stop: Floor Mounted, Type L12131, half-moon or door stop floor mount similar to Acklands Granger #GGH33J807.
    - .3 Door Stop: Wall Mounted, Type L12011, concave wall door stop.
    - .4 Door Holder: Kick-down, door mounted, Type L11381.

- .9 Door bottom seal: door seal of extruded aluminum frame and solid closed cell neoprene weather seal, surface mounted with drip cap, closed ends, adjustable, clear anodized finish.
- .10 Thresholds: depth to suit wall type x full width of door opening, extruded aluminum, mill finish, serrated surface, with thermal break of rigid PVC, with vinyl door seal insert.
- .11 Weatherstripping:
  - .1 Head and jamb seal:
    - .1 Extruded aluminum frame and hollow closed cell neoprene insert, clear anodized finish.
    - .2 Adhesive backed neoprene material.
  - .2 Door bottom seal:
    - .1 Extruded aluminum frame and nylon brush sweep, clear anodized finish.
- .12 Smoke Seals: silicone seal, extruded from high-temperature silicone, self-extinguishing and non-toxic. Unaffected by sunlight, ozone and ultraviolet rays, impervious to fungus and mildew; will not deteriorate under normal exposure.
  - .1 Adhesive-backed fire and smoke gasketing around door jambs: similar to Pemko S88.
- .13 Astragal: adjustable, overlapping, extruded aluminum frame with vinyl insert, finished to match doors. Surface mounted at the middle of double doors.

## 2.3 FASTENINGS

- .1 Use only fasteners provided by manufacturer. Failure to comply may void warranties and applicable licensed labels.
- .2 Supply screws, bolts, expansion shields and other fastening devices required for satisfactory installation and operation of hardware.
- .3 Exposed fastening devices to match finish of hardware.
- .4 Where pull is scheduled on one side of door and push plate on other side, supply fastening devices, and install so pull can be secured through door from reverse side. Install push plate to cover fasteners.
- .5 Use fasteners compatible with material through which they pass.

## 2.4 KEYING

- .1 Provide contractor temporary keying for all locks to be installed to allow for the building to be secured during construction. Supply the Departmental Representative three of the temporary construction keys until all locks have been re-keyed with the permanent keying.
- .2 Final permanent keying: Immediately before building hand over, all door locks to be custom keyed, in accordance with the Owner's requirements.
  - .1 All doors to be keyed to Owners "Campgrounds standard key", except,
  - .2 Mechanical room doors to be keyed to Owners "Trades standard key"
- .3 Stamp keying code numbers on keys and cylinders.
- .4 Supply construction cores.

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- .5 Install permanent cores and handover keys to Owner.

### **Part 3 Execution**

#### **3.1 INSTALLATION**

- .1 Manufacturer's Instructions: comply with manufacturer's written recommendations, including product technical bulletins, product catalogue installation instructions, product carton installation instructions, and data sheets.
- .2 Coordinate installation of hardware items with Division 26 including, but not limited to:
  - .1 Barrier free operators,
  - .2 Electric strikes.
- .3 Supply metal door and frame manufacturers with complete instructions and templates for preparation of their work to receive hardware.
- .4 Supply manufacturers' instructions for proper installation of each hardware component.
- .5 Install hardware to standard hardware location dimensions in accordance with CSDFMA Canadian Metric Guide for Steel Doors and Frames (Modular Construction).
- .6 Where door stop contacts door pulls, mount stop to strike bottom of pull.
- .7 Use only manufacturer's supplied fasteners.
  - .1 Use of "quick" type fasteners, unless specifically supplied by manufacturer, is unacceptable.
- .8 Remove construction cores and locks when directed by Consultant.
  - .1 Install permanent cores and verify locks operate correctly.

#### **3.2 ADJUSTING**

- .1 Adjust door hardware, operators, closures and controls for optimum, smooth operating condition, safety and for weather tight closure.
- .2 Lubricate hardware, operating equipment and other moving parts.
- .3 Adjust door hardware for tight fit at contact points with frames.

#### **3.3 CLEANING**

- .1 Progress Cleaning: clean in accordance with Section 01 74 11 - Cleaning.
  - .1 Leave Work area clean at end of each day.
  - .2 Clean hardware with damp rag and approved non-abrasive cleaner, and polish hardware in accordance with manufacturer's instructions.
  - .3 Remove protective material from hardware items where present.
- .2 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment in accordance with Section 01 74 11 - Cleaning.

#### **3.4 DEMONSTRATION**

- .1 Keying System Setup:

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- .1 Set up key control system with file key tags, duplicate key tags, numerical index, alphabetical index and key change index, label shields, control book and key receipt cards.
  - .2 Turnover file keys and duplicate keys to Owner.
  - .2 Maintenance Staff Briefing:
    - .1 Proper care, cleaning, and general maintenance of projects complete hardware.
    - .2 Description, use, handling, and storage of keys.
    - .3 Use, application and storage of wrenches for door closers, locksets, and fire exit hardware.
  - .3 Demonstrate operation, operating components, adjustment features, and lubrication requirements.

### **3.5 PROTECTION**

- .1 Protect installed products and components from damage during construction.
- .2 Repair damage to adjacent materials caused by door hardware installation.

### **3.6 SCHEDULE**

- .1 As indicated on Drawing A110.

### **3.7 DOOR HARDWARE FUNCTION**

- .1 Typical for all doors:
  - .1 Kick plate on “inside” of door.
  - .2 All doors opening to an adjacent wall are to have wall or floor door stops to prevent damage to adjacent walls.
  - .3 All stall doors to include two commercial grade stainless steel coat hangers on the inside of the door. Contractor to propose product to be used before installation.
- .2 Janitor’s Room Exterior Door
  - .1 Intended function:
    - .1 Door lever handle with no handle lock and separate deadbolt.
    - .2 Deadbolt will have a key from outside, and a locking handle on the inside of janitor room.
    - .3 Deadbolt key: #68 key.
    - .4 Door closer at top of door.
    - .5 Door holder.
    - .6 Include bar or chain at top of door to prevent door swinging beyond 120 degrees.
- .3 Janitor’s Room Interior Door
  - .1 Intended function:
    - .1 Door lever handle with no handle lock and separate manual deadbolt.
    - .2 Deadbolt will have a key from washroom side, and a locking handle on the inside of janitor room.

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- .3 Deadbolt key: #68 key.
      - .4 Door closer at top of door.
  - .4 Main Washroom Area Exterior Door
    - .1 Intended function:
      - .1 Exterior side: Pull handle only with separate manual deadbolt.
      - .2 Interior side: Horizontal push bar to de-latch door.
      - .3 Deadbolt to be 'classroom style'. It will have a key from outside and have a handle on the inside that can be used to unlock the door, but not lock it.
      - .4 Deadbolt key: '68' key.
      - .5 Barrier free, push button operated automatic door opener.
        - 1. Include bar or chain at top of door to prevent door swinging beyond 95 degrees.
        - 2. Automatic door opener is to be configured to automatically close the door when not held open.
  - .5 Washroom Stall Doors
    - .1 Intended function:
      - .1 Door lever handle with built in lock; for visitors to use to secure the door closed when using the stall.
      - .2 Lever handle lock to be push button operated from inside the stall, and pin operated from outside of stall.
        - 1. Lock is to be selected to prevent users from locking the door behind them locking the stall door closed when empty.
      - .3 Provide classroom style deadbolt to allow operations staff to lock-out individual stalls if required. It will have a key from outside and have a handle on the inside that can be used to unlock the door, but not lock it.
      - .4 Deadbolt key: '68'key.
      - .5 Include top door opener to hold door open when door is not latched closed. Will require a user to manually close the door.
  - .6 Mechanical Room Double Door
    - .1 Intended function:
      - .1 Active leaf:
        - 1. Door lever handle on outside with push bar on inside.
        - 2. Locked with a key from outside only.
          - 1. Door can only be locked and unlocked from outside but can always be exited with push bar.
        - 3. Include bar or chain at top of active leaf to prevent door swinging beyond 120 degrees.
      - .2 Inactive leaf:
        - 1. Lever extension flush bolt firm locking door closed when not in use.
      - .3 Lock to be T9 key.

**END OF SECTION**

**Part 1            General**

**1.1            RELATED REQUIREMENTS**

- .1      Section 07 92 00 - Joint Sealants
- .2      Section 08 11 00 - Metal Doors And Frames
- .3      Section 08 50 00 - Windows

**1.2            REFERENCE STANDARDS**

- .1      ASTM International
  - .1      ASTM C542-05, Standard Specification for Lock-Strip Gaskets.
  - .2      ASTM C1036-16, Standard Specification for Flat Glass.
  - .3      ASTM C1172-14, Standard Specification for Laminated Architectural Flat Glass
  - .4      ASTM D790-07e1, Standard Test Methods for Flexural Properties of Unreinforced and Reinforced Plastics and Electrical Insulating Materials.
  - .5      ASTM D1003-07e1, Standard Test Method for Haze and Luminous Transmittance of Plastics.
  - .6      ASTM D1929-96(R2001)e1, Standard Test Method for Determining Ignition Temperature of Plastics.
  - .7      ASTM D2240-05, Standard Test Method for Rubber Property - Durometer Hardness.
  - .8      ASTM E84-10, Standard Test Method for Surface Burning Characteristics of Building Materials.
  - .9      ASTM E330-02, Standard Test Method for Structural Performance of Exterior Windows, Doors, Skylights and Curtain Walls by Uniform Static Air Pressure Difference.
  - .10     ASTM F1233-08, Standard Test Method for Security Glazing Materials and Systems.
- .2      Canadian General Standards Board (CGSB)
  - .1      CAN/CGSB-12.1-M90, Tempered or Laminated Safety Glass.
  - .2      CAN/CGSB-12.3-M91, Flat, Clear Float Glass.
  - .3      CAN/CGSB-12.4-M91, Heat Absorbing Glass.
  - .4      CAN/CGSB-12.8-97, Insulating Glass Units.
  - .5      CAN/CGSB-12.8-97 (Amendment), Insulating Glass Units.
  - .6      CAN/CGSB-12.9-M91, Spandrel Glass.
- .3      Glass Association of North American (GANA)
  - .1      GANA Glazing Manual - 2008.
  - .2      GANA Laminated Glazing Reference Manual - 2009.

**1.3            ACTION AND INFORMATIONAL SUBMITTALS**

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

- 
- .2 Product Data:
    - .1 Submit manufacturer's instructions, printed product literature and data sheets for glass, sealants, and glazing accessories and include product characteristics, performance criteria, physical size, finish and limitations.
  - .3 Samples:
    - .1 Submit for review and acceptance of each sealed unit.
    - .2 Submit duplicate 300 x 300 mm size samples of and sealant material.
  - .4 Certificates: submit product certificates signed by manufacturer certifying materials comply with specified performance characteristics and criteria and physical requirements.
  - .5 Test Reports: certified test reports showing compliance with specified performance characteristics and physical properties.
    - .1 Submit testing and analysis of glass under provisions of Section 01 45 00 - Quality Control.
    - .2 Submit shop testing for glass.

#### **1.4 CLOSEOUT SUBMITTALS**

- .1 Submit in accordance with Section 01 78 00 - Closeout Submittals.
- .2 Operation and Maintenance Data: submit operation and maintenance data for glazing for incorporation into manual.

#### **1.5 QUALITY ASSURANCE**

- .1 Certificates: product certificates signed by manufacturer certifying materials comply with specified performance characteristics and criteria and physical requirements.
- .2 Insulating glass units to be certified by the Insulated Glass Manufacturers Alliance (IGMA).

#### **1.6 DELIVERY, STORAGE AND HANDLING**

- .1 Deliver, store and handle materials in accordance with Section 01 61 00 - Common Product Requirements.
- .2 Storage and Handling Requirements:
  - .1 Store materials off ground, indoors, in dry location, and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.
  - .2 Store and protect glazing and frames from nicks, scratches, and blemishes.
  - .3 Protect prefinished aluminum surfaces with wrapping and strippable coating.
- .3 Replace defective or damaged materials with new.

#### **1.7 AMBIENT CONDITIONS**

- .1 Ambient Requirements:
  - .1 Install glazing when ambient temperature is 10 degrees C minimum. Maintain ventilated environment for 24 hours after application.
  - .2 Maintain minimum ambient temperature before, during and 24 hours after installation of glazing compounds.

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## Part 2 Products

### 2.1 PERFORMANCE AND DESIGN CRITERIA

- .1 Design Criteria:
  - .1 Provide continuity of building enclosure vapour and air barrier using glass and glazing materials as follow:
    - .1 Utilize inner light of multiple light sealed units for continuity of air and vapour seal.
  - .2 Size glass to withstand wind loads, dead loads and positive and negative live loads to ASTM E330 acting normal to plane of glass to design pressure.
  - .3 Limit glass deflection to 1/200 or flexural limit of glass with full recovery of glazing materials.
- .2 Performance Criteria: calculated in accordance with ASHRAE 90.1.
  - .1 U-factors: determined in accordance with NFRC 100.
    - 1. U-effective: minimum 2.20 W/m<sup>2</sup>K.
    - 2. R-Value: minimum 2.6 ft<sup>2</sup>·°F·hr/Btu.
  - .2 Solar heat gain coefficient: determined in accordance with NFRC 200.
    - 1. SHGC: minimum 0.33.
  - .3 Visible light transmittance: determined in accordance with NFRC 200.
    - 1. Visible transmittance: minimum 67%.

### 2.2 MATERIALS

- .1 Flat Glass:
  - .1 Float glass: to CAN/CGSB-12.3, thickness as determined by opening size or wind/suction loads, whichever is more restrictive, but not less than 6 mm thick.
  - .2 Heat absorbing glass (for use in sealed unit glazing): to CAN/CGSB-12.4, thickness as determined by opening size or wind/suction loads, whichever is more restrictive, but not less than 6 mm thick.
    - .1 Type 1-single glass, 2-insulating glass unit.
    - .2 Class A-annealed, C-tempered where required by Building Code.
  - .3 Clear Tempered Safety Glass: to CAN/CGSB-12.1-M90.
    - .1 Type: 2 - Tempered
    - .2 Class: B - Float Glass
    - .3 Category: II - 540 J impact resistance
  - .4 Tinted Float glass: to CAN/CGSB-12.3, float glass, tint colour as selected by Consultant.
  - .5 Low emissivity (LOW E) glass, on clear float glass, deposited by vacuum deposition process, performance values listed are in a 25 mm thick insulating glass unit.
    - .1 Metallic-oxide coating: sputtered on second surface
    - .2 Light transmittance: 67%.

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- .3 Shading co-efficient: 0.43.
  - .4 Solar Heat Gain Coefficient: 0.38.
  - .5 U-Value: winter nighttime 1.63 maximum.
  - .6 Light to Solar Gain: 1.76
  - .7 Exterior visible reflectance: 10%
  - .8 Acceptable Product:
    - 1. Vitro Solarban 60 by Vitro.
    - 2. Other preapproved product.
  - .2 Insulating Glass Units: in accordance with 2.1.
    - .1 Insulating glass units: to CAN/CGSB-12.8, double unit, 25 mm overall thickness.
      - .1 Outer Light: 6 mm thick, tinted float glass with low "E" coating on second surface.
      - .2 Inter-cavity space thickness: with low conductivity (warm edge) spacers, 12 mm between middle and outer lights, filled with argon gas.
      - .3 Inert gas fill: argon.
      - .4 Inner Light: 6 mm thick, clear float glass.
    - .2 Performance requirements: as indicated.
  - .3 Security Film:
    - .1 Acceptable product:
      - .1 Safety & Security Window Film Safety Series, as manufactured by 3M.
      - .2 Other preapproved product.
  - .4 Sealant: in accordance with Section 07 92 00 - Joint Sealants.

## 2.3 ACCESSORIES

- .1 Setting blocks: silicone, 80-90 Shore A durometer hardness to ASTM D2240, to suit glazing method, glass light weight and area, length of 25 mm for each square meter of glazing, minimum 100 mm x width of glazing rabbet space minus 1.5 mm x height.
- .2 Spacer shims: neoprene, 50-60 Shore A durometer hardness to ASTM D2240, 75 mm long x one half height of glazing stop x thickness to suit application. Self-adhesive on one face.
- .3 Glazing tape:
  - .1 Preformed butyl compound, 10-15 Shore A durometer hardness to ASTM D2240; coiled on release paper; size to suit opening; black colour.
  - .2 Closed cell polyvinyl chloride foam, coiled on release paper over adhesive on two sides, maximum water absorption by volume 2 %, designed for compression of 25 %, to effect an air and vapour seal; size to suit opening.
- .4 Glazing splines: resilient silicone, extruded shape to suit glazing channel retaining slot, colour as selected by Consultant.
- .5 Glazing clips: manufacturer's standard type.
- .6 Lock-strip gaskets: to ASTM C542.

## **Part 3            Execution**

### **3.1            EXAMINATION**

- .1    Verification of Conditions: verify conditions of substrates previously installed under other Sections or Contracts are acceptable for glazing installation in accordance with manufacturer's written instructions.
  - .1    Verify that openings for glazing are correctly sized and within tolerance.
  - .2    Verify that surfaces of glazing channels or recesses are clean, free of obstructions, and ready to receive glazing.
  - .3    Visually inspect substrate.
  - .4    Inform Consultant of unacceptable conditions immediately upon discovery.
  - .5    Proceed with installation only after unacceptable conditions have been remedied.

### **3.2            PREPARATION**

- .1    Clean contact surfaces with solvent and wipe dry.
- .2    Seal porous glazing channels or recesses with substrate compatible primer or sealer.
- .3    Prime surfaces scheduled to receive sealant.

### **3.3            INSTALLATION: EXTERIOR - DRY METHOD (PREFORMED GLAZING)**

- .1    Manufacturer's Instructions: comply with manufacturer's written data, including product technical bulletins, product catalogue installation instructions, product carton installation instructions, and data sheets.
- .2    Dry method - tape/tape and sealant (to exterior hollow metal doors where applicable):
  - .1    Perform work in accordance with GANA Glazing Manual for glazing installation methods.
  - .2    Cut glazing tape to length; install on glazing light. Seal corners by butting tape and sealing junctions with sealant.
  - .3    Place setting blocks at 1/4 points, with edge block maximum 150 mm from corners.
  - .4    Rest glazing on setting blocks and push against fixed stop with sufficient pressure to attain full contact.
  - .5    Install removable stops without displacing glazing tape. Exert pressure for full continuous contact.
  - .6    Trim protruding tape edge.
- .3    Lock strip gasket method (to exterior glazing, entrances, and doors):
  - .1    Unpack and lay out gaskets on flat warm area to permit recovery of shape.
  - .2    Install gaskets under compression from corners inward. Seal corner junctions between gaskets with a black type 1 sealant specified in Section 07 92 00.
  - .3    Drain infiltrated moisture to exterior through drain holes in sill.
  - .4    Install locking strip and gasket assembly to manufacturer's instructions.

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**3.4 INSTALLATION OF SEALED GLASS UNITS**

- .1 Where not otherwise covered in this Section, install sealed glass units in accordance with the specifications of the Insulated Glass Manufacturer's Alliance (IGMA).

**3.5 INSTALLATION: SECURITY FILM**

- .1 Install film with adhesive, applied in accordance with film manufacturer's instructions.
- .2 Place without air bubbles, creases or visible distortion.
- .3 Install security film before glazing is installed in frame. Installation of security film after glazing is installed in frame is not acceptable.

**3.6 CLEANING**

- .1 Cleaning: clean in accordance with Section 01 74 11 - Cleaning.
  - .1 Leave Work area clean at end of each day.
    - .1 Remove traces of primer, caulking.
    - .2 Remove glazing materials from finish surfaces.
    - .3 Remove labels.
    - .4 Clean glass and mirrors using approved non-abrasive cleaner in accordance with manufacturer's instructions.

**3.7 PROTECTION**

- .1 Protect installed products and components from damage during construction.
- .2 After installation, mark each light with an "X" by using removable plastic tape or paste.
  - .1 Do not mark heat absorbing or reflective glass units.
- .3 Repair damage to adjacent materials caused by glazing installation.

**END OF SECTION**

**Part 1            General**

**1.1            SECTION INCLUDES**

- .1        Section includes, but is not limited to:
  - .1            Gypsum board materials and components used in assemblies.

**1.2            RELATED REQUIREMENTS**

- .1        Section 06 10 53 - Miscellaneous Rough Carpentry

**1.3            REFERENCE STANDARDS**

- .1        American Society for Testing and Materials (ASTM)
  - .1            ASTM C475/C475M-12e1), Standard Specification for Joint Compound and Joint Tape for Finishing Gypsum Board.
  - .2            ASTM C840-16, Standard Specification for Application and Finishing of Gypsum Board.
  - .3            ASTM C1002-14, Standard Specification for Steel Self-Piercing Tapping Screws for the Application of Gypsum Panel Products or Metal Plaster Bases to Wood Studs or Steel Studs.
  - .4            ASTM C1047-14a, Standard Specification for Accessories for Gypsum Wallboard and Gypsum Veneer Base.
  - .5            ASTM C1177/C1177M-13, Standard Specification for Glass Mat Gypsum Substrate for Use as Sheathing.
  - .6            ASTM C1178/C1178M-18, Standard Specification for Glass Mat Water-Resistant Gypsum Backing Board.
  - .7            ASTM C1280-13a, Standard Specification for Application of Gypsum Sheathing.
  - .8            ASTM C1396/C1396M-17, Standard Specification for Gypsum board.
  - .9            ASTM C1766-15, Standard Specification for Factory Laminated Gypsum Panel Products.
  - .10          ASTM D3273-16, Standard Test Method for Resistance to Growth of Mold on the Surface of Interior Coatings in an Environmental Chamber
- .2        Association of the Wall and Ceilings Industries International (AWCI)
  - .1            AWCI Levels of Gypsum Board Finish-GA-214-2015.
- .3        Underwriters' Laboratories of Canada (ULC)
  - .1            CAN/ULC-S102-10, Standard Method of Test of Surface Burning Characteristics of Building Materials and Assemblies.

**1.4            ACTION AND INFORMATIONAL SUBMITTALS**

- .1        Submit in accordance with Section 01 33 00- Submittal Procedures.
- .2        Product Data:

- .1 Submit manufacturer's instructions, printed product literature and data sheets for gypsum board assemblies and include product characteristics, performance criteria, physical size, finish and limitations.
- .3 Shop Drawings:
  - .1 Indicate components such as fastener type, dimensions, spacing and locations at gypsum board edges, ends and in field of board as well as installation methods. Components and work to confirm to ASTM C 840 standard specification for application and finishing of gypsum board.
  - .2 Indicate type of joint compound, and number of joint compound layers.
- .4 Samples:
  - .1 Submit for review and acceptance of each component specified or necessary for complete installation. Include technical descriptive data.
- .5 Certifications:
  - .1 Submit certificates signed by manufacturer certifying that materials comply with specified performance characteristics and physical properties.

## **1.5 DELIVERY, STORAGE AND HANDLING**

- .1 Deliver, store and handle materials in accordance with Section 01 61 00 - Common Product Requirements.
- .2 Exercise care in unloading gypsum board materials shipment to prevent damage.
- .3 Storage and Handling Requirements in accordance with ASTM C840 -16:
  - .1 Store gypsum board assembly materials level, flat, indoors, in dry location, off ground, and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.
  - .2 Store and protect gypsum board assemblies from nicks, scratches, and blemishes.
  - .3 Protect gypsum board from direct exposure to rain, snow, sunlight, or other excessive weather conditions.
  - .4 Protect ready mix joint compounds from freezing, exposure to extreme heat and direct sunlight.
  - .5 Protect from weather, elements and damage from construction operations.
  - .6 Handle gypsum boards to prevent damage to edges, ends or surfaces.
  - .7 Protect prefinished aluminum surfaces with strippable coating. Do not use adhesive papers or sprayed coatings which bond when exposed to sunlight or weather.
  - .8 Replace defective or damaged materials with new.

## **1.6 AMBIENT CONDITIONS**

- .1 Maintain temperature 10 °C minimum, 21 °C maximum for 48 hours before and during application of gypsum boards and joint treatment, and for 48 hours minimum after completion of joint treatment.
- .2 Apply board and joint treatment to dry, clean, frost free surfaces.
- .3 Ventilation: ventilate building spaces as required to remove excess moisture that would prevent drying of joint treatment material immediately after its application.

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## **1.7 PROVISIONS FOR USING GLASS-MAT GYPSUM BOARD PRODUCTS**

- .1 Install glass-mat gypsum board products in all locations where gypsum board will be erected before achieving a dry, watertight building condition for each specific area in addition to the areas indicated in this Section and on the drawings which are to receive glass-mat gypsum board products.
- .2 Once a dry, watertight condition exists for each specific area, glass-mat faced gypsum board is no longer required to be installed in remaining areas scheduled for paper faced gypsum board products.

## **Part 2 Products**

### **2.1 MATERIALS**

- .1 Gypsum board in fire rated construction (including fire rated ceilings): to ASTM C1396/C1396M, Type 'X' special ULC approved fire retardant type, 15.9 mm thick as indicated on drawings, x 1200 mm wide x maximum permissible length, ends square cut, edges tapered. Where required to meet ULC or Intertek Testing Services (Warnock Hersey) designs, use "C" formulation fire rated gypsum board.
- .2 Gypsum board in moisture-resistant construction (including moisture resistant ceilings): to ASTM D3273, and to ASTM C1396 and ASTM D3273 for ceilings, 12.7 mm or 15.9 mm thick as indicated, Type 'X' as indicated on drawings, 1200 mm wide x maximum practical length. Including, but not limited to the following:
  - .3 Tape: to ASTM C475, 50 mm wide spark perforated tape; as recommended by the gypsum board manufacturer. To fibre glass faced smooth gypsum board use 50 mm wide fibreglass tape as recommended by the manufacturer.
  - .4 Steel drill screws: to ASTM C1002, type W for application of gypsum board to wood. Power drilling self-applying type, case hardened, socketed countersunk head, galvanized, of type and sizes recommended by gypsum board manufacturer and as required for fire rated partitions.
  - .5 Trim: conforming to ASTM C1047; minimum 0.5 mm thickness commercial grade sheet steel with wiped coat zinc finish to ASTM A924/A924M, type specially design for use in gypsum board applications, flanges designed to be concealed with taping compound and as follows:
    - .1 Casing beads and trim: metal or metal and paper combination "J" type, beaded angle, with one side perforated for joint filling, to suit gypsum board thickness.
    - .2 Corner beads: square, metal or metal and paper combination, beaded angle, flanges 28.6 mm or 32 mm.
    - .3 Expansion joints: preformed metal, beaded, with one side perforated for joint filling.
    - .4 Control Joints: to ASTM C1047, pre-formed galvanized metal or plastic "V" type, perforated flanges.
- .6 Sealants: in accordance with Section 07 92 00 - Joint Sealants.
  - .1 Acoustic sealant: in accordance with Section 07 92 00 - Joint Sealants.
- .7 Firestop putty pads: in accordance with Section 07 84 00 - Firestopping.

- .8 Insulating strip: rubberized, moisture resistant, 3 mm thick closed cell neoprene strip, 12 mm wide, with self-sticking permanent adhesive on one face, lengths as required.
- .9 Joint compound: to ASTM C475, asbestos-free, slow setting, vinyl bedding and finishing compound, as recommended by gypsum board manufacturer.
- .10 Setting Compound: to fibreglass faced gypsum board, use setting compound for fibreglass tape instead of regular jointing compound for bedding of fibreglass tape (first coat). Use regular joint compound for all other coats to joints. Type as recommended by the fibreglass faced gypsum board manufacturer.
- .11 Plywood backing, wood framing and blocking: as specified in Section 06 10 53 - Miscellaneous Rough Carpentry.

### **Part 3 Execution**

#### **3.1 EXAMINATION**

- .1 Verification of Conditions: verify conditions of substrates previously installed under other Sections or Contracts are acceptable for gypsum board assembly installation in accordance with manufacturer's written instructions.
  - .1 Visually inspect substrate.
    - .1 Verify backing, acoustical putty, and firestop putty pads have been installed and observed by Consultant before proceeding with application of gypsum board or concealing enclosed spaces.
  - .2 Inform Consultant of unacceptable conditions immediately upon discovery.
  - .3 Proceed with installation only after unacceptable conditions have been remedied.

#### **3.2 ERECTION**

- .1 Do application and finishing of gypsum board to ASTM C840-16 except where specified otherwise.
- .2 Do application of gypsum sheathing to ASTM C1280-13a.
- .3 Install work level to tolerance of 1:1200.
- .4 Frame with furring channels, perimeter of openings for access panels, light fixtures, diffusers, and grilles.
- .5 Furr for gypsum board faced vertical bulkheads within and at termination of ceilings.
- .6 Furr above suspended ceilings for gypsum board fire and sound stops and to form plenum areas as indicated.
- .7 Install wall furring for gypsum board wall finishes to ASTM C840-16, except where specified otherwise.
- .8 Furr openings and around built-in equipment, cabinets, access panels, above recessed electrical fixtures, and as indicated on drawings, on four sides. Extend furring into reveals. Check clearances with equipment suppliers.
- .9 Furr duct shafts, beams, columns, pipes and exposed services where indicated.

- .10 Erect drywall resilient furring transversely across studs and joists and as indicated, spaced maximum 600 mm on centre and not more than 150 mm from ceiling/wall juncture. Secure to each support with 32 mm drywall screw.
- .11 Install 150 mm continuous strip of 12.7 mm gypsum board along base of partitions where resilient furring installed.

### 3.3 APPLICATION

- .1 Apply gypsum board after bucks, anchors, blocking, sound attenuation, electrical and mechanical work have been approved.
- .2 Apply single layer gypsum board to wood furring or framing using screw fasteners unless indicated in rated and listed tested assembly. Install screws at a maximum of 200 mm on centre at periphery of board and at 300 mm on centre in field, along each framing member. For fire rated assemblies, install screws at 175 mm on centre for partitions and 150 mm on centre for ceilings.
  - .1 Single-Layer Application:
    - .1 Apply gypsum board on ceilings before application of walls to ASTM C840-16.
    - .2 Apply gypsum board on walls vertically or horizontally, providing sheet lengths that will minimize number of board edges or end joints.
- .3 Ceilings: install exterior gypsum board perpendicular to supports; stagger end joints over supports.
- .4 Apply 12 mm diameter bead of acoustic sealant continuously around periphery of each face of partitioning to seal gypsum board and structure junction where partitions abut fixed building components. Seal full perimeter of cut-outs around electrical boxes, ducts, and the like, in partitions where perimeter sealed with acoustic sealant and in assemblies with sound transmission class of 50 or higher.
- .5 Install ceiling boards in direction that will minimize number of end-butt joints. Stagger end joints at least 250 mm.
- .6 Install gypsum board on walls vertically to avoid end-butt joints.
- .7 Install gypsum board with face side out.
- .8 Do not install damaged or damp boards.
- .9 Locate edge or end joints over supports. Stagger vertical joints over different studs on opposite sides of wall.

### 3.4 INSTALLATION

- .1 Erect accessories straight, plumb or level, rigid and at proper plane. Use full length pieces where practical. Make joints tight, accurately aligned and rigidly secured. Mitre and fit corners accurately, free from rough edges. Secure using contact adhesive for full length.
- .2 Install casing beads on unfinished edges exposed to view.
- .3 Install casing beads where gypsum board butts against surfaces having no trim concealing junction and where indicated. Seal joints with sealant.
- .4 Install insulating strips continuously at edges of gypsum board and casing beads abutting metal window and exterior door frames, to provide thermal break.

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- .5 Construct control joints of preformed units set in gypsum board facing and supported independently on both sides of joint.
  - .6 Locate control joints where indicated, at changes in substrate construction, where the wall runs in an uninterrupted straight plane exceeding 9100 mm and at approximate 15 m spacing on ceilings.
  - .7 Install control joints in accordance with manufacturer's recommendations, straight and true, and seal in accordance with manufacturer's recommendations.
  - .8 Verify that screws are properly applied in process of attaching gypsum board to framing without damaging of gypsum board edges and ends.
  - .9 Construct expansion joints as detailed and at building expansion and construction joints.
  - .10 Install expansion joints in accordance with manufacturer's recommendations, straight and true, seal in accordance with manufacturer's recommendations.
  - .11 Splice corners and intersections together and secure to each member with three screws.
  - .12 Install access doors to electrical and mechanical fixtures specified in respective sections.
    - .1 Rigidly secure frames to furring or framing systems. Finish face panel joints and internal angles with joint system consisting of joint compound, joint tape and taping compound installed according to manufacturer's directions and feathered out onto panel faces.
  - .13 Finish face panel joints and internal angles with joint system consisting of joint compound, joint tape and taping compound installed according to manufacturer's directions and feathered out onto panel faces.
  - .14 Gypsum Board Finish: finish gypsum board walls and ceilings to following levels in accordance with AWCI Levels of Gypsum Board Finish:
    - .1 Levels of finish:
      - .1 Level 0: no tapping, finishing or accessories required.
        1. Temporary construction only.
      - .2 Level 1: embed tape for joints and interior angles in joint compound. Surfaces free of excess joint compound; tool marks and ridges are acceptable.
        1. Plenum areas above ceilings, in attics or in areas where the assembly is concealed.
      - .3 Level 2: embed tape for joints and interior angles in joint compound and apply one separate coat of joint compound over joints, angles, fastener heads and accessories; surfaces free of excess joint compound; tool marks and ridges are acceptable.
        1. Where water resistant gypsum backing board is used as a substrate for tile and storage areas.
      - .4 Level 3: embed tape for joints and interior angles in joint compound and apply two separate coats of joint compound over joints, angles, fastener heads and accessories; surfaces smooth and free of tool marks and ridges.
        1. Not used.

- .5 Level 4: embed tape for joints and interior angles in joint compound and apply three separate coats of joint compound over joints, angles, fastener heads and accessories; surfaces smooth and free of tool marks and ridges.
  - 1. Where gloss, semi-gloss, eggshell, non-textural flat, and enamel paints are specified or where severe lighting conditions occur.
- .6 Level 5: embed tape for joints and interior angles in joint compound and apply three separate coats of joint compound over joints, angles, fastener heads and accessories; apply a thin skim coat of joint compound to entire surface; surfaces smooth and free of tool marks and ridges.
  - 1. Not used.
- .15 Finish corner beads, control joints and trim as required with two coats of joint compound and one coat of taping compound, feathered out onto panel faces.
- .16 Fill screw head depressions with joint and taping compounds to bring flush with adjacent surface of gypsum board, invisible after surface finish is completed.
- .17 Sand lightly to remove burred edges and other imperfections. Avoid sanding adjacent surface of board.
- .18 Completed installation smooth, level or plumb, free from waves and other defects and ready for surface finish.
- .19 Provide skim coating to provide a light, thin coating of joint compound when gloss, semi-gloss or eggshell paints are specified. Also use skim on long walls with side lighting where differences in texture between finished sanded compound and gypsum board surface would be noticeable and unacceptable.
- .20 Mix joint compound slightly thinner than for joint taping.
- .21 Apply thin coat to entire surface using trowel or drywall broad knife to fill surface texture differences, variations or tool marks.
- .22 Allow skim coat to dry completely.
- .23 Remove ridges by light sanding or wiping with damp cloth.

### **3.5 CLEANING**

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

### **3.6 PROTECTION**

- .1 Protect installed products and components from damage during construction.
- .2 Repair damage to adjacent materials caused by gypsum board assemblies' installation.

### **3.7 SCHEDULES**

- .1 Construct fire rated assemblies where indicated.

**END OF SECTION**

**Part 1            General**

**1.1            RELATED REQUIREMENTS**

- .1        Section 07 92 00 - Joint Sealants
- .2        Section 08 11 00 - Metal Doors And Frames
- .3        Section 09 21 16 - Gypsum Board Assemblies

**1.2            REFERENCE STANDARDS**

- .1        Green Seal Environmental Standards (GS)
  - .1        GS-11-11, Paints and Coatings.
- .2        Health Canada/Workplace Hazardous Materials Information System (WHMIS)
  - .1        Material Safety Data Sheets (SDS).
- .3        The Master Painters Institute (MPI)
  - .1        Architectural Painting Specification Manual - current edition.
  - .2        Maintenance Repainting Manual - current edition.

**1.3            ACTION AND INFORMATIONAL SUBMITTALS**

- .1        Submit in accordance with Section 01 33 00- Submittal Procedures.
- .2        Product Data:
  - .1        Submit manufacturer's instructions, printed product literature and data sheets for paint and coating products and include product characteristics, performance criteria, physical size, finish and limitations.
  - .2        Submit electronic copy of WHMIS SDS for each material.
  - .3        Confirm products to be used are in MPI's approved product list.
- .3        Upon completion, provide records of products used. List products in relation to finish system and include the following:
  - .1        Product name, type and use.
  - .2        Manufacturer's product number.
  - .3        Colour numbers.
  - .4        MPI Environmentally Friendly classification system rating if applicable.
  - .5        Manufacturer's Material Safety Data Sheets (SDS).
  - .6        MPI #'s of products reviewed and installed.
- .4        Samples:
  - .1        Submit for review and acceptance of each unit.
  - .2        Samples will not be returned for inclusion into work.
  - .3        Submit duplicate 200 x 300 mm sample panels of each special finish, clear coating, stain, and paint with specified paint or coating in colours, gloss/sheen and textures required to MPI Painting Specification Manual standards.

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- .4 Retain reviewed samples on-site to demonstrate reviewed standard of quality for appropriate on-site surface.
    - .5 Certificates: submit product certificates signed by manufacturer certifying materials comply with specified performance characteristics and criteria and physical requirements.
    - .6 Manufacturer's Instructions:
      - .1 Provide manufacturer's installation and application instructions.
  - 1.4 CLOSEOUT SUBMITTALS**
    - .1 Provide in accordance with Section 01 78 00 - Closeout Submittals.
    - .2 Operation and Maintenance Data: Provide operation and maintenance data for painting materials for incorporation into manual.
    - .3 Include:
      - .1 Product name, type and use.
      - .2 Manufacturer's product number.
      - .3 Colour numbers.
      - .4 MPI Environmentally Friendly classification system rating if applicable.
  - 1.5 MAINTENANCE MATERIAL SUBMITTALS**
    - .1 Extra Stock Materials:
      - .1 Provide maintenance materials in accordance with:
        - .1 Section 01 78 00 - Closeout Submittals.
      - .2 Submit one 4 litre can of each type and colour of primer, stain, and finish coating. Identify colour and paint type in relation to established colour schedule and finish system.
  - 1.6 QUALITY ASSURANCE**
    - .1 Qualifications:
      - .1 Contractor: to have a minimum of five years proven satisfactory experience. When requested, provide list of last three comparable jobs including, job name and location, specifying authority, and project manager.
      - .2 Qualified journeypersons as defined by local jurisdiction to be engaged in painting work.
      - .3 Apprentices: may be employed provided they work under direct supervision of qualified journeyperson in accordance with trade regulations.
      - .4 Conform to latest MPI requirements for exterior painting work including preparation and priming.
      - .5 Materials: in accordance with MPI Painting Specification Manual "Approved Product" listing and from a single manufacturer for each system used.
      - .6 Retain purchase orders, invoices and documents to prove conformance with noted MPI requirements when requested by Consultant.
      - .7 Standard of Acceptance:
        - .1 Walls: no defects visible from a distance of 1000 mm at 90 degrees to surface.

- .2 Soffits and Ceilings: no defects visible from floor at 45 degrees to surface when viewed using final lighting source.
- .3 Final coat to exhibit uniformity of colour and uniformity of sheen across full surface area.
- .2 Mock-Ups:
  - .1 When requested by Consultant, prepare and paint designated surface, area, room or item to requirements specified herein, with specified paint or coating showing selected colours, number of coats, gloss/sheen, textures and quality of work to MPI Painting Specification Manual standards for review and approval.
  - .2 Construct mock-ups in accordance with Section 01 45 00- Quality Control.
    - .1 Mock-up will be used:
      - 1. To judge quality of work, substrate preparation, operation of equipment and material application and skill to MPI Architectural Painting Specification Manual standards.
    - .2 Locate where directed.
    - .3 Coordinate construction of mock-up with regular site meetings for review of mock-up before proceeding with work.
    - .4 When accepted, mock-up will demonstrate minimum standard of quality required for this work. Reviewed mock-up may remain as part of finished work.

## **1.7 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.
  - .1 Labels: to indicate:
    - .1 Type of paint or coating.
    - .2 Compliance with applicable standard.
    - .3 Colour number in accordance with established colour schedule.
- .3 Storage and Handling Requirements:
  - .1 Store materials off ground, indoors, in clean, secure, temperature controlled, well ventilated, dry location, and in accordance with manufacturer's recommendations.
  - .2 Store painting materials and supplies away from heat generating devices.
  - .3 Store materials and equipment in well ventilated area with temperature range 7 degrees C to 30 degrees C.
  - .4 Keep areas used for storage, cleaning and preparation, clean and orderly to approval of Consultant. After completion of operations, return areas to clean condition to approval of Consultant.
  - .5 Remove paint materials from storage only in quantities required for same day use.

- .6 Comply with requirements of Workplace Hazardous Materials Information System (WHMIS) regarding use, handling storage, and disposal of hazardous materials.
- .4 Fire Safety Requirements:
  - .1 Provide one 9 kg Type ABC fire extinguisher adjacent to storage area.
  - .2 Store oily rags, waste products, empty containers and materials subject to spontaneous combustion in ULC approved, sealed containers and remove from site on a daily basis.
  - .3 Handle, store, use and dispose of flammable and combustible materials in accordance with the National Fire Code of Canada (NFC).

## 1.8 SITE CONDITIONS

- .1 Heating, Ventilation and Lighting:
  - .1 Ventilate enclosed spaces.
  - .2 Co-ordinate use of existing ventilation system with Contractor and verify its operation during and after application of paint as required.
  - .3 Provide minimum lighting level of 323 Lux on surfaces to be painted.
- .2 Temperature, Humidity and Substrate Moisture Content Levels:
  - .1 Apply paint finishes when ambient air and substrate temperatures at location of installation can be satisfactorily maintained during application and drying process, within MPI and paint manufacturer's prescribed limits.
  - .2 Unless specifically pre-approved by specifying body and applied product manufacturer, perform no painting work when:
    - .1 Ambient air and substrate temperatures are below 10 degrees C.
    - .2 Substrate temperature is over 32 degrees C unless paint is specifically formulated for application at high temperatures.
    - .3 Substrate and ambient air temperatures are expected to fall outside MPI or paint manufacturer's prescribed limits.
    - .4 Relative humidity is above 85 % or when dew point is less than 3 degrees C variance between air/surface temperatures.
    - .5 Rain or snow are forecast to occur before paint has thoroughly cured or when it is foggy, misty, raining or snowing at site.
    - .6 Verify that conditions are within specified limits during drying or curing process, until newly applied coating can itself withstand 'normal' adverse environmental factors.
  - .3 Perform no painting work when maximum moisture content of substrate exceeds:
    - .1 12 % for gypsum board.
  - .4 Conduct 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 Apply paint to adequately prepared surfaces, when moisture content is below paint manufacturer's prescribed limits.
- .3 Additional application requirements:

- .1 Apply paint finishes when temperature at location of installation can be satisfactorily maintained within manufacturer's recommendations.
- .2 Apply paint finish in areas where dust is no longer being generated by related construction operations or when wind or ventilation conditions are such that airborne particles will not affect quality of finished surface.
- .3 Apply paint to adequately prepared surfaces and to surfaces within moisture limits noted herein.
- .4 Apply paint when previous coat of paint is dry or adequately cured.
- .5 Apply paint finishes when conditions forecast for entire period of application fall within manufacturer's recommendations.
- .6 Do not apply paint when:
  - .1 Surface to be painted is wet, damp or frosted.
  - .2 Provide and maintain cover when paint must be applied in damp or cold weather. Heat substrates and surrounding air to comply with temperature and humidity conditions specified by manufacturer. Protect until paint is dry or until weather conditions are suitable.
  - .3 Schedule painting operations such that surfaces exposed to direct, intense sunlight are scheduled for completion during early morning.
  - .4 Remove paint from areas which have been exposed to freezing, excess humidity, rain, snow or condensation. Prepare surface again and repaint.
  - .5 Paint occupied facilities in accordance with approved schedule only. Schedule operations to approval of Owner such that painted surfaces will have dried and cured sufficiently before occupants are affected.

## **1.9 GUARANTEE**

- .1 For paints, stains, varnishes and the like, which are not listed under MPI, provide manufacturer's standard guarantee for the materials.
- .2 Provide a two-year Maintenance Bond to the full value of the Work.

## **Part 2 Products**

### **2.1 MATERIALS**

- .1 Supply paint materials for paint systems from single manufacturer.
- .2 Conform to latest MPI requirements for painting work including preparation and priming.
- .3 Materials in accordance with MPI - Architectural Painting Specification Manual and MPI - Maintenance Repainting Manual Approved Product" listing.
- .4 Colours:
  - .1 Colour per Schedule in Drawings, submit proposed Colour Schedule to Consultant for review.
- .5 Mixing and tinting:
  - .1 Perform colour tinting operations before delivery of paint to site, in accordance with manufacturer's written recommendations. Obtain written approval from Consultant for tinting of painting materials.

- .2 Use and add thinner in accordance with paint manufacturer's recommendations.
  - .1 Do not use kerosene or similar organic solvents to thin water-based paints.
- .3 Thin paint for spraying in accordance with paint manufacturer's written recommendations.
- .4 Re-mix paint in containers prior to and during application to ensure break-up of lumps, complete dispersion of settled pigment, and colour and gloss uniformity.
- .6 Slip Resistant Additive (SRA): clean washed silica sand for use with or as a component part of paint on horizontal surfaces required to provide slip resistance. Where site applied, material to either mixed into paint (and mixed constantly to keep material in suspension) or broadcast into first or prime coat.
- .7 Gloss and sheen ratings:
  - .1 Paint gloss is defined as sheen rating of applied paint, in accordance with following values:

Gloss Level-Category	Gloss @ 60 degrees	Sheen @ 85 degrees
Gloss Level 1 - Matte Finish	Max. 5	Max. 10
Gloss Level 2 - Velvet	Max.10	10 to 35
Gloss Level 3 - Eggshell	10 to 25	10 to 35
Gloss Level 4 - Satin	20 to 35	min. 35
Gloss Level 5 - Semi-Gloss	35 to 70	
Gloss Level 6 - Gloss	70 to 85	
Gloss Level 7 - High Gloss	More than 85	
  - .2 Gloss level ratings of painted surfaces as indicated or as selected by the Consultant.
- .8 Exterior painting:
  - .1 Galvanized Metal: high contact/high traffic areas (doors, frames, railings, and handrails, etc.).
    - .1 EXT 5.3J - Water based light industrial semi-gloss coating (over water based galvanized primer).
    - .2 EXT 5.3M - High Performance architectural latex semi-gloss coating (over water based galvanized primer).
- .9 Interior painting:
  - .1 Concrete horizontal surfaces: floors.
    - .1 INT 3.2C - Epoxy slip resistant coating, G5 or G6, utilizing slip-resistant additive (SRA).
  - .2 Galvanized Metal: high contact/high traffic areas (doors, frames, railings, and handrails, etc.).
    - .1 INT 5.3 K - Water based light industrial semi-gloss coating (over water-based primer).
  - .3 Gypsum Board (Walls): gypsum wallboard, drywall, "sheet rock" type material, etc.
    - .1 INT 9.2A - Latex Eggshell finish (over latex sealer).
  - .4 Gypsum Board (Ceilings): gypsum wallboard, drywall, "sheet rock" type material, etc.

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.1 INT 9.2A - Latex Flat finish (over latex sealer).

**Part 3 Execution**

**3.1 MANUFACTURER'S INSTRUCTIONS**

- .1 Compliance: comply with manufacturer's written recommendations or specifications, including product technical bulletins, handling, storage and installation instructions, and data sheet.

**3.2 GENERAL**

- .1 Compliance: comply with manufacturer's written recommendations or specifications, including product technical bulletins, handling, storage and installation instructions, and data sheets.
- .2 Perform preparation and operations for interior painting in accordance with MPI - Architectural Painting Specifications Manual and MPI - Maintenance Repainting Manual except where specified otherwise.

**3.3 EXAMINATION**

- .1 Verification of Conditions: verify that conditions of substrate previously installed under other Sections or Contracts are acceptable to be painted in accordance with manufacturer's written instructions:
- .1 Visually inspect substrate.
- .1 Investigate existing substrates for problems related to proper and complete preparation of surfaces to be painted.
- .2 Inform Consultant of unacceptable conditions including, but not limited to damages, defects, unsatisfactory or unfavourable conditions immediately upon discovery.
- .3 Proceed with installation only after unacceptable conditions have been remedied.
- .2 Conduct moisture testing as described in PART 1, SITE CONDITIONS. Do not proceed with work until conditions fall within acceptable range as recommended by manufacturer.

**3.4 PREPARATION**

- .1 Protection of in-place conditions:
- .1 Protect existing building surfaces and adjacent structures from paint spatters, markings and other damage by suitable non-staining covers or masking. If damaged, clean and restore surfaces as directed by Consultant.
- .2 Protect items that are permanently attached such as Fire Labels on doors and frames.
- .3 Protect factory finished products and equipment.
- .4 Protect passing pedestrians, building occupants, and general public in and about the building.
- .2 Surface Preparation:
- .1 Remove electrical cover plates, light fixtures, surface hardware on doors, bath accessories and other surface mounted equipment, fittings and fastenings before

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- undertaking painting operations. Identify and store items in secure location and re-installed after painting is completed.
  - .2 Move and cover furniture and portable equipment as necessary to carry out painting operations. Replace as painting operations progress.
  - .3 Place "WET PAINT" signs in occupied areas as painting operations progress.
  - .4 Clean and prepare surfaces in accordance with MPI - Architectural Painting Specification Manual and MPI - Maintenance Repainting Manual specific requirements and coating manufacturer's recommendations.
    - .1 Remove dust, dirt, and other surface debris by vacuuming, wiping with dry, clean cloths or compressed air.
    - .2 Wash surfaces with a biodegradable detergent, and bleach where applicable, and clean warm water using a stiff bristle brush to remove dirt, oil and other surface contaminants.
    - .3 Rinse scrubbed surfaces with clean water until foreign matter is flushed from surface.
    - .4 Allow surfaces to drain completely and allow to dry thoroughly.
    - .5 Prepare surfaces for water-based painting, water-based cleaners should be used in place of organic solvents.
    - .6 Use trigger operated spray nozzles for water hoses.
    - .7 Many water-based paints cannot be removed with water once dried. Minimize use of mineral spirits or organic solvents to clean up water-based paints.
  - .5 Prevent contamination of cleaned surfaces by salts, acids, alkalis, other corrosive chemicals, grease, oil and solvents before prime coat is applied and between applications of remaining coats. Apply primer, paint, or pretreatment as soon as possible after cleaning and before deterioration occurs.
  - .6 Sand and dust between coats as required to provide adequate adhesion for next coat and to remove defects visible from a distance up to 1000 mm.
  - .7 Clean metal surfaces to be painted by removing rust, loose mill scale, welding slag, dirt, oil, grease and other foreign substances in accordance with MPI requirements.
  - .8 Carried out during shop priming: clean metal surfaces to be painted by removing rust, loose mill scale, welding slag, dirt, oil, grease and other foreign substances in accordance with MPI requirements. Remove traces of blast products from surfaces, pockets and corners to be painted by blowing with clean dry compressed air, vacuum cleaning, or brushing with clean brushes.
  - .9 Touch up of shop primers with primer as specified.

### 3.5 APPLICATION

- .1 Use method of application reviewed by Consultant.
  - .1 Conform to manufacturer's application recommendations.
- .2 Brush and Roller Application:
  - .1 Apply paint in uniform layer using brush and/or roller type suitable for application.
  - .2 Work paint into cracks, crevices and corners.

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- .3 Paint surfaces and corners not accessible to brush using spray, daubers and/or sheepskins. Paint surfaces and corners not accessible to roller using brush, daubers or sheepskins.
  - .4 Brush and/or roll out runs and sags, and over-lap marks. Rolled surfaces free of roller tracking and heavy stipple.
  - .5 Remove runs, sags and brush marks from finished work and repaint.
  - .3 Spray application:
    - .1 Provide and maintain equipment that is suitable for intended purpose, capable of atomizing paint to be applied, and equipped with suitable pressure regulators and gauges.
    - .2 Keep paint ingredients properly mixed in containers during paint application either by continuous mechanical agitation or by intermittent agitation as frequently as necessary.
    - .3 Apply paint in uniform layer, with overlapping at edges of spray pattern. Back roll first coat application.
    - .4 Brush out immediately all runs and sags.
    - .5 Use brushes and rollers to work paint into cracks, crevices and places which are not adequately painted by spray.
    - .6 Gypsum board; if sprayed, must be back rolled.
  - .4 Use dipping, sheepskins or daubers only when no other method is practical in places of difficult access.
  - .5 Apply coats of paint in continuous film of uniform thickness.
    - .1 Repaint thin spots or bare areas before next coat of paint is applied.
  - .6 Allow surfaces to dry and properly cure after cleaning and between subsequent coats for minimum time period as recommended by manufacturer.
  - .7 Sand and dust between coats to remove visible defects.
  - .8 Finish surfaces both above and below sight lines as specified for surrounding surfaces.
  - .9 Finish top, bottom, edges and cutouts of doors after fitting as specified for door surfaces.
  - .10 Allow an "out gassing" period at the end of the project of minimum three days before Owner's move in.
  - .11 Mechanical/Electrical Equipment:
    - .1 Paint conduits, piping, hangers, ductwork and other mechanical and electrical equipment exposed in finished areas, to match adjacent surfaces, except as indicated.
    - .2 Do not paint over nameplates.
    - .3 Paint inside of ductwork where visible behind grilles, registers and diffusers with primer and one coat of matt black paint.
    - .4 Paint disconnect switches for fire alarm system and exit light systems in red enamel.
    - .5 Paint natural gas piping yellow.
    - .6 Paint both sides and edges of backboards for telephone and electrical equipment before installation.

- .1 Leave equipment in original finish except for touch-up as required, and paint conduits, mounting accessories and other unfinished items.
- .7 Do not paint interior transformers and substation equipment.

### **3.6 CLEANING**

- .1 Progress Cleaning: clean in accordance with Section 01 74 11 - Cleaning.
  - .1 Leave Work area clean at end of each day.
- .2 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment in accordance with Section 01 74 11 - Cleaning.
- .3 Place primer, stains, and paint defined as hazardous or toxic waste, including tubes and containers, in containers or areas designated for hazardous waste.

### **3.7 RESTORATION**

- .1 Clean and re-install hardware items removed before undertaken painting operations.
- .2 Remove protective coverings and warning signs as soon as practical after operations cease.
- .3 Remove paint splashings on exposed surfaces that were not painted. Remove smears and spatter immediately as operations progress, using compatible solvent.
- .4 Protect freshly completed surfaces from paint droppings and dust to approval of Consultant. Avoid scuffing newly applied paint.
- .5 Restore areas used for storage, cleaning, mixing and handling of paint to clean condition to approval of Consultant.

**END OF SECTION**

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## **PART 1.0 - GENERAL**

### **.1 Environmental Requirements**

- .1 Do not apply finish in areas where dust is being generated.
- .2 Do not apply paint to work at a temperature below 15°C.

### **.2 Colour Schedule**

- .1 The colour schedule is as follows in accordance with the colour code below. The entire length of the pipe shall be painted in the basic colour.

Line	Colour	
Raw Water (Cold)	B-147	Dark Green
Hangers, Brackets, Supports	C-421	Black
Handles	C-421	Black
Pumps	A-58	Deep Blue
Domestic Cold & Filtered Water	A-84	Light Blue
Chlorine Gas or Liquid	B-243	OSHA Safety Yellow
Air Wash (Filters)	-	Standard White
Natural Gas	C-312	OSHA Safety Orange
Electrical Conduit	Match color of conduit to surrounding wall color	

- .2 The above colour codes are from International Paint (Canada) Ltd. and are for reference use and colour selection only. They are not intended as an endorsement of the products specified above, nor are they an exclusion of other manufacturers or suppliers.

### **.3 Paint Systems**

- .1 Piping, fittings and valves:
  - .1 Prime - iron oxide primer (etch type primer for PVC piping and galvanized metal).
  - .2 Intermediate - alkyd metal enamel (gloss)
  - .3 Finish - alkyd metal enamel (gloss)
- .2 Equipment (for units having factory-applied finish):
  - .1 Prime - touch-up finish with paint compatible with manufacturer's paint.
  - .2 Finish - alkyd metal enamel (gloss)
- .3 Equipment (for units with prime coat only):
  - .1 Prime - touch-up prime coat with paint compatible with manufacturer's prime.
  - .2 Intermediate - alkyd metal enamel (gloss).
  - .3 Finish - alkyd metal enamel (gloss).

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**.4 Items to be Painted**

- .1 All piping, mechanical and electrical equipment, including sleeves through floors, and pump assemblies are to be painted.

**PART 2.0 - PRODUCTS**

**.1 Materials**

- .1 Paint materials:
  - .1 To CGSB Standards corresponding to finish formulae.
  - .2 Paint materials for each coating formula to be products of a single manufacturer.
  - .3 Materials for each coating formula to be products of a single manufacturer.
- .2 Thinners
  - .1 Odorless paint thinner, pure and clean with no deleterious material.
- .3 Approved manufacturers:
  - .1 General Paint Corp. Ltd.
  - .2 British American Paint Company (BAPCO)
  - .3 Canadian Industries Ltd. (CIL)
  - .4 Glidden Company

**PART 3.0 - EXECUTION**

**.1 General**

- .1 Remove dust, dirt, loose material, grease and other extraneous matter. Broom clean before starting.
- .2 Protect floors, walls, ceilings, fixtures and any items not being painted with clean, dry, cover sheets.

**.2 Handling and Storage of Materials**

- .1 Deliver all materials in unopened original packages or containers of a suitable size for the particular application. Use without alternation of any kind, except where specifically recommended by the manufacturer and with the **Consultant's** approval.
- .2 Store material in a heated and suitable protected enclosure at one location on the site.

**.3 Cleaning and Preparation of Surfaces**

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.1 Preparation of steel surfaces:

- .1 Steel surfaces that are not galvanized and will be subject to normal exterior or interior atmospheric exposure shall be cleaned either in the shop or in the field by means of solvents, emulsions, cleaning compounds, steam cleaning, or similar materials or methods to the specifications issued by the Steel Structures Painting Council, SSPC-SP1-63. After solvent cleaning, blast the metal with abrasives to standards specified by SSPC-SP6-63 or CGSB 31-GP-404, Type 2. Prime cleaned surfaces as soon as practicable after cleaning with the appropriate specified primer. Prior to applying subsequent coats, clean and reprime all welds and other damaged areas of shop primed surfaces. Neutralize and remove all slag and weld spatter by acid washing.
- .2 All steel surfaces that are not galvanized and will be subject to being wet by spray or condensation shall be cleaned off all rust, millscale and other foreign matter to bright base metal solvent cleaning to specification SSPC-SP1-63 issued by the Steel Structures Painting Council and then blast cleaning to Standard SSWPC-SP5-63 to CGSB 31-GP-404 Type 1. Carry out blast cleaning using abrasives of such particular shape, hardness and gradation as to effectively clean the metal and leave a roughened surface suitable for adequate bonding of subsequent coatings. As soon after cleaning as practicable, and prior to the formation of any corrosion from atmospheric moisture or other causes, clean all blast cleaned metal surfaces of dust and coat with the specified primer, protective coating, or paint. Do not leave blast cleaned surfaces overnight prior to receiving the priming coat.
- .3 Prior to field application of subsequent coats, thoroughly clean the surfaces of shop applied coating with mineral spirits.
- .4 Properly clean all welds or other unpainted areas as specified for the adjacent area. Give one coat of primer as specified.

**.4 Application**

- .1 Finish tops, bottoms, edges and areas not readily visible.
- .2 Apply each coat by brush unless specifically recommended otherwise by the manufacturer.
- .3 Following manufacturer's recommendations for thinning, coverage and film thickness. Use four coat system for piping or equipment in contact with water.
- .4 Ensure that there is no flow in piping during application.

**.5 Inspection**

- .1 Notify **Consultant** 24 hours in advance of prime coat applications to all surfaces, piping and equipment.
- .2 Do not proceed with finish coats until **Consultant's** approval has been received for prime coat.

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**.6 Posting of Signs**

- .1 Post "WET PAINT" signs in prominent locations while painting is in progress.

**.7 Clean-Up**

- .1 Each day at completion of day's work, remove all oily rags and debris. Waste will not be allowed to accumulate.
- .2 On completion of work, remove masking tape and protective devices. Clean off paint spots and leave structure in a clean, presentable condition. Remove all unused material and tools from the site.

**.8 Touch-Up**

- .1 Inspect all areas of work for damage.
- .2 Remove all splattering, finger marks, rust, water marks, scratches, blemishes.
- .3 Touch-up damaged or cleaned areas to leave whole job in perfect condition.

END OF SECTION

**Part 1            General**

**1.1            SECTION INCLUDES**

- .1 Section includes, but is not limited to:
  - .1 Regulatory signage required for occupancy.
  - .2 Other interior signage including, but not limited to:
    - .1 Mechanical and meter rooms, storage room, janitor rooms.

**1.2            RELATED REQUIREMENTS**

- .1 Section 08 11 00 - Metal Doors And Frames

**1.3            REFERENCE STANDARDS**

- .1 Canadian General Standards Board (CGSB)
  - .1 CGSB 31-GP-107Ma-90, Non-Inhibited Phosphoric Acid Base Metal Conditioner and Rust Remover.
  - .2 CGSB 41-GP-6M-1983, Sheets, Thermosetting Polyester Plastics, Glass Fibre Reinforced.
- .2 Health Canada/Workplace Hazardous Materials Information System (WHMIS)
  - .1 Material Safety Data Sheets (MSDS).

**1.4            ACTION AND INFORMATIONAL SUBMITTALS**

- .1 Submit in accordance with Section 01 33 00 - Submittal Procedures.
- .2 For all signage supplied by the Contractor:
  - .1 Product Data:
    - .1 Submit manufacturer's instructions, printed product literature and data sheets for signage and include product characteristics, performance criteria, physical size, finish and limitations.
  - .2 Shop Drawings:
    - .1 Submit catalogue sheets.
    - .2 Indicate materials, thicknesses, sizes, finishes, colours, construction details, removable and interchangeable components, mounting methods, and a schedule of signs.
    - .3 Submit drawn-to-scale details for individually fabricated or incised lettering indicating word and letter spacing.
  - .3 Samples:
    - .1 Submit duplicate representative sample of each type sign, sign image and mounting method including, but not limited to: graphics and wall plates fixed mounting installation method.
- .3 For all signage to be supplied by the Owner:
  - .1 Communicate to the Departmental Representative the intended installation date. Notification is required a minimum of eight weeks before installation.

- .1 Departmental Representative: supply signage to the Contractor to be installed.
- .2 Contractor: responsible for supplying all hardware and supplies required to install the supplied signage.

## **1.5 CLOSEOUT SUBMITTALS**

- .1 Submit in accordance with Section 01 78 00 - Closeout Submittals.

## **1.6 DELIVERY, STORAGE AND HANDLING**

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

## **Part 2 Products**

### **1.1 SIGN GRAPHICS**

- .1 Sign graphics: well defined, arranged for balanced appearance, and properly word and letter spaced.
- .2 Silk screen process: apply one colour photographic produced silk screen printed images to face side of transparent sign faces; face side of opaque sign faces.
- .3 Engraving: apply sign images using pantograph mechanical engraving machine to obtain incised paint-filled letters as detailed or specified.

### **2.2 MATERIALS**

- .1 Interior PVC Signs
  - .1 Engraving sheet: lamicoid 3.2 mm thick plastic sheet, black core.
  - .2 Primer: epoxy.
  - .3 Base coat: tinted polyurethane.
  - .4 Screened Letters and Graphics: epoxy ink compatible with polyurethane base coat.
  - .5 Finish coat: clear matt polyurethane finish.
  - .6 Signage to washroom doors: Barrier Free compliant international washroom symbols for washrooms.
  - .7 Other interior signage: provide signage to service rooms, janitor rooms and the like.

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- .2 Self-stick foam tape: thickness as recommended by manufacturer, 352.4 kg/m<sup>3</sup> density polyurethane open-cell foam tape for sign purposes, with synthetic self-stick adhesive on both sides. Width: to suit sign sizes.
  - .3 Double sided clear tape: thickness as recommended by manufacturer, tape for sign purposes, with synthetic self-stick adhesive on both sides. Width: to suit sign sizes.
  - .4 Adhesives, paints, sealants and solvents for acrylic sheet: type recommended by sheet manufacturer for applicable condition.

## **2.3 FABRICATION**

- .1 Fabricate signs in accordance with details, specifications and reviewed shop drawings.
- .2 Build units square, true, accurate to size, free from visual or performance defects.
- .3 Fit and securely join sections to obtain tight, closed joints.
- .4 Allow for thermal movement without distortion of components.
- .5 Exposed inconspicuous fasteners of same finish and colour as base material or stainless steel anchors, permitted where indicated.
- .6 Polish exposed edges of metal to smooth, slightly convex profile.
- .7 Manufacturer's nameplates on sign surface permitted in non-visible locations in completed work.

## **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 signage installation in accordance with manufacturer's written instructions.
  - .1 Visually inspect substrate.
  - .2 Inform Consultant of unacceptable conditions immediately upon discovery.
  - .3 Proceed with installation only after unacceptable conditions have been remedied.

### **3.2 INSTALLATION**

- .1 Manufacturer's Instructions: compliance: comply with manufacturer's written recommendations or specifications, including product technical bulletins, handling, storage and installation instructions, and data sheets.
- .2 Install signage in locations indicated and as directed by Consultant.
- .3 Erect and secure signs plumb and level at elevations indicated and as directed by Consultant.
- .4 Comply with sign manufacturer's installation instructions and approved shop drawings.
- .5 Adhesive attachment:
  - .1 Use self-stick adhesive foam tape to manufacturer's instructions to fix sign and prevent "rocking".
  - .2 Keep tape maximum 1.6 mm from edges.

### **3.3            CLEANING**

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

**END OF SECTION**

**Part 1            General**

**1.1            SECTION INCLUDES**

- .1    Section includes, but is not limited to:
  - .1    Decorative and protective wall panels with textured finishes. Mounting hardware, adhesives, accessories, and trims

**1.2            RELATED REQUIREMENTS**

- .1    Section 06 10 53 - Miscellaneous Rough Carpentry
- .2    Section 09 21 16 - Gypsum Board Assemblies

**1.3            REFERENCE STANDARDS**

- .1    ASTM International
  - .1    ASTM E84 Standard Test Method for Surface Burning Characteristics of Building Materials.
  - .2    ASTM D256 Standard Test Methods for Determining the Izod Pendulum Impact Resistance of Plastics.
  - .3    ASTM D638 Standard Test Method for Tensile Properties of Plastics.
  - .4    ASTM D790 Standard Test Methods for Flexural Properties of Unreinforced and Reinforced Plastics and Electrical Insulating Materials.
  - .5    ASTM D2583 Standard Test Method for Indentation Hardness of Rigid Plastics by Means of a Barcol Impressor.

**1.4            ACTION AND INFORMATIONAL SUBMITTALS**

- .1    Submit in accordance with Section 01 33 00 - Submittal Procedures.
- .2    Product Data:
  - .1    Submit manufacturer's instructions, printed product literature and data sheets for each type of wall protection system, components, and accessories. Include product characteristics, performance criteria, physical size, finish and limitations, and installation methods for each type of substrate.
  - .2    Submit electronic copies of WHMIS MSDS.
- .3    Shop Drawings:
  - .1    Submit shop drawings showing locations, extent and installation details of each type of wall protection system location. Show methods of attachment to adjoining construction.
    - .1    Horizontal joints in panelling are not permitted.
    - .2    No vertical joints on walls less than 1220 mm wide and multiple partial panel pieces are not permitted to be used in locations where one continuous piece could be used.
- .4    Installation Drawings:

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- .1 Indicate on drawings large scale details, materials, finishes, dimensions, anchorage and assembly.
  - .5 Samples:
    - .1 Submit duplicate 305 mm long samples of each type of wall protection system proposed for this work, for verification of color, texture, pattern and end cap attachment and alignment, and mounting hardware.
  - 1.5 CLOSEOUT SUBMITTALS**
    - .1 Submit in accordance with Section 01 78 00 - Closeout Submittals.
  - 1.6 QUALITY ASSURANCE**
    - .1 Test Reports:
      - .1 Submit certified test reports showing compliance with specified performance characteristics and physical properties.
    - .2 Installer qualifications:
      - .1 Installer with minimum five years experience in installation of systems similar in complexity to those required for this project.
    - .3 Manufacturer's qualifications:
      - .1 Manufacturer with minimum five years experience in the production of specified products and a record of successful in-service performance.
    - .4 Single source responsibility:
      - .1 Provide all components of the wall protection system manufactured by the same company.
  - 1.7 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 in original, undamaged packaging in a cool, dry place out of direct sunlight and exposure to the elements. Maintain a minimum room temperature of 4°C and a maximum of 38°C.
      - .2 Materials must be stored flat.
      - .3 Replace defective or damaged materials with new.
  - 1.8 SITE CONDITIONS**
    - .1 Materials must be acclimated in an environment of 15°-24°C a minimum of 24 hours before beginning the installation.
    - .2 Installation areas must be enclosed and weatherproofed before installation commences.

- .3 Field Measurements: Verify actual measurements and openings by field measurements before fabrication. Show recorded measurements on shop drawings. Coordinate field measurements and fabrication schedule with construction progress to avoid construction delays.
  - .1 Verify walls and openings are be level, plumb, straight, in-line and square

## **Part 2 Products**

### **2.1 MANUFACTURERS**

- .1 Acceptable Manufacturer for wall protection:
  - .1 Nudo.
  - .2 Other preapproved alternate.

### **2.2 PRODUCTS**

- .1 Fibre reinforced panels: embossed, solid sheets, composed of fiberglass and calcium carbonate-filled polyester resin and comply with the ASTM D5319 Standard for Glass-Fiber Reinforced Polyester Wall and Ceiling Panels.
  - .1 Nominal panel thickness: .090"
  - .2 Nominal panel weight: 0.65 psf
  - .3 Nominal panel size: 4'x8',10'
  - .4 Colour: as selected by Consultant.
  - .5 Adhesive: in accordance with manufacturer's recommendations.
  - .6 Acceptable products:
    - .1 LP-F9 FibreLite FRP Embossed Wall Panel, as manufactured by NUDO.
      - 1. Include for manufacturers coordinating PVC mouldings, colour to match wall panel colour.
    - .2 Other preapproved alternate.

### **2.3 FABRICATION**

- .1 Fabricate wall protection systems to comply with requirements indicated for design, dimensions, detail, finish and member sizes.

## **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 wall protection systems installation in accordance with manufacturer's written instructions.
  - .1 Visually inspect substrate.
    - .1 Verify blocking and backing has been installed.
  - .2 Inform Consultant of unacceptable conditions immediately upon discovery.
  - .3 Proceed with installation only after unacceptable conditions have been remedied Consultant.

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### 3.2 MANUFACTURER'S INSTRUCTIONS

- .1 Compliance: comply with manufacturer's written data, including product technical bulletins, product catalogue installation instructions, product carton installation instructions, and data sheets.

### 3.3 PREPARATION

- .1 Surface preparation: Before installation, clean substrate to remove dirt, debris and loose particles. Perform additional preparation procedures as required by manufacturer's instructions.
- .2 Protection: Take all necessary steps to prevent damage to material during installation as required in manufacturer's installation instructions.
- .3 Minimum 48 hours before installation remove panels from packaging and allow them to acclimate to room temperature and humidity.
  - .1 Inspect panels for any defects immediately. Do not install panels of unacceptable quality.

### 3.4 INSTALLATION

- .1 Install on solid backing and erect with materials and components straight, tight and in alignment.
  - .1 Straight and level to variation plus or minus 3 mm over 3050 mm straight edge, non-cumulative.
- .2 Install in strict accordance with the manufacturer's recommendations, using only approved mounting hardware, and locating all components firmly into position, level and plumb.
  - .1 Field cutting of all wall systems should be accomplished using a circular saw with fine tooth carbide blade.
  - .2 Position panel so that the saw blade enters the finished HPL side first to avoid chipping or damage. Protect decorative laminate face of panel by covering work area, do not remove protective will until after installation.
  - .3 Follow adhesive manufacturer's recommendations for appropriate height of adhesive bead left by trowel and do not allow adhesive to skin over. When interior paneling is on an exterior wall or wet area, provide a barrier sheet and follow the adhesive manufacturer's installation recommendations for a secure bond.
- .4 Installation Using PVC Trims:
  - .1 Start in the corner. Mark plumb line 1223 mm from corner.
  - .2 Apply adhesive directly to entire back of composite wall panel using correct trowel with 100% adhesive coverage using crosshatch pattern. Apply adhesive to within 13 mm of all edges of panel.
  - .3 Slide panel into molding and withdraw 3 mm to provide appropriate gap. Align with plumb line.
  - .4 Begin in top corner nearest molding with laminate roller, rolling down and out toward the edge without molding.

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- .5 Continue rolling down and out working across panel away from previously installed panel or initial molding. Remove all trapped air.
  - .6 Install one-piece division bar and caps or next molding by sliding onto panel.
  - .7 Repeat process, working in one direction around room.
  - .8 Immediately remove all adhesive residue. To remove, clean with nonabrasive cotton cloth and warm water. If necessary, use a mild nonabrasive detergent. For cleanup with solvent based adhesives, use mineral spirits or acetone to remove residue.
- .3 Install wall protection systems top surface measured vertically above floor as indicated and in accordance with the reviewed shop drawings.
  - .4 Temperature at the time of installation must be between 18°-24°C and be maintained for a minimum of 48 hours after the installation.
  - .5 Horizontal joints in panelling are not permitted.
    - .1 Select sheet sizes accordingly to provide one continuous sheet from the floor to the ceiling.
  - .6 Complete installation to minimize the number of required vertical panel joints. No vertical joints on walls less than 1220 mm wide and multiple partial panel pieces are not permitted to be used in locations where one continuous piece could be used.

### **3.5 CLEANING**

- .1 Cleaning: clean in accordance with Section 01 74 11 - Cleaning.
  - .1 Leave Work area clean at end of each day.
  - .2 Immediately upon completion of installation, clean rails, and accessories in accordance with manufacturer's recommended cleaning method.
  - .3 Remove surplus materials, rubbish and debris resulting from installation as work progresses and upon completion of work.

### **3.6 PROTECTION**

- .1 Protect installed products and components to prevent damage during construction. Use materials that may be easily removed without leaving residue or permanent stains.
- .2 Repair damage to adjacent materials caused by wall protection systems installation.

**END OF SECTION**

**Part 1            General**

**1.1            RELATED REQUIREMENTS**

- .1      Section 06 10 53 - Miscellaneous - Rough Carpentry
- .2      Section 07 92 00 - Joint Sealants
- .3      Section 09 21 16 - Gypsum Board Assemblies

**1.2            REFERENCES**

- .1      ASTM International
  - .1      ASTM A167-99(2009), Standard Specification for Stainless and Heat-Resisting Chromium-Nickel Steel Plate, Sheet, and Strip.
  - .2      ASTM A653/A653M-15, Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.
  - .3      ASTM A924/A924M-14, Standard Specification for General Requirements for Steel Sheet, Metallic-Coated by the Hot-Dip Process.
  - .4      ASTM B456-11e1, Standard Specification for Electrodeposited Coatings of Copper Plus Nickel Plus Chromium and Nickel Plus Chromium.
- .2      Canadian General Standards Board (CGSB)
  - .1      CGSB 31-GP-107MA, Non-inhibited Phosphoric Acid Base Metal Conditioner and Rust Remover.
- .3      CSA International
  - .1      CAN/CSA-B651-12, Accessible Design for the Built Environment.
  - .2      CAN/CSA-G164-M92(R2003), Hot Dip Galvanizing of Irregularly Shaped Articles.

**1.3            ACTION AND INFORMATIONAL SUBMITTALS**

- .1      Provide submittals in accordance with Section 01 33 00 - Submittal Procedures.
- .2      Product Data:
  - .1      Provide manufacturer's printed product literature and data sheets and include product characteristics, performance criteria, physical size, finish and limitations.
- .3      Shop Drawings:
  - .1      Indicate size and description of components, base material, surface finish inside and out, hardware and locks, attachment devices, description of rough-in-frame, building-in details of anchors for grab bars.
  - .2      Indicate mounting heights for each accessory.
- .4      Samples:
  - .1      Upon request submit samples for each type of accessory.

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#### **1.4 CLOSEOUT SUBMITTALS**

- .1 Provide maintenance data for toilet and bath accessories for incorporation into manual specified in Section 01 78 00 - Closeout Submittals.

#### **1.5 MAINTENANCE MATERIAL SUBMITTALS**

- .1 Tools:
  - .1 Provide special tools required for assembly, disassembly or removal for toilet and bath accessories in accordance with requirements specified in Section 01 78 00 - Closeout Submittals.
  - .2 Deliver special tools to Owner.

#### **1.6 DELIVERY, STORAGE AND HANDLING**

- .1 Deliver, store and handle materials in accordance with Section 01 61 00 - Common Product Requirements.
- .2 Delivery and Acceptance Requirements: deliver materials to site in original factory packaging, labelled with manufacturer's name and address.
- .3 Storage and Handling Requirements:
  - .1 Store materials off ground, indoors, in dry location and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.
  - .2 Store and protect toilet and bathroom accessories from nicks, scratches, and blemishes.
  - .3 Replace defective or damaged materials with new.
- .4 Contractor: Responsible for picking up Owner supplied fixtures from Parks Canada's Banff operations compound and deliver to site.
  - .1 Contractor: Responsible for securing those items from damage, loss or theft once those items have left Parks Canada's operations compound.

### **Part 2 Products**

#### **2.1 MATERIALS**

- .1 Refer to 01 27 00 Measurement and Payment for items to be supplied by Parks Canada.
- .2 Sheet steel: to ASTM A653/A653M with ZF001 designation zinc coating.
- .3 Stainless steel sheet metal: to ASTM A167, Type 304, with No. 4 finish.
- .4 Stainless steel tubing: Type 304, commercial grade, seamless welded, minimum 1.2 mm wall thickness unless otherwise specified, with No. 4 finish.
- .5 Fasteners: concealed screws and bolts hot dip galvanized, exposed fasteners to match face of unit. Expansion shields fibre, lead or rubber as recommended by accessory manufacturer for component and its intended use.

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## 2.2 COMPONENTS

- .1 Provide and install toilet and bath accessories: sizes, types, finish, colours, and manufacturers as indicated in Washroom Accessories Schedule on Drawings.
  - .1 Stainless Steel Sheet Backsplash: mounted behind all hand-dryers and mop sink.
    - .1 Custom ordered to fit each specific area.
    - .2 Sizing per drawing A111.
    - .3 16-gauge minimum thickness.
  - .2 WA08: Surface mounted robe hook:
    - .1 Bobrick: B-6827.
    - .2 Other preapproved alternate.

## 2.3 FABRICATION

- .1 Weld and grind joints of fabricated components flush and smooth. Use mechanical fasteners only where approved.
- .2 Wherever possible form exposed surfaces from one sheet of stock, free of joints.
- .3 Brake form sheet metal work with 1.5 mm radius bends.
- .4 Form surfaces flat without distortion. Maintain flat surfaces without scratches or dents.
- .5 Back paint components where contact is made with building finishes to prevent electrolysis.
- .6 Hot dip galvanize concealed ferrous metal anchors and fastening devices to CAN/CSA-G164.
- .7 Shop assemble components and package complete with anchors and fittings.
- .8 Deliver inserts and rough-in frames to job site at appropriate time for building-in. Provide templates, details and instructions for building in anchors and inserts.
- .9 Provide steel anchor plates and components for installation on studding and building framing.

## 2.4 FINISHES

- .1 Exposed surfaces of accessories to be stainless steel, Type 304, with No. 4 finish unless noted otherwise.
- .2 Chrome and nickel plating: to ASTM B456, polished finish.
- .3 Manufacturer's or brand names on face of units not acceptable.

## Part 3 Execution

### 3.1 EXAMINATION

- .1 Verification of Conditions: verify that conditions of substrates and surfaces to receive toilet and bathroom accessories previously installed under other Sections or Contracts are acceptable for product installation in accordance with manufacturer's instructions before toilet and bathroom accessories installation.

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- .2 Inform Consultant of unacceptable conditions immediately upon discovery.
  - .3 Proceed with installation only after unacceptable conditions have been remedied.
  - .4 Contractor: Responsible for inspecting all Owner supplied materials for defects at the time of pick up and notify the Departmental Representative before moving the products from Parks Canada's operations compound. If no defects are identified, the Contractor is assumed to accept the products in new condition and will be responsible for any damage or issues with those products before the building being handed over to Parks Canada.

### **3.2 INSTALLATION**

- .1 Install all Parks Canada supplied materials in addition to all Contractor supplied items.
- .2 Install accessories in accordance with manufacturer's instructions, quantities and locations as indicated on Drawings.
- .3 Coordinate toilet and bath accessory locations to prevent interference with clearances required for accessibility, installation and securement within substrate, adjustment, operation, cleaning and servicing of accessories.
- .4 Install and secure accessories rigidly in place as follows:
  - .1 Stud walls: install blocking and 19 mm thick plywood back-plate to stud before gypsum board finish.
  - .2 Hollow masonry units, existing plaster or drywall: use toggle bolts drilled into cell or wall cavity.
  - .3 Toilet compartments: use male to female through bolts.
- .5 Install grab bars on built-in anchors provided by bar manufacturer.
- .6 Use tamper proof screws or bolts for fasteners.
- .7 Fill units with necessary supplies shortly before final acceptance of building.
- .8 Key lockable washroom accessories alike.

### **3.3 ADJUSTING**

- .1 Adjust toilet and bathroom accessories components and systems for correct function and operation in accordance with manufacturer's written instructions.
- .2 Lubricate moving parts to operate smoothly and fit accurately.

### **3.4 CLEANING**

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

### **3.5 PROTECTION**

- .1 Protect installed products and components from damage during construction.
- .2 Repair damage to adjacent materials caused by toilet and bathroom accessories installation.

**3.6 SCHEDULE**

- .1 Locate accessories where indicated.

**END OF SECTION**

**Part 1            General**

**1.1               RELATED REQUIREMENTS**

- .1       Section 07 42 46 - Fibre Reinforced Cementitious Wall Panels
- .2       Division 26

**1.2               REFERENCE STANDARDS**

- .1       Health Canada/Workplace Hazardous Materials Information System (WHMIS)
  - .1       Material Safety Data Sheets (SDS).

**1.3               ACTION AND INFORMATIONAL SUBMITTALS**

- .1       Submit in accordance with Section 01 33 00- Submittal Procedures.
- .2       Product Data:
  - .1       Submit manufacturer's instructions, printed product literature and data sheets for equipment and include product characteristics, performance criteria, physical size, finish and limitations.
  - .2       Submit electronic copies of WHMIS SDS.

**1.4               CLOSEOUT SUBMITTALS**

- .1       Submit in accordance with Section 01 78 00- Closeout Submittals.
- .2       Operation and Maintenance Data: submit operation and maintenance data for equipment for incorporation into manual.
- .3       Supply part numbers of equipment to allow for replacement of worn or damaged equipment parts.
- .4       Supply instructions detailing procedures for repairing or replacing worn equipment parts.

**1.5               DELIVERY, STORAGE AND HANDLING**

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

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**Part 2            Products**

**2.1            ANTENNA**

- .1    Heavy Duty Wide Band Directional Antenna: Wide band, high gain, professional grade log-periodic directional antenna, providing 9 dBi gain and operating effectively across the operating range of 810-2500 MHz with a VSWR of 1.5:1 or less, meeting the following:
  - .1    Operating Frequency (VSWR  $\leq$  1.5 MHz): 810-2500
  - .2    Nominal Gain (dBi): 9
  - .3    Horizontal Beamwidth (Deg-3dB): 72
  - .4    Vertical Beamwidth (Deg-3dB): 70
  - .5    Power Rating (W): 50
  - .6    Lateral Thrust at 100mph (lbs.): 5.5
  - .7    Rated Wind Velocity (mph): 125
  - .8    Rated Wind Velocity with 1/2" radical (mph): 120
  - .9    Acceptable product:
    - .1    Laird Connectivity LP800-2500-9-NF.
    - .2    Other preapproved alternate.

**2.2            ANTENNA MOUNTING BRACKET**

- .1    Heavy Duty Antenna Mount with extended mounting arm.
  - .1    Acceptable product:
    - 1.    Laird Technologies UM/L Universal Antenna Mounting System.
    - 2.    Other preapproved alternate.
  - .2    Supplied mounting pole to be replaced with 1200mm long stainless steel pipe if necessary to allow for antenna manufacturer recommended separation from roof.

**2.3            ANTENNA CABLE**

- .1    Provide 40 ft long N-male to N-male antenna cable.

**Part 3           Execution**

**3.1            EXAMINATION**

- .1    Verification of Conditions: verify conditions of substrates and surfaces to receive equipment previously installed under other Sections or Contracts including but not limited to installation tolerances, operational clearances, and other conditions impacting performance of the Work are acceptable for product installation in accordance with manufacturer's instructions before roller window shade installation.
  - .1    Visually inspect substrate.
  - .2    Inform Consultant of unacceptable conditions immediately upon discovery.
  - .3    Proceed with installation only after unacceptable conditions have been remedied.

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**3.2            INSTALLATION**

- .1        Install equipment according to manufacturer's written instructions in coordination with the Work of Division 26.
- .2        Equipment Locations: as indicated on Drawings.
- .3        Mounting bracket pole to be mounted vertically to maximize height of antenna on pole.
- .4        Contractor: Have telecommunication professional aim the directional antenna towards the nearest Bell or Telus cell phone tower to maximize signal strength.
- .5        Install antenna cable from directional antenna to the future PLC location within the mechanical room. Installation is to include all junction boxes, rigid conduit inside attic space to prevent potential for rodent damage to cable, and service loop on outside gable wall to prevent water infiltration into building.
  - .1        Departmental Representative will direct the Contractor on where to terminate the cable inside the mechanical room.

**3.3            CLEANING**

- .1        Clean equipment, after installation, according to manufacturer's written instructions.
- .2        Progress Cleaning: clean in accordance with Section 01 74 11 - Cleaning.
  - .1        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.

**3.4            PROTECTION**

- .1        Protect installed products and components from damage during construction.
- .2        Replace damaged equipment that cannot be repaired
- .3        Repair damage to adjacent materials caused by equipment installation.

**END OF SECTION**

## **1.0 GENERAL**

### **1.1 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 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 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 33 00 - 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 78 00 - 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, Departmental Representative before final inspection.
  - .2 Operation data to include:
    - .1 Control schematics for systems including environmental controls.
    - .2 Description of systems and their controls.

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- .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 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 as left after commissioning is complete.
  - .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 Building Mechanical Systems.
- .5 Approvals:
- .1 Submit two (2) copies of draft Operation and Maintenance Manual to Departmental Representative for approval. Submission of individual data will not be accepted unless directed by Departmental Representative.
  - .2 Make changes as required and re-submit as directed by Departmental 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 The Contractor will be required to provide one (1) set of reproducible mechanical drawings. Provide sets of white prints as required for each phase of work. Mark changes as work progresses and as changes occur.
  - .2 Transfer information 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 Departmental 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 78 00 - Closeout Submittals.
- .2 Furnish spare parts as follows:
  - .1 One (1) glass for each gauge glass.
  - .2 Two (2) set of filter media for each filter or filter bank in addition to final operating set.
- .3 Provide one (1) set of special tools required to service equipment as recommended by manufacturers.
- .4 Furnish one (1) 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 61 00 - Common Product Requirements with manufacturer's written instructions.
- .2 Delivery and Acceptance Requirements: deliver materials to site in original factory packaging, labelled with manufacturer's name and address.
- .3 Storage and Handling Requirements:
  - .1 Store materials off ground, 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.

## **2.0 EXECUTION**

## **2.1 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.

## **2.2 SYSTEM CLEANING**

- .1 Clean interior and exterior of all systems including strainers. Vacuum interior of ductwork and air handling units.

## **2.3 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 Departmental Representative will record these demonstrations on video tape for future reference.

## **2.4 CLEANING**

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

## **2.5 PROTECTION**

- .1 Protect equipment and systems openings from dirt, dust, and other foreign materials with materials appropriate to system.

**END OF SECTION**

## **1.0 GENERAL**

### **1.1 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 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 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 33 00 - 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 78 00 - 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, Departmental Representative before final inspection.
  - .2 Operation data to include:
    - .1 Control schematics for systems including environmental controls.
    - .2 Description of systems and their controls.

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- .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 as left after commissioning is complete.
  - .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 Building Mechanical Systems .
- .5 Approvals:
- .1 Submit two (2) copies of draft Operation and Maintenance Manual to Departmental Representative for approval. Submission of individual data will not be accepted unless directed by Departmental Representative.
  - .2 Make changes as required and re-submit as directed by Departmental 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 The Contractor is required to provide one (1) set of reproducible mechanical drawings. Provide sets of white prints as required for each phase of work. Mark changes as work progresses and as changes occur.
  - .2 Transfer information 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 Departmental 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 78 00 - Closeout Submittals.
- .2 Furnish spare parts as follows:
  - .1 One (1) glass for each gauge glass.
- .3 Provide one (1) set of special tools required to service equipment as recommended by manufacturers.
- .4 Furnish one (1) 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 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, 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.

### **2.0 PRODUCTS – NOT APPLICABLE**

### **3.0 EXECUTION**

### **3.1 PAINTING REPAIRS AND RESTORATION**

- .1 Do painting in accordance with Section 09 91 10 – Painting and Finishing
- .2 Prime and touch up marred finished paintwork to match original.
- .3 Restore to new condition, finishes which have been damaged.

### **3.2 SYSTEM CLEANING**

- .1 Prior to substantial completion, contract professional duct cleaning service to clean interior and exterior of all systems including strainers. Vacuum interior of ductwork and air handling units.

### **3.3 FIELD QUALITY CONTROL**

- .1 Site Tests: conduct following tests in accordance with Section 01 45 00 - Quality Control and submit report as described in PART 1 -ACTION AND INFORMATIONAL SUBMITTALS.
- .2 Manufacturer's Field Services:
  - .1 Obtain written report from manufacturer verifying compliance of Work, in handling, installing, applying, protecting and cleaning of product and submit Manufacturer's Field Reports as described in PART 1 - ACTION AND INFORMATIONAL SUBMITTALS.
  - .2 Provide manufacturer's field services consisting of product use recommendations and periodic site visits for inspection of product installation in accordance with manufacturer's instructions.

### **3.4 CLEANING**

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

### **3.5 PROTECTION**

- .1 Protect equipment and systems openings from dirt, dust, and other foreign materials with materials appropriate to system.

**END OF SECTION**

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## 1.0 GENERAL

### 1.1 REFERENCES

- .1 American National Standards Institute (ANSI)/American Society of Mechanical Engineers International (ASME)
  - .1 ASME B16.15-18, Cast Bronze Threaded Fittings, Classes 125 and 250.
  - .2 ANSI/ASME B16.18-18, Cast Copper Alloy Solder Joint Pressure Fittings.
  - .3 ANSI/ASME B16.22-18, Wrought Copper and Copper Alloy Solder Joint Pressure Fittings.
  - .4 ANSI/ASME B16.24-16, Cast Copper Alloy Pipe Flanges and Flanged Fittings, Class 150, 300, 400, 600, 900, 1500 and 2500.
- .2 ASTM International Inc.
  - .1 ASTM A 307-07b, Standard Specification for Carbon Steel Bolts and Studs, 60,000 PSI Tensile Strength.
  - .2 ASTM A 536-84(2004)e1, Standard Specification for Ductile Iron Castings.
  - .3 ASTM B 88M-05, Standard Specification for Seamless Copper Water Tube (Metric).
  - .4 ASTM F876-15, Standard Specification for Crosslinked Polyethylene (PEX) Tubing.
  - .5 ASTM F877-11, Standard Specification for Crosslinked Polyethylene (PEX) Hot and Cold Water Distribution System.
- .3 American National Standards Institute/American Water Works Association (ANSI)/(AWWA)
  - .1 AWWA C904-06, Crosslinked Polyethylene (PEX) Pressure Pipe, ½ In. (12 mm) through 3 In. (76mm), for Water Service.
- .4 CSA Group
  - .1 CSA B137.5-20, Crosslinked Polyethylene (PEX) Tubing Systems for Pressure Applications.
- .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-67-02a, Butterfly Valves.

- .2 MSS-SP-70-06, Gray Iron Gate Valves, Flanged and Threaded Ends.
- .3 MSS-SP-71-05, Gray Iron Swing Check Valves, Flanged and Threaded Ends.
- .4 MSS-SP-80-03, Bronze Gate, Globe, Angle and Check Valves.
- .8 National Research Council (NRC)/Institute for Research in Construction
  - .1 NRCC 38728, National Plumbing Code of Canada (NPC) - 2015.
- .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 33 00 - Submittal Procedures.
- .2 Product Data:
  - .1 Provide manufacturer's printed product literature and datasheets for insulation and adhesives, and include product characteristics, performance criteria, physical size, finish and limitations.

## **2.0 PRODUCTS**

### **2.1 PIPING**

- .1 Domestic hot, cold and recirculation systems, within building.
  - .1 Above ground:
    - .1 Type "K" hard drawn seamless copper to ASTM B88, complete with copper solder type fittings to ASME/ANSI B16.18 and soldered joints using The Canada Metal Co. Ltd. "SILVABRITE 100" or equal lead-free solder for cold water pipe, and 95% tin/ 5% Antimony or "SILVABRITE 100" solder for other services.
  - .2 Buried or embedded:
    - .1 HDPE.

### **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:

- .1 ANSI/ASME B16.18 or ANSI/ASME B16.22 roll grooved to CSA B242.
- .2 PEX fittings to CSA B137.5 and F1960.
- .6 NPS 1 1/2 and smaller: .
  - .1 Wrought copper to ANSI/ASME B16.22; with 301 stainless steel internal components and EPDM seals. Suitable for operating pressure to 1380 kPa.
  - .2 PEX fittings to CSA B137.5.

## **2.3 JOINTS**

- .1 NPS 1 ½ and smaller: PEX fittings to CSA B137.5.
- .2 NPS 2 and larger: PEX fittings to CSA B137.5 and ASTM F1960. Elbows, adapters, couplings, plugs, tees, multi-port tees and valves.

## **2.4 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.
- .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.

## **2.5 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.
- .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.

## **3.0 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 and local authority having jurisdiction.
- .2 Install pipe work in accordance with Section 23 05 05 - Installation of Pipework, supplemented as specified herein.
- .3 Assemble piping using fittings manufactured to ANSI standards.
- .4 Install 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 Piping beneath the washroom building floor slab shall be inside conduit with a diameter equal to two times the water pipe diameter.
  - .2 Lay conduit in well compacted washed sand in accordance with AWWA Class B bedding.
  - .3 Bend tubing without crimping or constriction. Minimize use of fittings.

### **3.3 VALVES**

- .1 Isolate equipment, fixtures and branches with 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 one (1) times maximum system operating pressure or 860 kPa.
- .3 Provide all temporary water service connections and water supply required to perform pressure testing on all newly installed water pipes.

### **3.5 FLUSHING AND CLEANING**

- .1 Flush entire system for eight (8) hours. Ensure outlets flushed for two (2) hours. Let stand for twenty-four (24) hours, then draw one (1) sample of longest run. Submit to testing laboratory to verify that system is clean to Federal potable water guidelines. Let system flush for additional two (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 approval of Departmental Representative.
- .2 Upon completion, provide laboratory test reports on water quality for Departmental 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 Building Mechanical Systems.
  - .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 (1) outlet for ten (10) seconds, then shut-off 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 CLEANING**

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

**END OF SECTION**

## **1.0 GENERAL**

### **1.1 REFERENCES**

- .1 ASTM International Inc.
  - .1 ASTM D 2235-16, Standard Specification for Solvent Cement for Acrylonitrile-Butadiene-Styrene (ABS) Plastic Pipe and Fittings.
  - .2 ASTM D 2564-18, Standard Specification for Solvent Cements for Poly(Vinyl-Chloride) (PVC) Plastic Piping Systems.
- .2 Canadian Standards Association (CSA International)
  - .1 CAN/CSA-Series B1800-18, Thermoplastic Non-Pressure 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-A2017, Adhesive and Sealant Applications.

### **1.2 ACTION AND INFORMATIONAL SUBMITTALS**

- .1 Provide submittals in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Product Data:
  - .1 Provide manufacturer's printed product literature and datasheets for piping and adhesives, and include product characteristics, performance criteria, physical size, finish and limitations.
  - .2 Provide two (2) copies WHMIS MSDS - Material Safety Data Sheets in accordance with Section 01 35 30.00 - Health and Safety Requirements.

### **1.3 DELIVERY, STORAGE AND HANDLING**

- .1 Deliver, store and handle in accordance with Section 01 61 00 - Common Product Requirements.
- .2 Deliver materials to site in original factory packaging, labelled with manufacturer's name, address.
- .3 Store at temperatures and conditions recommended by manufacturer.

## **2.0 PRODUCTS**

### **2.1 MATERIAL**

- .1 Sustainable Requirements: materials and products in accordance with Section 01 47 15 - Sustainable Requirements: Construction.
- .2 Adhesives and Sealants:
  - .1 Maximum VOC limit to SCAQMD Rule 1168 and GSES GS-36.

### **2.2 PIPING AND FITTINGS**

- .1 For buried and above ground DWV piping to:
  - .1 CAN/CSA B1800.

### **2.3 JOINTS**

- .1 Solvent weld for PVC: to ASTM D 2564.
- .2 Solvent weld for ABS: to ASTM D 2235.

## **3.0 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 & 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 Ensure all cleanouts within public areas of the building are concealed behind cleanout doors or underneath countertops.

- .3 Open, cover with linseed oil and re-seal.
- .4 Verify cleanout rods can probe as far as the next cleanout, at least.
- .2 Test to ensure traps are fully and permanently primed.
- .3 Ensure fixtures are properly anchored, connected to system and effectively vented.
- .4 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 74 11 - Cleaning.
  - .1 Remove surplus materials, excess materials, rubbish, tools and equipment.

**END OF SECTION**

## **1.0 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(R2014), Construction and Test of Electric Storage Tank Water Heaters.
  - .3 CAN/CSA-C191-13(R2018), Performance of Electric Storage Tank Water Heaters for Household Service.
  - .4 CAN/CSA-C309-M90(R2014), 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 33 00 - 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 Province of 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 78 00 - Closeout Submittals.

### **1.4 DELIVERY, STORAGE AND HANDLING**

- .1 Deliver, store and handle in accordance with Section 01 61 00 - Common Product Requirements.
- .2 Deliver materials to site in original factory packaging, labelled with manufacturer's name, address.

### **1.5 WARRANTY**

- .1 For the Work of this Section 22 30 05 - Domestic Water Heaters, twelve (12) months warranty period prescribed in subsection GC 32.1 of General Conditions "C" is extended to number of years specified for each product.

## **2.0 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, with immersion type elements, and surface mounted or immersion type adjustable thermostats.

### **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 twenty (20) years of operation and located for easy replacement.

### **2.3 ANCHOR BOLTS AND TEMPLATES**

- .1 Supply anchor bolts and templates for installation in structural steel support in accordance with Section 05 50 00 - Metal fabrications.

### **2.4 DRAIN PAN**

- .1 Hot water heater to be set within a stainless steel drain pan. Drain pan to have drain pipe connection on the lowest point of the bottom face of the pan to allow the pan to be completely drained by gravity.

## **3.0 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 structural steel for horizontal mounted tanks.
- .3 Provide insulation between tank and supports.

### **3.3 FIELD QUALITY CONTROL**

- .1 Manufacturer's factory trained, certified Engineer to start-up DHW heaters.

### **3.4 CLEANING**

- .1 Clean in accordance with Section 01 74 11 - Cleaning.
- .2 Remove surplus materials, excess materials, rubbish, tools and equipment.

**END OF SECTION**

## **1.0 GENERAL**

### **1.1 REFERENCES**

- .1 ASTM International
  - .1 ASTM A 126-04(2019), Standard Specification for Gray Iron Castings for Valves, Flanges and Pipe Fittings.
  - .2 ASTM B 62-17, Standard Specification for Composition Bronze or Ounce Metal Castings.
- .2 American Water Works Association (AWWA)
  - .1 ANSI/AWWA C700-15, Standard for Cold Water Meters-Displacement Type, Bronze Main Case.
  - .2 ANSI/AWWA C701-15, Standard for Cold Water Meters-Turbine Type for Customer Service.
  - .3 ANSI/AWWA C702-15, Standard for Cold Water Meters-Compound Type.
- .3 CSA International
  - .1 CSA-B64 Series-11(R2016), Backflow Preventers and Vacuum Breakers.
  - .2 CSA B79-08(R2018), Commercial and Residential Drains and Cleanouts.
  - .3 CAN/CSA-B356-10, Water Pressure Reducing Valves for Domestic Water Supply Systems.
- .4 Efficiency Valuation Organization (EVO)
  - .1 International Performance Measurement and Verification Protocol (IPMVP).
    - .1 IPMVP 2007 Version.
- .5 Plumbing and Drainage Institute (PDI)
  - .1 PDI-G101-R2017, Testing and Rating Procedure for Grease Interceptors with Appendix of Installation and Maintenance.
  - .2 PDI-WH201-R2010, Water Hammer Arresters Standard.

### **1.2 ADMINISTRATIVE REQUIREMENTS**

- .1 Pre-installation Meetings:
  - .1 Convene pre-installation meeting one (1) week prior to beginning work of this Section and on-site installation, with Contractor's representative and Departmental Representative in accordance with Section 01 31 19 - Project Meetings to:
    - .1 Verify project requirements.

- .2 Review installation and substrate conditions.
- .3 Coordination 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 33 00 - 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 two (2) copies of WHMIS MSDS in accordance with Section 01 35 30.00 - Health and Safety Requirements. Indicate VOC's:
- .3 Shop Drawings:
  - .1 Submit drawings stamped and signed by professional engineer registered or licensed in Province of Alberta], Canada.
  - .2 Indicate on drawings to indicate materials, finishes, method of anchorage, dimensions construction and assembly details and accessories.
- .4 Certificates: submit certificates signed by manufacturer certifying that materials comply with specified performance characteristics and physical properties.
- .5 Instructions: submit manufacturer's installation instructions.
- .6 Manufacturers' Field Reports: manufacturers' field reports specified.

### **1.4 CLOSEOUT SUBMITTALS**

- .1 Submit in accordance with Section 01 78 00 - Closeout Submittals.
- .2 Operation and Maintenance Data: submit operation and maintenance data for plumbing specialties and accessories for incorporation into manual.
  - .1 Description of plumbing specialties and accessories, giving manufacturer's 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 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, indoors, 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.

## **2.0 PRODUCTS**

### **2.1 FLOOR DRAINS**

- .1 Floor Drains and Trench Drains: to CSA B79.

### **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 or stainless steel rectangular or round cover with flush head securing screws, bevelled edge frame complete with anchoring lugs.
  - .2 Floor Access: rectangular or round cast iron body and frame with adjustable secured nickel bronze top and:
    - .1 Plugs: bolted bronze with neoprene gasket.
    - .2 Cover for Unfinished Concrete Floors: nickel bronze round or square, gasket, vandal-proof screws.
    - .3 Cover for Tile and Linoleum Floors: polished nickel bronze with recessed cover for linoleum or tile infill, complete with vandal-proof locking screws.

### **2.3 WATER HAMMER ARRESTORS**

- .1 Stainless steel construction, bellows type: to PDI-WH201.

### **2.4 VACUUM BREAKERS**

- .1 Breakers: to CSA-B64 Series, vacuum breaker atmospheric.

### **2.5 HOSE BIBBS AND SEDIMENT FAUCETS**

- .1 Bronze construction complete with integral backflow preventer, hose thread spout, replaceable composition disc, and chrome plated in finished areas.

### **3.0 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 Departmental Representative.
  - .2 Inform Departmental Representative of unacceptable conditions immediately upon discovery.
  - .3 Proceed with installation only after unacceptable conditions have been remedied.

#### **3.2 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, and 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 WATER HAMMER ARRESTORS**

- .1 Install on branch supplies to fixtures or group of fixtures.

#### **3.6 START-UP**

- .1 General:
  - .1 In accordance with Section 01 91 13 - General Commissioning (Cx) Requirements: 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.

### **3.7 TESTING AND ADJUSTING**

- .1 General:
  - .1 Test and adjust plumbing specialties and accessories in accordance with Section 01 91 13 - General Commissioning (Cx) Requirements: 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 Check security, accessibility, removability of strainer.
  - .2 Clean out baskets.
- .6 Cleanouts:
  - .1 Verify covers are gas-tight, secure, yet readily removable.
- .7 Water hammer arrestors:
  - .1 Verify proper installation of correct type of water hammer arrester.

### **3.8 CLOSEOUT ACTIVITIES**

- .1 Commissioning Reports: in accordance with Section 01 91 13 - General Commissioning (Cx) Requirements: reports, supplemented as specified.
- .2 Training: provide training in accordance with Section 01 91 13 - General Commissioning (Cx) Requirements: Training of O&M Personnel, supplemented as specified.

### **3.9 CLEANING**

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

### **3.10 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**

## **1.0 GENERAL**

### **1.1 REFERENCES**

- .1 Canadian Standards Association (CSA International)
  - .1 CAN/CSA-B45 Series-02R2013, Plumbing Fixtures.
  - .2 CAN/CSA-B125.3-18, Plumbing Fittings.
  - .3 CAN/CSA-B651-18, Accessible Design for the Built Environment.
- .2 Green Seal Environmental Standards (GSES)
  - .1 Standard GS-36, Commercial Adhesives.
- .3 South Coast Air Quality Management District (SCAQMD), California State
  - .1 SCAQMD Rule 1168-A2017, Adhesive and Sealant Applications.

### **1.2 ACTION AND INFORMATIONAL SUBMITTALS**

- .1 Provide submittals in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Product Data:
  - .1 Provide manufacturer's printed product literature and datasheets for washroom fixtures, and include product characteristics, performance criteria, physical size, finish and limitations.
- .3 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, urinals): minimum pressure required for flushing.
- .4 Shop Drawings:
  - .1 Provide drawings stamped and signed by professional engineer registered or licensed in the Province of Alberta, Canada.

### **1.3 CLOSEOUT SUBMITTALS**

- .1 Provide operation and maintenance data for washroom fixtures, for incorporation into manual specified in Section 01 78 00 - Closeout Submittals.
- .2 Include:
  - .1 Product data forms for all items supplied by the Owner.

- .2 Description of fixtures and trim, giving manufacturer's name, type, model, year, capacity.
- .3 Details of operation, servicing, maintenance.
- .4 List of recommended spare parts.

#### **1.4 DELIVERY, STORAGE AND HANDLING**

- .1 Pickup all Owner supplied washroom fixtures and deliver to site. Inspect all items prior to removing from Parks Canada's storage facility and immediately notify the Departmental Representative of any defects, missing materials or damaged goods.
- .2 Deliver, store and handle in accordance with Section 01 61 00 - Common Product Requirements.
- .3 Deliver materials to site in original factory packaging, labelled with manufacturer's name, address.
- .4 Store all items, including owner supplied fixtures in a manner which prevents damage, loss or theft. The Contractor is responsible for replacing any damaged, lost or stolen items once they leave Parks Canada's operations compound.

### **2.0 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.
- .3 Exposed plumbing brass to be chrome plated.
- .4 Number, locations: as indicated.
- .5 Fixtures in any one (1) location to be product of one (1) manufacturer and of same type.
- .6 Trim in any one (1) location to be product of one (1) manufacturer and of same type.
- .7 Fixture piping:
  - .1 Hot and cold water supplies to fixtures:
    - .1 Chrome plated rigid supply pipes with screwdriver stop, reducers, escutcheon.
  - .2 Waste:
    - .1 Brass P-trap with clean out on fixtures not having integral trap.
    - .2 Chrome plated in exposed places.

.8 Chair carriers:

.1 Factory manufactured floor-mounted carrier systems for wall-mounted fixtures.

### **3.0 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 Barrier free: to most stringent CAN/CSA B651.

.2 Install all owner supplied washroom fixtures as per manufacturer instructions.

#### **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 Clean in accordance with Section 01 74 11 - Cleaning.

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

**END OF SECTION**

## **1.0 GENERAL**

### **1.1 RELATED REQUIREMENTS**

### **1.2 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 Heating coils and compartments;
    - .3 Fans, fan blades and fan housing;
    - .4 Filter housing and frames;
    - .5 Diffusers, registers and terminal units;
    - .6 Dampers and controls;
- .2 Reference Standards:
  - .1 National Air Duct Cleaners Association (NADCA)
    - .1 ACR Standard, 2013 edition: Assessment, Cleaning and Restoration of HVAC Systems.
  - .2 North American Insulation Manufacturers Association (NAIMA)
    - .1 NAIMA 2016, Cleaning Fibrous Glass Insulated Duct Systems - Recommended Practices.

### **1.3 ADMINISTRATIVE REQUIREMENTS**

- .1 Site Evaluation: conduct site visit two (2) weeks before start of work to establish specific coordinated video survey and cleaning plan to establish specific coordinated 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.
- .2 Project Coordination: assign Project Coordinator to oversee air duct cleaning processes.
  - .1 Provide Departmental Representative with contact information of Project Coordinator including: name, telephone number, cell phone number.

- .3 Damaged or broken equipment and components found during initial testing and inspection will be repaired or replaced by Departmental Representative.

#### **1.4 ACTION AND INFORMATIONAL SUBMITTALS**

- .1 Provide submittals in accordance with Section 01 33 00 - 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 (2) copies of WHMIS MSDS in accordance with Section 01 35 29.06 - Health and Safety Requirements for antimicrobial agents or coatings.
- .4 Submit verification of delivery of hazardous or toxic waste materials to contaminated waste facility, as described in PART 3 - CLEANING - Waste Management.

#### **1.5 CLOSEOUT SUBMITTALS**

- .1 Provide submittals in accordance with Section 01 78 00 - Closeout Submittals.
- .2 Post Cleaning Inspection Report: submit four (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 sketches 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 two (2) copies of video survey USB Drive 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 on video using text or voice over.

## **1.6 EXTRA MATERIALS**

- .1 Extra Stock Materials:
  - .1 Supply four (4) extra filters for each HVAC System cleaned.
  - .2 Ensure filters are correct match, size, type and configuration of existing HVAC Systems.

## **1.7 QUALITY ASSURANCE**

- .1 Contractor: verification of membership in NADCA verification of five (5) years minimum experience in work similar to or exceeding work of this Section.
- .2 Project Coordinator: Air System Cleaning Specialist (ASCS) certified by NADCA on full time basis verification of five (5) years minimum experience.

## **2.0 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 three (3) screws per side minimum.

### **2.2 SYSTEM FILTERS**

- .1 Supply and install new filters for each HVAC System cleaned.

### **2.3 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.

### **3.0 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 Fire alarm devices;
  - .5 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 instructed by Departmental Representative to facilitate system inspection and cleaning.
  - .1 Install access doors and panels for inspection and cleaning of equipment as follows:
    - .1 Heating coils;
    - .2 Fan units;
    - .3 Filters;
    - .4 Dampers;
    - .5 Sensors;
- .5 Installation of Access Doors in Ductwork: install access doors in ductwork where instructed by Departmental Representative 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.

### **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 Departmental Representative.
    - .1 Do not proceed further with inspection operations until written approval from Departmental 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 four (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 zone which has already been cleaned.

- .1 Isolate zone of duct 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 Clean equipment, components and other features in isolated zone before moving to next zone of HVAC air duct system.
- .5 Clean diffusers, registers, louvers, and other terminal units.

### **3.5 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 Identify on HVAC system record drawings access points used for inspection and cleaning.
  - .2 Re-collect and analyze particulates collected at same locations where original samples were collected before cleaning.
  - .3 Reset components including dampers and sensors, which have been disturbed during cleaning operations.

### **3.6 SYSTEM START-UP**

- .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.

### **3.7 CLEANING**

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

**END OF SECTION**

## **1.0 GENERAL**

### **1.1 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 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 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 33 00 - 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 78 00 - 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, Departmental 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 as left after commissioning is complete.
  - .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 Building Mechanical Systems.
- .5 Approvals:
  - .1 Submit two (2) copies of draft Operation and Maintenance Manual to Departmental Representative for approval. Submission of individual data will not be accepted unless directed by Departmental Representative.
  - .2 Make changes as required and re-submit as directed by Departmental 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 The Contractor is required to provide one (1) set of reproducible mechanical drawings. Provide sets of white prints as required for each phase of work. Mark changes as work progresses and as changes occur. Include changes to existing mechanical systems, control systems and low voltage control wiring.
- .2 Use different colour waterproof ink for each service.
- .3 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 Departmental 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 78 00 - Closeout Submittals.
- .2 Furnish spare parts as follows:
  - .1 One (1) filter cartridge or set of filter media for each filter or filter bank in addition to final operating set.
- .3 Provide one (1) set of special tools required to service equipment as recommended by manufacturers.
- .4 Furnish one (1) 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 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 indoors in dry location and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.
  - .2 Replace defective or damaged materials with new.

#### **2.0 EXECUTION**

##### **2.1 EXAMINATION**

- .1 Verification of Conditions: verify that conditions of substrate previously installed under other Sections or Contracts are acceptable for PTAC Units 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.

##### **2.2 PAINTING REPAIRS AND RESTORATION**

- .1 Do painting in accordance with Section 09 90 00 - Painting.
- .2 Prime and touch up marred finished paintwork to match original.
- .3 Restore to new condition, finishes which have been damaged.

##### **2.3 SYSTEM CLEANING**

- .1 Clean interior and exterior of all systems including strainers. Vacuum interior of ductwork and air handling units.

## **2.4 FIELD QUALITY CONTROL**

- .1 Site Tests: conduct following tests in accordance with Section 01 45 00 - Quality Control and submit report as described in PART 1 - ACTION AND INFORMATIONAL SUBMITTALS.
  - .1 PTAC Units.

## **2.5 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 Departmental Representative will record these demonstrations on video tape for future reference.

## **2.6 CLEANING**

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

## **2.7 PROTECTION**

- .1 Protect equipment and systems openings from dirt, dust, and other foreign materials with materials appropriate to system.

**END OF SECTION**

## **1.0 GENERAL**

### **1.1 SUMMARY**

.1 Section Includes:

.1 Use of mechanical systems during construction.

### **1.2 1.02 USE OF SYSTEMS**

.1 Use of new heating or ventilating systems for supplying temporary heat or ventilation is not permitted.

.2 Filters specified in this Section are over and above those specified in other Sections of this project.

.3 Exhaust systems are not included in approvals for temporary heating ventilation.

### **2.0 PRODUCTS – NOT APPLICABLE**

### **3.0 EXECUTION – NOT APPLICABLE**

**END OF SECTION**

## **1.0 GENERAL**

### **1.1 REFERENCES**

- .1 Canadian General Standards Board (CGSB)
  - .1 CAN/CGSB-1.181-99, Ready-Mixed Organic Zinc-Rich Coating.
- .2 Canadian Standards Association (CSA International)
  - .1 CSA B139-19, Installation Code for Oil Burning Equipment.
- .3 Green Seal Environmental Standards (GSES)
  - .1 Standard GS-11-2008, 2<sup>nd</sup> Edition, Environmental Standard for Paints and Coatings.
- .4 National Fire Code of Canada (NFCC 2015)

### **1.2 ACTION AND INFORMATIONAL SUBMITTALS**

- .1 Provide submittals in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Product Data:
  - .1 Provide manufacturer's printed product literature, specifications and 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 61 00 - Common Product Requirements and 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.

## **2.0 PRODUCTS**

### **2.1 MATERIAL**

- .1 Paint: zinc-rich to CAN/CGSB-1.181.
  - .1 Primers, Paints, 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 - Sealants.
- .1 Sealants: maximum VOC limit to SCAQMD Rule 1168.
- .3 Sealants: maximum VOC limit to SCAQMD Rule 1168.
- .4 Adhesives: maximum VOC limit to SCAQMD Rule 1168.
- .5 Fire Stopping: in accordance with Section 07 84 00 - Fire Stopping and Smoke Seals.

### **3.0 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.
- .2 Provide space for disassembly, removal of equipment and components as recommended by manufacturer 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 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 Screwed fittings jointed with Teflon tape.
- .2 Protect openings against entry of foreign material.
- .3 Install to isolate equipment and allow removal without interrupting operation of other equipment or systems.
- .4 Assemble piping using fittings manufactured to ANSI standards.
- .5 Saddle type branch fittings may be used on mains if branch line is no larger than half size of main.
  - .1 Hole saw (or drill) and ream main to maintain full inside diameter of branch line prior to welding saddle.
- .6 Install exposed piping, equipment, rectangular cleanouts and similar items parallel or perpendicular to building lines.
- .7 Install concealed pipework to minimize furring space, maximize headroom, conserve space.
- .8 Slope piping, except where indicated, in direction of flow for positive drainage and venting.
- .9 Install, except where indicated, to permit separate thermal insulation of each pipe.
- .10 Group piping wherever possible.

- .11 Maintain minimum 25mm separation between parallel domestic hot and cold waterlines.
- .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.
  - .7 Install butterfly valves between weld neck flanges to ensure full compression of liner.
- .16 All pipework (sanitary drains, air vents, and domestic waterlines) shall be concealed inside public areas unless otherwise noted on the drawings or as directed in writing by the Departmental Representative.

### **3.8 SLEEVES**

- .1 General: install where pipes pass through masonry, concrete structures, fire rated assemblies, or will exist beneath interior concrete slabs, and as indicated.
- .2 Material: schedule 40 PVC pipe.
- .3 Construction: use annular fins continuously welded at mid-point at foundation walls and where sleeves extend above finished floors.
- .4 Sizes: Greater of:
  - .1 6 mm minimum clearance between sleeve and uninsulated pipe or between sleeve and insulation, or
  - .2 Two times the size of the interior pipe.
- .5 Installation:
  - .1 Concrete, masonry walls, concrete floors on grade: terminate flush with finished surface.
  - .2 Other floors: terminate 25 mm above finished floor.
  - .3 Before installation, paint exposed exterior surfaces with heavy application of zinc-rich paint to CAN/CGSB-1.181.

.6 Sealing:

- .1 Foundation walls and below grade floors: fire retardant, waterproof non-hardening mastic.
- .2 Elsewhere:
  - .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 and Smoke Seals.
- .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 Before start-up, clean interior of piping systems in accordance with requirements of Section 01 74 11 - Cleaning supplemented as specified in relevant mechanical sections.
- .2 Preparatory to acceptance, clean and refurbish equipment and leave in operating condition, including replacement of filters in piping systems.
- .3 After flushing all waterlines, disassemble all interior plumbing fixtures and remove all construction debris from plumbing fixture controls to allow normal unimpeded fixture operation.

### **3.12 PRESSURE TESTING OF EQUIPMENT AND PIPEWORK**

- .1 Advise Departmental Representative forty-eight (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 four (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 Departmental Representative.
- .6 Pay costs for repairs or replacement, retesting, and making good. Departmental Representative to determine whether repair or replacement is appropriate.
- .7 Insulate or conceal work only after approval and certification of tests by Departmental Representative.

### **3.13 CLEANING**

- .1 Clean in accordance with Section 01 74 11 - Cleaning.
  - .1 Remove surplus materials, excess materials, rubbish, tools and equipment.

**END OF SECTION**

## **1.0 GENERAL**

### **1.1 REFERENCES**

- .1 American National Standards Institute (ANSI)/American Society of Mechanical Engineers (ASME)
  - .1 ANSI/ASME B1.20.1-1983(R2006), Pipe Threads, General Purpose (Inch).
  - .2 ANSI/ASME B16.18-2001, Cast Copper Alloy Solder Joint Pressure Fittings.
- .2 ASTM International
  - .1 ASTM A 276-08, Standard Specification for Stainless Steel Bars and Shapes.
  - .2 ASTM B 62-02, Standard Specification for Composition Bronze or Ounce Metal Castings.
  - .3 ASTM B 283-08a, Standard Specification for Copper and Copper Alloy Die Forgings (Hot-Pressed).
  - .4 ASTM B 505/B 505M-08a, Standard Specification for Copper-Base Alloy Continuous Castings.
- .3 Manufacturers Standardization Society of the Valve and Fittings Industry, Inc. (MSS)
  - .1 MSS-SP-25-1998, Standard Marking System for Valves, Fittings, Flanges and Unions.
  - .2 MSS-SP-80-2008, Bronze Gate Globe, Angle and Check Valves.
  - .3 MSS-SP-110-1996, Ball Valves, Threaded, Socket-Welding, Solder Joint, Grooved and Flared Ends.

### **1.2 ACTION AND INFORMATIONAL SUBMITTALS**

- .1 Provide submittals in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Product Data:
  - .1 Provide manufacturer's printed product literature and data sheets for equipment and systems 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 Shop Drawings:
  - .1 Submit drawings stamped and signed by professional engineer registered or licensed in the Province of Canada.
  - .2 Submit data for valves specified in this Section.

### **1.3 CLOSEOUT SUBMITTALS**

- .1 Provide maintenance data for incorporation into manual specified in Section 01 78 00 - Closeout Submittals.

### **1.4 MAINTENANCE MATERIAL SUBMITTALS**

- .1 Extra Materials/Spare Parts:
  - .1 Furnish following spare parts:
    - .1 Valve seats: one (1) for every [ten (10)] valves each size, minimum one (1).
    - .2 Discs: one (1) for every ten (10) valves, each size, minimum one (1).
    - .3 Valve handles: two (2) of each size.
    - .4 Gaskets for flanges: one (1) for every ten (10) flanged joints.
  - .2 Tools:
    - .1 Furnish special tools for maintenance of systems and equipment.

### **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:
  - .1 Deliver materials to site in original factory packaging, labelled with manufacturer's name, address.

## **2.0 PRODUCTS**

### **2.1 MATERIALS**

- .1 Valves:
  - .1 Except for specialty valves, to be single manufacturer.
  - .2 Products to have CRN registration numbers.
- .2 End Connections:
  - .1 Connection into adjacent piping/tubing:
    - .1 Steel pipe systems: screwed ends to ANSI/ASME B1.20.1.
    - .2 Copper tube systems: solder ends to ANSI/ASME B16.18.
- .3 Gate Valves:

- .1 Requirements common to gate valves, unless specified otherwise:
  - .1 Standard specification: MSS SP-80.
  - .2 Bonnet: union with hexagonal shoulders.
  - .3 Connections: screwed with hexagonal shoulders.
  - .4 Inspection and pressure testing: to MSS SP-80. Tests to be hydrostatic.
  - .5 Packing: non-asbestos.
  - .6 Handwheel: non-ferrous.
  - .7 Handwheel Nut: bronze to ASTM B 62.
- .2 NPS 2 and under, non-rising stem, solid wedge disc, Class 125
  - .1 Body: with long disc guides, screwed bonnet with stem retaining nut.
  - .2 Operator: handwheel.
- .3 NPS 2 and under, non-rising stem, solid wedge disc, Class 150:
  - .1 Body: with long disc guides, screwed bonnet with stem retaining nut.
  - .2 Operator: handwheel.
- .4 NPS 2 and under, rising stem, split wedge disc, Class 125:
  - .1 Body: with long disc guides, screwed bonnet.
  - .2 Disc: split wedge, bronze to ASTM B 283, loosely secured to stem.
  - .3 Operator: handwheel.
- .5 NPS 2 and under, rising stem, solid wedge disc, Class 125:
  - .1 Body: with long disc guides, screwed bonnet.
  - .2 Operator: handwheel.
- .6 NPS 2 and under, rising stem, solid wedge disc, Class 150:
  - .1 Body: with long disc guides, screwed bonnet.
  - .2 Operator: handwheel.
- .4 Globe Valves:
  - .1 Requirements common to globe valves, unless specified otherwise:
    - .1 Standard specification: MSS SP-80.
    - .2 Bonnet: union with hexagonal shoulders.
    - .3 Connections: screwed with hexagonal shoulders.
    - .4 Pressure testing: to MSS SP-80. Tests to be hydrostatic.

- 
- .5 Stuffing box: threaded to bonnet with gland follower, packing nut, high grade non-asbestos packing.
    - .6 Handwheel: non-ferrous.
    - .7 Handwheel Nut: bronze to ASTM B 62.
  - .2 NPS 2 and under, composition disc, Class 125:
    - .1 Body and bonnet: screwed bonnet.
    - .2 Disc and seat: renewable rotating PTFE disc composition to suit service conditions] regrindable bronze seat, loosely secured to bronze stem to ASTM B 505.
    - .3 Operator: handwheel.
  - .3 NPS 2 and under, composition disc, Class 150:
    - .1 Body and bonnet: union bonnet.
    - .2 Disc and seat: renewable rotating PTFE disc in easily removable disc holder, regrindable bronze seat, loosely secured to bronze stem to ASTM B 505.
    - .3 Operator: handwheel.
  - .4 NPS 2 and under, plug disc, Class 150, screwed ends:
    - .1 Body and bonnet: union bonnet.
    - .2 Disc and seat ring: tapered plug type with disc stem ring of AISI S420 stainless steel to ASTM A 276, loosely secured to stem.
    - .3 Operator: handwheel.
  - .5 Angle valve, NPS 2 and under, composition disc, Class 150:
    - .1 Body and bonnet: union bonnet.
    - .2 Disc and seat: renewable rotating PTFE disc in slip-on easily removable disc holder having integral guides, regrindable bronze seat, loosely secured to stem.
    - .3 Operator: handwheel.
  - .5 Ball Valves:
    - .1 NPS 2 and under:
      - .1 Body and cap: cast high tensile bronze to ASTM B 62.
      - .2 Pressure rating: Class125.
      - .3 Connections: solder ends to ANSI.
      - .4 Stem: tamperproof ball drive.

- .5 Stem packing nut: external to body.
  - .6 Ball and seat: replaceable stainless steel solid ball and Teflon seats.
  - .7 Stem seal: TFE with external packing nut.
  - .8 Operator: removable lever handle.
- .6 Butterfly Valves:
- .1 NPS 2 1/2 through NPS 6, 2068 kPa with grooved ends.
    - .1 Body: cast bronze, with copper-tube dimensioned grooved ends.
    - .2 Disc: elastomer coated ductile iron with integrally cast stem.
    - .3 Operator: lever.

### **3.0 EXECUTION**

#### **3.1 INSTALLATION**

- .1 Install rising stem valves in upright position with stem above horizontal.
- .2 Remove internal parts before soldering.
- .3 Install valves with unions at each piece of equipment arranged to allow servicing, maintenance, and equipment removal.

#### **3.2 CLEANING**

- .1 Clean in accordance with Section 01 74 11 - Cleaning.
  - .1 Remove surplus materials, excess materials, rubbish, tools and equipment.

**END OF SECTION**

## **1.0 GENERAL**

### **1.1 REFERENCES**

- .1 American Society of Mechanical Engineers (ASME)
  - .1 ASME B31.1-18, Power Piping.
- .2 ASTM International
  - .1 ASTM A 125-1996(2018), Standard Specification for Steel Springs, Helical, Heat-Treated.
  - .2 ASTM A 307-14e1, Standard Specification for Carbon Steel Bolts and Studs, 60,000 PSI Tensile Strength.
  - .3 ASTM A 563-15, Standard Specification for Carbon and Alloy Steel Nuts.
- .3 Factory Mutual (FM).
- .4 Manufacturer's Standardization Society of the Valves and Fittings Industry (MSS)
  - .1 MSS SP 58-2018, Pipe Hangers and Supports - Materials, Design and Manufacture.
  - .2 MSS SP 69-2003, Pipe Hangers and Supports - Selection and Application.
  - .3 MSS SP 89-2003, Pipe Hangers and Supports - Fabrication and Installation Practices.
- .5 Underwriter's Laboratories of Canada (ULC).

### **1.2 ACTION AND INFORMATIONAL SUBMITTALS**

- .1 Provide submittals in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Product Data:
  - .1 Provide manufacturer's printed product literature and data sheets for hangers and supports 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 the Province of Alberta, Canada.
  - .2 Submit shop drawings for:
    - .1 Bases, hangers and supports.
    - .2 Connections to equipment and structure.
    - .3 Structural assemblies.

.4 Certificates:

- .1 Submit certificates signed by manufacturer certifying that materials comply with specified performance characteristics and physical properties.

.5 Manufacturers' Instructions:

- .1 Provide manufacturer's installation instructions.
  - .1 Departmental Representative will make available one (1) copy of systems supplier's installation instructions.

### **1.3 CLOSEOUT SUBMITTALS**

- .1 Provide maintenance data for incorporation into manual specified in Section 01 78 00 - Closeout Submittals.

### **1.4 DELIVERY, STORAGE AND HANDLING**

- .1 Deliver, store and handle materials in accordance with Section 01 61 00 - Common Product Requirements and with manufacturer's written instructions.
- .2 Delivery and Acceptance Requirements:
  - .1 Deliver materials to site in original factory packaging, labelled with manufacturer's name, address.

## **2.0 PRODUCTS**

### **2.1 SYSTEM DESCRIPTION**

- .1 Design Requirements:
  - .1 construct pipe hanger and support to manufacturer's recommendations utilizing manufacturer's regular production components, parts and assemblies.
  - .2 Base maximum load ratings on allowable stresses prescribed by ASME B31.1 or MSS SP 58.
  - .3 Ensure that supports, guides, anchors do not transmit excessive quantities of heat to building structure.
  - .4 Design hangers and supports to support systems under conditions of operation, allow free expansion and contraction, prevent excessive stresses from being introduced into pipework or connected equipment.
  - .5 Provide for vertical adjustments after erection and during commissioning. Amount of adjustment in accordance with MSS SP 58.

## 2.2 GENERAL

- .1 Fabricate hangers, supports and sway braces in accordance with MSS SP 58. ANSI B31.1 and
- .2 Use components for intended design purpose only. Do not use for rigging or erection purposes.

## 2.3 PIPE HANGERS

- .1 Finishes:
  - .1 Ensure steel hangers in contact with copper piping are copper.
- .2 Upper attachment structural: suspension from lower flange of I-Beam:
  - .1 Cold piping NPS 2 maximum: malleable iron C-clamp with hardened steel cup point setscrew, locknut and carbon steel retaining clip.
    - .1 Rod: 9 mm UL listed.
  - .2
- .3 Upper attachment structural: suspension from upper flange of I-Beam:
  - .1 Cold piping NPS 2 maximum: ductile iron top-of-beam C-clamp with hardened steel cup point setscrew, locknut and carbon steel retaining clip, UL listed.
  - .2 Cold piping NPS 2 1/2 or greater, hot piping: malleable iron top-of-beam jaw-clamp with hooked rod, spring washer, plain washer and nut UL listed.
- .4 Hanger rods: threaded rod material to MSS SP 58:
  - .1 Ensure that hanger rods are subject to tensile loading only.
  - .2 Provide linkages where lateral or axial movement of pipework is anticipated.
  - .3 Do not use 22 mm or 28 mm rod.
- .5 Pipe attachments: material to MSS SP 58:
  - .1 Attachments for steel piping: carbon steel black.
  - .2 Attachments for copper piping: copper plated black steel.
  - .3 Use insulation shields for hot pipework.

## 2.4 INSULATION PROTECTION SHIELDS

- .1 Insulated cold piping:
  - .1 64 kg/m<sup>3</sup> density insulation plus insulation protection shield to: MSS SP 69, galvanized sheet carbon steel. Length designed for maximum 3 m span.

.2 Insulated hot piping:

- .1 Curved plate 300 mm long, with edges turned up, welded-in centre plate for pipe sizes NPS 12 and over, carbon steel to comply with MSS SP 69.

## **2.5 EQUIPMENT SUPPORTS**

- .1 Fabricate equipment supports not provided by equipment manufacturer from structural grade steel meeting requirements of Section 05 12 23 - Structural Steel for Buildings. Submit calculations with shop drawings.

## **2.6 EQUIPMENT ANCHOR BOLTS AND TEMPLATES**

- .1 Provide templates to ensure accurate location of anchor bolts.

## **2.7 OTHER EQUIPMENT SUPPORTS**

- .1 Fabricate equipment supports from structural grade steel meeting requirements of Section 05 12 23 - Structural Steel for Buildings.
- .2 Submit structural calculations with shop drawings.

## **3.0 EXECUTION**

### **3.1 MANUFACTURER'S INSTRUCTIONS**

- .1 Compliance: comply with manufacturer's written recommendations or specifications, including product technical bulletins, handling, storage and installation instructions, and datasheet.

### **3.2 INSTALLATION**

- .1 Install in accordance with:
  - .1 Manufacturer's instructions and recommendations.
- .2 Use approved constant support type hangers where:
  - .1 Vertical movement of pipework is 13 mm or more,
  - .2 Transfer of load to adjacent hangers or connected equipment is not permitted.

### 3.3 HANGER SPACING

- .1 Plumbing piping: to Canadian Plumbing Code.
- .2 Fire protection: to applicable fire code.
- .3 Gas and fuel oil piping: up to NPS 1/2: every 1.8 m.
- .4 Copper piping: up to NPS 1/2: every 1.5 m.
- .5 Flexible joint roll groove pipe: in accordance with table below for steel, but not less than one hanger at joints. Table listings for straight runs without concentrated loads and where full linear movement is not required.
- .6 Within 300 mm of each elbow.

Maximum Pipe Size: NPS	Maximum Spacing Steel	Maximum Spacing Copper
Up to 1-1/4	2.4 m	1.8 m
1-1/2	3.0 m	2.4 m
2	3.0 m	2.4 m
2-1/2	3.7 m	3.0 m
3	3.7 m	3.0 m
3-1/2	3.7 m	3.3 m
4	3.7 m	3.6 m
5	4.3 m	
6	4.3 m	
8	4.3 m	
10	4.9 m	
12	4.9 m	

- .7 Pipework greater than NPS 12: to MSS SP 69.

### 3.4 HANGER INSTALLATION

- .1 Install hanger so that rod is vertical under operating conditions.
- .2 Adjust hangers to equalize load.
- .3 Support from structural members. Where structural bearing does not exist or inserts are not in suitable locations, provide supplementary structural steel members.

### 3.5 HORIZONTAL MOVEMENT

- .1 Angularity of rod hanger resulting from horizontal movement of pipework from cold to hot position not to exceed 4 degrees from vertical.
- .2 Where horizontal pipe movement is less than 13 mm, offset pipe hanger and support so that rod hanger is vertical in the hot position.



### **3.6 FINAL ADJUSTMENT**

- .1 Adjust hangers and supports:
  - .1 Ensure that rod is vertical under operating conditions.
  - .2 Equalize loads.
- .2 Adjustable clevis:
  - .1 Tighten hanger load nut securely to ensure proper hanger performance.
  - .2 Tighten upper nut after adjustment.
- .3 C-clamps:
  - .1 Follow manufacturer's recommended written instructions and torque values when tightening C-clamps to bottom flange of beam.
- .4 Beam clamps:
  - .1 Hammer jaw firmly against underside of beam.

### **3.7 CLEANING**

- .1 Clean in accordance with Section 01 74 11 - Cleaning.
  - .1 Remove surplus materials, excess materials, rubbish, tools and equipment.

**END OF SECTION**

## **1.0 GENERAL**

### **1.1 REFERENCES**

- .1 Canadian General Standards Board (CGSB)
  - .1 CAN/CGSB-1.60-97, Interior Alkyd Gloss Enamel.
  - .2 CAN/CGSB-24.3-92, Identification of Piping Systems.

### **1.2 ACTION AND INFORMATIONAL SUBMITTALS**

- .1 Submittals: in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Product data to include paint colour chips, other products specified in this section.
- .3 Samples:
  - .1 Submit samples in accordance with Section 01 33 00 - Submittal Procedures.
  - .2 Samples to include nameplates, labels, tags, lists of proposed legends.

### **1.3 QUALITY ASSURANCE**

- .1 Quality assurance submittals: submit following in accordance with Section 01 33 00 - Submittal Procedures.

### **1.4 DELIVERY, STORAGE, AND HANDLING**

- .1 Packing, shipping, handling and unloading:
  - .1 Deliver, store and handle in accordance with Section 01 61 00 - Common Product Requirements.
  - .2 Deliver, store and handle materials in accordance with manufacturer's written instructions.

## **2.0 PRODUCTS**

### **2.1 MANUFACTURER'S EQUIPMENT NAMEPLATES**

- .1 Metal or plastic laminate nameplate mechanically fastened to each piece of equipment by manufacturer.
- .2 Lettering and numbers raised or recessed.
- .3 Information to include, as appropriate:
  - .1 Equipment: manufacturer's name, model, size, serial number, capacity.
  - .2 Motor: voltage, Hz, phase, power factor, duty, frame size.

### **2.2 SYSTEM NAMEPLATES**

- .1 Colours:
  - .1 Hazardous: red letters, white background.
  - .2 Elsewhere: black letters, white background (except where required otherwise by applicable codes).
- .2 Construction:
  - .1 3 mm thick laminated plastic, matte finish, with square corners, letters accurately aligned and machine engraved into core.
- .3 Sizes:
  - .1 Conform to following table:

Size #	mm	Size (mm)	No. of Lines	Height of Letters (mm)
1		10 x 50	1	3
2		13 x 75	1	5
3		13 x 75	2	3
4		20 x 100	1	8
5		20 x 100	2	5
6		20 x 200	1	8
7		25 x 125	1	12
8		25 x 125	2	8
9		35 x 200	1	20
  - .2 Use maximum of 25 letters/numbers per line.
- .4 Locations:
  - .1 Terminal cabinets, control panels: use size # 5.
  - .2 Equipment in Mechanical Rooms: use size # 9.

## 2.3 IDENTIFICATION OF PIPING SYSTEMS

- .1 Identify contents by background colour marking, pictogram (as necessary), legend; direction of flow by arrows. To CAN/CGSB 24.3 except where specified otherwise.
- .2 Pictograms:
  - .1 Where required: Workplace Hazardous Materials Information System (WHMIS) regulations.
- .3 Legend:
  - .1 Block capitals to sizes and colours listed in CAN/CGSB 24.3.
- .4 Arrows showing direction of flow:

- .1 Outside diameter of pipe or insulation less than 75 mm: 100 mm long x 50 mm high.
- .2 Outside diameter of pipe or insulation 75 mm and greater: 150 mm long x 50 mm high.
- .3 Use double-headed arrows where flow is reversible.
- .5 Extent of background colour marking:
  - .1 To full circumference of pipe or insulation.
  - .2 Length to accommodate pictogram, full length of legend and arrows.
- .6 Materials for background colour marking, legend, arrows:
  - .1 Pipes and tubing 20 mm and smaller: waterproof and heat-resistant pressure sensitive plastic marker tags.
  - .2 Other pipes: pressure sensitive plastic-coated cloth with protective overcoating, waterproof contact adhesive undercoating, suitable for ambient of 100% RH and continuous operating temperature of 150 degrees C and intermittent temperature of 200 degrees C.
- .7 Colours and Legends:
  - .1 Where not listed, obtain direction from Departmental Representative.
  - .2 Colours for legends, arrows: to following table:

<b>Background Colour</b>	<b>Legend, Arrows</b>
Yellow	BLACK
Green	WHITE
Red	WHITE

- .3 Background colour marking and legends for piping systems:

<b>Contents</b>	<b>Background Colour</b>	<b>Legend Marking</b>
Raw water	Green	RAW WATER
Treated water	Green	TREATED WATER
Domestic hot water supply	Green	DOM. HW SUPPLY
Domestic cold water supply	Green	DOM. CWS
Waste water	Green	WASTE WATER
Sanitary	Green	SAN
Plumbing vent	Green	SAN. VENT
Compressed air (<700kPa)	Green	COMP. AIR [_____] kPa

## 2.4 IDENTIFICATION DUCTWORK SYSTEMS

- .1 50 mm high stencilled letters and directional arrows 150 mm long x 50 mm high.

- .2 Colours: back, or coordinated with base colour to ensure strong contrast.

## **2.5 VALVES, CONTROLLERS**

- .1 Brass tags with 12 mm stamped identification data filled with black paint.
- .2 Include flow diagrams for each system, of approved size, showing charts and schedules with identification of each tagged item, valve type, service, function, normal position, location of tagged item.

## **2.6 CONTROLS COMPONENTS IDENTIFICATION**

- .1 Identify all systems, equipment, components, controls, sensors with system nameplates specified in this section.
- .2 Inscriptions to include function and (where appropriate) fail-safe position.

## **2.7 LANGUAGE**

- .1 Identification in English.

## **3.0 EXECUTION**

### **3.1 MANUFACTURER'S INSTRUCTIONS**

- .1 Compliance: comply with manufacturer's written recommendations or specifications, including product technical bulletins, handling, storage and installation instructions, and datasheet.

### **3.2 TIMING**

- .1 Provide identification only after painting specified Section 09 91 23 - Interior Painting has been completed.

### **3.3 INSTALLATION**

- .1 Perform work in accordance with CAN/CGSB-24.3 except as specified otherwise.
- .2 Provide ULC and CSA registration plates as required by respective agency.
- .3 Identify systems, equipment to conform to PWGSC PMSS.

### **3.4 NAMEPLATES**

- .1 Locations:
  - .1 In conspicuous location to facilitate easy reading and identification from operating floor.
- .2 Standoffs:

- .1 Provide for nameplates on hot and/or insulated surfaces.
- .3 Protection:
  - .1 Do not paint, insulate or cover.

### **3.5 LOCATION OF IDENTIFICATION ON PIPING AND DUCTWORK SYSTEMS**

- .1 On long straight runs in open areas in boiler rooms, equipment rooms, galleries, tunnels: at not more than 17 m intervals and more frequently if required to ensure that at least one is visible from any one viewpoint in operating areas and walking aisles.
- .2 Adjacent to each change in direction.
- .3 At least once in each small room through which piping or ductwork passes.
- .4 On both sides of visual obstruction or where run is difficult to follow.
- .5 On both sides of separations such as walls, floors, partitions.
- .6 Where system is installed in pipe chases, ceiling spaces, galleries, confined spaces, at entry and exit points, and at access openings.
- .7 At beginning and end points of each run and at each piece of equipment in run.
- .8 At point immediately upstream of major manually operated or automatically controlled valves, and dampers. Where this is not possible, place identification as close as possible, preferably on upstream side.
- .9 Identification easily and accurately readable from usual operating areas and from access points.
  - .1 Position of identification approximately at right angles to most convenient line of sight, considering operating positions, lighting conditions, risk of physical damage or injury and reduced visibility over time due to dust and dirt.

### **3.6 CLEANING**

- .1 Proceed in accordance with Section 01 74 11 - Cleaning.
- .2 Upon completion and verification of performance of installation, remove surplus materials, excess materials, rubbish, tools and equipment.

**END OF SECTION**

## **1.0 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 ninety (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
  - .2 National Environmental Balancing Bureau (NEBB) TABES, Procedural Standards for Testing, Adjusting, Balancing of Environmental Systems-1998.
  - .3 Sheet Metal and Air Conditioning Contractors' National Association (SMACNA), HVAC TAB HVAC Systems - Testing, Adjusting and Balancing-2002.
- .4 Recommendations and suggested practices contained in the TAB Standard: mandatory.
- .5 Use TAB Standard provisions, including checklists, and report forms to satisfy Contract requirements.
- .6 Use TAB Standard for TAB, including qualifications for TAB Firm and Specialist and calibration of TAB instruments.
- .7 Where instrument manufacturer calibration recommendations are more stringent than those listed in TAB Standard, use manufacturer's recommendations.
- .8 TAB Standard quality assurance provisions such as performance guarantees form part of this contract.
  - .1 For systems or system components not covered in TAB Standard, use TAB procedures developed by TAB Specialist.
  - .2 Where new procedures, and requirements, are applicable to Contract requirements have been published or adopted by body responsible for TAB Standard used (AABC, NEBB, or TABB), requirements and recommendations contained in these procedures and requirements are mandatory.

### **1.3 PURPOSE OF TAB**

- .1 Test to verify proper and safe operation, determine actual point of performance, evaluate qualitative and quantitative performance of equipment, systems and controls at design, average and low loads using actual or simulated loads
- .2 Adjust and regulate equipment and systems to meet specified performance requirements and to achieve specified interaction with other related systems under normal and emergency loads and operating conditions.
- .3 Balance systems and equipment to regulate flow rates to match load requirements over full operating ranges.

#### **1.4 EXCEPTIONS**

- .1 TAB of systems and equipment regulated by codes, standards to satisfaction of authority having jurisdiction.

#### **1.5 COORDINATION**

- .1 Schedule time required for TAB (including repairs, re-testing) into project construction and completion schedule to ensure completion before acceptance of project.

#### **1.6 PRE-TAB REVIEW**

- .1 Review contract documents before project construction is started and confirm in writing to Departmental Representative adequacy of provisions for TAB and other aspects of design and installation pertinent to success of TAB.
- .2 Review specified standards and report to Departmental Representative in writing proposed procedures which vary from standard.
- .3 During construction, coordinate 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 seven (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 weather stripping, 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 Other HVAC systems: plus 5%, minus 5%.

#### **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 three (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 six (6) copies of TAB Report to Departmental Representative for verification and approval, in English in D-ring binders, complete with index tabs.

#### **1.16 VERIFICATION**

- .1 Reported results subject to verification by Departmental Representative.
- .2 Provide personnel and instrumentation to verify up to 30% of reported results.
- .3 Number and location of verified results as directed by Departmental Representative.
- .4 Pay costs to repeat TAB as required to satisfaction of Departmental Representative.

#### **1.17 SETTINGS**

- .1 After TAB is completed to satisfaction of Departmental Representative, replace drive guards, close access doors, lock devices in set positions, 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.
- .2 Do TAB of systems, equipment, components, controls specified Division 23.
- .3 Qualifications: personnel performing TAB [current member in good standing of AABC.
- .4 Quality assurance: perform TAB under direction of supervisor qualified by 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.

#### **2.0 PRODUCTS – NOT APPLICABLE**

#### **3.0 EXECUTION – NOT APPLICABLE**

**END OF SECTION**

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## 1.0 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 90.1-16, SI; Energy Standard for Buildings Except Low-Rise Residential Buildings.

##### .2 ASTM International Inc.

- .1 ASTM B 209M-14, Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate (Metric).
- .2 ASTM C 335-17, Standard Test Method for Steady State Heat Transfer Properties of Pipe Insulation.
- .3 ASTM C 411-19, Standard Test Method for Hot-Surface Performance of High-Temperature Thermal Insulation.
- .4 ASTM C 449/C 449M-00, Standard Specification for Mineral Fiber-Hydraulic-Setting Thermal Insulating and Finishing Cement.
- .5 ASTM C 547-19, Standard Specification for Mineral Fiber Pipe Insulation.
- .6 ASTM C 553-13(2019), Standard Specification for Mineral Fiber Blanket Thermal Insulation for Commercial and Industrial Applications.
- .7 ASTM C 612-14(2019), Standard Specification for Mineral Fiber Block and Board Thermal Insulation.
- .8 ASTM C 795-08(2018), Standard Specification for Thermal Insulation for Use in Contact with Austenitic Stainless Steel.
- .9 ASTM C 921-10(2015), Standard Practice for Determining the Properties of Jacketing Materials for Thermal Insulation.

- .3 Canadian General Standards Board (CGSB)
  - .1 CGSB 51-GP-52Ma-89, Vapour Barrier, Jacket and Facing Material for Pipe, Duct and Equipment Thermal Insulation.
- .4 Green Seal Environmental Standards (GSES)
  - .1 Standard GS-36, Commercial Adhesives.
- .5 South Coast Air Quality Management District (SCAQMD), California State
  - .1 SCAQMD Rule 1168-A2017, Adhesive and Sealant Applications.
- .6 Thermal Insulation Association of Canada (TIAC): National Insulation Standards (2005).
- .7 Underwriters Laboratories of Canada (ULC)
  - .1 CAN/ULC-S102-10, Method of Test for Surface Burning Characteristics of Building Materials and Assemblies.
  - .2 CAN/ULC-S701-11, Standard for Thermal Insulation, Polystyrene, Boards and Pipe Covering.

## 1.2 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Provide submittals in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Product Data:
  - .1 Provide manufacturer's printed product literature 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 Province of 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 Manufacturer's Instructions:

- .1 Provide manufacturer'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 three (3) years successful experience in this size and type of project, member of TIAC.

### **1.4 DELIVERY, STORAGE AND HANDLING**

- .1 Deliver, store and handle in accordance with Section 01 61 00 - Common Product Requirements.
- .2 Deliver materials to site in original factory packaging, labelled with manufacturer's name, address.

## **2.0 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 conductivity ("k" factor) not to exceed specified values at 24 degrees C mean temperature when tested in accordance with ASTM C 335.
- .3 TIAC Code C-1: Rigid mineral fibre board to ASTM C 612, 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 C 553 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 C 553.
  - .2 Jacket: to CGSB 51-GP-52Ma.
  - .3 Maximum "k" factor: to ASTM C 553.

### **2.3 JACKETS**

- .1 Canvas:

- .1 220 gm/m<sup>2</sup> cotton, plain weave, treated with dilute fire retardant lagging adhesive to ASTM C 921.
- .2 Lagging adhesive: compatible with insulation.

## **2.4 ACCESSORIES**

- .1 Vapour retarder lap adhesive:
  - .1 Water based, fire retardant type, compatible with insulation.
- .2 Indoor Vapour Retarder Finish:
  - .1 Vinyl emulsion type acrylic, compatible with insulation.
- .3 Insulating Cement: hydraulic setting on mineral wool, to ASTM C 449.
- .4 ULC Listed Canvas Jacket:
  - .1 220 gm/m<sup>2</sup> cotton, plain weave, treated with dilute fire retardant lagging adhesive to ASTM C 921.
- .5 Tape: self-adhesive, aluminum, plain, 50 mm wide minimum.
- .6 Tie wire: 1.5 mm stainless steel.
- .7 Banding: 12 mm wide, 0.5 mm thick stainless steel.
- .8 Facing: 25 mm galvanized] steel hexagonal wire mesh stitched on both faces of insulation.
- .9 Fasteners: 2 mm diameter pins with 35 mm square clips, length to suit thickness of insulation.

## **3.0 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 manufacturer's instructions and as indicated.

- .3 Use two (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 two (2) rows each side.

### 3.4 DUCTWORK INSULATION SCHEDULE

- .1 Insulation types and thicknesses: conform to following table:

	TIAC Code	Vapour Retarded	Thickness (mm)
Round cold and dual temperature supply air ducts	C-2	Yes	50
Round warm air ducts	C-1	No	25
Supply, return exhaust ducts exposed in space being served			None
Outside air ducts to mixing plenum	C-1	Yes	25
Exhaust duct between dampers and louvers	C-1	No	25

### 3.5 CLEANING

- .1 Clean in accordance with Section 01 74 11 - Cleaning.
  - .1 Remove surplus materials, excess materials, rubbish, tools and equipment.

**END OF SECTION**

## **1.0 GENERAL**

### **1.1 REFERENCES**

- .1 American Society of Heating, Refrigerating and Air-Conditioning Engineers (ASHRAE)
- .2 ASTM International
  - .1 ASTM A 480/A 480M-12, Standard Specification for General Requirements for Flat-Rolled Stainless and Heat-Resisting Steel Plate, Sheet and Strip.
  - .2 ASTM A 635/A 635M-15, Standard Specification for Steel, Sheet and Strip, Heavy-Thickness Coils, Hot-Rolled, Alloy, Carbon, Structural, High-Strength Low-Alloy, and High-Strength Low-Alloy with Improved Formability, General Requirements for.
  - .3 ASTM A 653/A 653M-19a, Standard Specification for Steel Sheet, Zinc Coated (Galvanized) or Zinc-Iron Alloy Coated (Galvannealed) by the Hot-Dip Process.
- .3 Green Seal Environmental Standards (GS)
  - .1 GS-36-11, Standard for Adhesives for Commercial Use.
- .4 National Fire Protection Association (NFPA)
  - .1 NFPA 90A-18, Standard for the Installation of Air-Conditioning and Ventilating Systems.
  - .2 NFPA 90B-18, Standard for the Installation of Warm Air Heating and Air-Conditioning Systems.
- .5 Sheet Metal and Air Conditioning Contractors' National Association (SMACNA)
  - .1 SMACNA HVAC Duct Construction Standards - Metal and Flexible, [2005].
  - .2 SMACNA HVAC Air Duct Leakage Test Manual, [2012].
- .6 South Coast Air Quality Management District (SCAQMD), California State, Regulation XI. Source Specific Standards
  - .1 SCAQMD Rule 1168-A2005, Adhesives and Sealants 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 metal ducts 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 the Province of Alberta, Canada.
- .4 Test and Evaluation Reports:
  - .1 Certification of Ratings:
    - .1 Catalogue or published ratings to be those obtained from tests carried out by manufacturer or independent testing agency signifying adherence to codes and standards.

### 1.3 DELIVERY, STORAGE AND HANDLING

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

## 2.0 PRODUCTS

### 2.1 SEAL CLASSIFICATION

- .1 Classification as follows:

Maximum Pressure Pa	SMACNA Seal Class
125	[C]

- .2 Seal classification:
  - .1 Class C: transverse joints and connections made air tight with sealant. Longitudinal seams unsealed.

## **2.2 SEALANT**

- .1 Sealant: oil resistant, water borne, polymer type flame resistant duct sealant. Temperature range of minus 30 degrees C to plus 93 degrees C.

## **2.3 DUCT LEAKAGE**

- .1 In accordance with SMACNA HVAC Air Duct Leakage Test Manual.

## **2.4 FITTINGS**

- .1 Fabrication: to SMACNA.
- .2 Radiused elbows:
  - .1 Round: smooth radius, centreline radius: 1.5 times diameter.
- .3 Branches:
  - .1 Round main and branch: enter main duct at 45 degrees with conical connection.
  - .2 Provide volume control damper in branch duct near connection to main duct.
  - .3 Main duct branches: with splitter damper.
- .4 Transitions:
  - .1 Diverging: 20 degrees maximum included angle.
  - .2 Converging: 30 degrees maximum included angle.
- .5 Offsets:
  - .1 Full radiused elbows.

## **2.5 FIRE STOPPING**

- .1 Retaining angles around duct, on both sides of fire separation in accordance with Section 07 84 00 - Fire Stopping.
- .2 Fire stopping material and installation must not distort duct.

## **2.6 GALVANIZED STEEL**

- .1 Lock forming quality: to ASTM A 653/A 653M, Z90 zinc coating.
- .2 Thickness, fabrication and reinforcement: to SMACNA.
- .3 Joints: to SMACNA.

## **2.7 HANGERS AND SUPPORTS**

- .1 Hangers and Supports: in accordance with Section 23 05 29 - Hangers and Supports for HVAC Piping and Equipment.

- .1 Strap hangers: of same material as duct.

- .1 Maximum size duct supported by strap hanger: 500.

- .2 Hanger configuration: to ASHRAE and SMACNA.

- .3 Hangers: galvanized steel angle with galvanized] steel rods to ASHRAE and SMACNA following table:

Duct Size (mm)	Angle Size (mm)	Rod Size (mm)
Up to 750	25 x 25 x 3	6
751 to 1050	40 x 40 x 3	6
1051 to 1500	40 x 40 x 3	10
1501 to 2100	50 x 50 x 3	10
2101 to 2400	50 x 50 x 5	10
2401 and Over	50 x 50 x 6	10

- .4 Upper hanger attachments:

- .1 For steel joist: manufactured joist clamp.

- .2 For steel beams: manufactured beam clamps:

### 3.0 EXECUTION

#### 3.1 EXAMINATION

- .1 Verification of Conditions: verify that conditions of substrate previously installed under other Sections or Contracts are acceptable for metal duct installation in accordance with manufacturer's written instructions.

- .1 Visually inspect substrate in presence of Departmental Representative.

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

- .3 Proceed with installation only after unacceptable conditions have been remedied.

#### 3.2 GENERAL

- .1 Do work SMACNA.

- .2 Do not break continuity of insulation vapour barrier with hangers or rods.

- .1 Insulate strap hangers 100 mm beyond insulated duct.

- .3 Install breakaway joints in ductwork on sides of fire separation.

- .4 Install proprietary manufactured flanged duct joints in accordance with manufacturer's instructions.

### **3.3 HANGERS**

- .1 Strap hangers: install in accordance with SMACNA.
- .2 Angle hangers: complete with locking nuts and washers.
- .3 Hanger spacing: in accordance with SMACNA.

### **3.4 SEALING AND TAPING**

- .1 Apply sealant in accordance with SMACNA.
- .2 Bed tape in sealant and recoat with minimum of one (1) coat of sealant to manufacturer's recommendations.

### **3.5 LEAKAGE TESTS**

- .1 In accordance with SMACNA HVAC Duct Leakage Test Manual.
- .2 Make trial leakage tests as instructed to demonstrate workmanship.
- .3 Complete test before performance insulation or concealment Work.

### **3.6 CLEANING**

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

**END OF SECTION**

## **1.0 GENERAL**

### **1.1 REFERENCES**

- .1 Sheet Metal and Air Conditioning Contractors' National Association (SMACNA)
  - .1 SMACNA - HVAC Duct Construction Standards - Metal and Flexible, 2005.

### **1.2 ACTION AND INFORMATIONAL SUBMITTALS**

- .1 Submit in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Product Data:
  - .1 Submit manufacturer's instructions, printed product literature and data sheets for air duct accessories and include product characteristics, performance criteria, physical size, finish and limitations.
  - .2 Indicate:
    - .1 Flexible connections.
    - .2 Duct access doors.

### **1.3 DELIVERY, STORAGE AND HANDLING**

- .1 Deliver, store and handle materials in accordance with Section 01 61 00 - Common Product Requirements and with manufacturer's written instructions.
- .2 Delivery and Acceptance Requirements: deliver materials to site in original factory packaging, labelled with manufacturer's name and address.
- .3 Storage and Handling Requirements:
  - .1 Store materials off ground, 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.

## **2.0 PRODUCTS**

### **2.1 GENERAL**

- .1 Manufacture in accordance with SMACNA - HVAC Duct Construction Standards.

### **2.2 FLEXIBLE CONNECTIONS**

- .1 Frame: galvanized sheet metal frame with fabric clenched by means of double locked seams.
- .2 Material:

- .1 Fire resistant, self-extinguishing, neoprene coated glass fabric, temperature rated at minus 40 degrees C to plus 90 degrees C, density of 1.3 kg/m<sup>3</sup>.

## **2.3 ACCESS DOORS IN DUCTS**

- .1 Non-Insulated Ducts: sandwich construction of same material as duct, one (1) 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 (1) 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: foam rubber.
- .4 Hardware:
  - .1 Up to 300 x 300 mm: two (2) sash locks complete with safety chain.
  - .2 Hold open devices.

## **3.0 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.

### **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 Locations:
    - .1 Fire and smoke dampers.
    - .2 Control dampers.
    - .3 Devices requiring maintenance.
    - .4 Required by code.
    - .5 Reheat coils.
    - .6 Elsewhere as indicated.

### **3.3 CLEANING**

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

**END OF SECTION**

## **1.0 GENERAL**

### **1.1 REFERENCES**

- .1 Sheet Metal and Air Conditioning National Association (SMACNA)
- .1 SMACNA HVAC Duct Construction Standards, Metal and Flexible-2013.

### **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 dampers and include product characteristics, performance criteria, physical size, finish and limitations.

### **1.3 CLOSEOUT SUBMITTALS**

- .1 Submit in accordance with Section 01 78 00 - Closeout Submittals.
- .2 Operation and Maintenance Data: submit operation and maintenance data for dampers for incorporation into manual.

### **1.4 DELIVERY, STORAGE AND HANDLING**

- .1 Deliver, store and handle materials in accordance with Section 01 61 00 - Common Product Requirements and with manufacturer's written instructions.
- .2 Delivery and Acceptance Requirements: deliver materials to site in original factory packaging, labelled with manufacturer's name and address.
- .3 Storage and Handling Requirements:
  - .1 Store materials off ground, 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.

## **2.0 PRODUCTS**

### **2.1 GENERAL**

- .1 Manufacture to SMACNA standards.

### **2.2 SINGLE BLADE DAMPERS**

- .1 Fabricate from same material as duct, but one (1) sheet metal thickness heavier. V-groove stiffened.
- .2 Size and configuration to recommendations of SMACNA, except maximum height as indicated.
- .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.

### **3.0 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.

#### **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 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**

## **1.0 GENERAL**

### **1.1 REFERENCES**

- .1 National Fire Protection Association (NFPA)
  - .1 NFPA 90A-18, Standard for the Installation of Air Conditioning and Ventilating Systems.
- .2 Underwriters Laboratories of Canada (ULC)
  - .1 CAN/ULC-S112-10(R2016), Standard Test Method of Fire Test of Fire Damper Assemblies.
  - .2 CAN/ULC-S112.2-07(R2016), Standard Method of Fire Test of Ceiling Fire Stop Flap Assemblies.
  - .3 ULC-S505-1974, Standard for Fusible Links for Fire Protection Service.

### **1.2 ACTION AND INFORMATIONAL SUBMITTALS**

- .1 Submit in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Product Data:
  - .1 Submit manufacturer's instructions, printed product literature and data sheets for fire dampers and include product characteristics, performance criteria, physical size, finish and limitations.
  - .2 Indicate the following:
    - .1 Fire dampers.
    - .2 Smoke dampers.
    - .3 Fire stop flaps.
    - .4 Operators.
    - .5 Fusible links.
    - .6 Design details of break-away joints.
- .3 Certificates: submit certificates signed by manufacturer certifying that materials comply with specified performance characteristics and physical properties.

### **1.3 CLOSEOUT SUBMITTALS**

- .1 Submit in accordance with Section 01 78 00 - Closeout Submittals.
- .2 Operation and Maintenance Data: submit operation and maintenance data for fire dampers for incorporation into manual.

### **1.4 MAINTENANCE MATERIAL SUBMITTALS**

- .1 Extra Materials:

- .1 Submit maintenance materials in accordance with Section 01 78 00 - Closeout Submittals.
- .2 Provide:
  - .1 Six (6) fusible links of each type.

## **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, indoors, in dry location and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.
  - .2 Store and protect fire and smoke dampers from nicks, scratches, and blemishes.
  - .3 Replace defective or damaged materials with new.

## **2.0 PRODUCTS**

### **2.1 FIRE DAMPERS**

- .1 Fire dampers: arrangement Type A., meet requirements of Fire Commissioner of Canada (FCC), CFFM and NFPA 90A authorities having jurisdiction. Fire damper assemblies fire tested in accordance with CAN/ULC-S112.
- .2 Mild steel, factory fabricated for fire rating requirement to maintain integrity of fire wall and/or fire separation.
  - .1 Fire dampers: 1-1/2 hour fire rated unless otherwise indicated.
  - .2 Fire dampers: automatic operating type and have dynamic rating suitable for maximum air velocity and pressure differential to which it will be subjected.
- .3 Top hinged: offset [single damper], round or square; multi-blade hinged sized to maintain full duct cross section as indicated.
- .4 Fusible link actuated, weighted to close and lock in closed position when released or having negator-spring-closing operator for multi-leaf type or roll door type in horizontal position with vertical air flow.
- .5 40 x 40 x 3 mm retaining angle iron frame, on full perimeter of fire damper, on both sides of fire separation being pierced.
- .6 Equip fire dampers with steel sleeve or frame installed disruption ductwork or impair damper operation.

- .7 Equip sleeves or frames with perimeter mounting angles attached on both sides of wall or floor opening. Construct ductwork in fire-rated floor-ceiling or roof-ceiling assembly systems with air ducts that pierce ceiling to conform with ULC.
- .8 Design and construct dampers to not reduce duct or air transfer opening cross-sectional area.
- .9 Dampers shall be installed so that the centerline of the damper depth or thickness is located in the centerline of the wall, partition or floor slab depth or thickness.
- .10 Unless otherwise indicated, the installation details given in SMACNA Install Fire Damper HVAC and in manufacturer's instructions for fire dampers shall be followed.

### **3.0 EXECUTION**

#### **3.1 EXAMINATION**

- .1 Verification of Conditions: verify that conditions of substrate previously installed under other Sections or Contracts are acceptable for fire and smoke 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.

#### **3.2 INSTALLATION**

- .1 Install in accordance with NFPA 90A and in accordance with conditions of ULC listing.
- .2 Maintain integrity of fire separation.
- .3 After completion and prior to concealment obtain approvals of complete installation from authority having jurisdiction.
- .4 Install access door adjacent to each damper. See Section 23 33 00 - Air Duct Accessories.
- .5 Coordinate with installer of fire stopping.
- .6 Ensure access doors/panels, fusible links, damper operators are easily observed and accessible.
- .7 Install break-away joints of approved design on each side of fire separation.

#### **3.3 CLEANING**

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

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

**END OF SECTION**

## **1.0 GENERAL**

### **1.1 REFERENCES**

- .1 American National Standards Institute/Air Movement and Control Association (ANSI/AMCA)
  - .1 ANSI/AMCA Standard 99-2016, Standards Handbook.
  - .2 ANSI/AMCA Standard 210-2016/( ANSI/ASHRAE 51-07), Laboratory Methods of Testing Fans for Aerodynamic Performance Rating.
  - .3 ANSI/AMCA Standard 300-2014, Reverberant Room Method for Sound Testing of Fans.
  - .4 ANSI/AMCA Standard 301-2014, Methods for Calculating Fan Sound Ratings from Laboratory Test Data.
- .2 The Master Painters Institute (MPI)
  - .1 Architectural Painting Specification Manual.
    - .1 MPI #18, Primer, Zinc Rich, Organic.

### **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 HVAC fans 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 the Province of Alberta, Canada.
  - .2 Provide:
    - .1 Fan performance curves showing point of operation, bhp and efficiency.
    - .2 Sound rating data at point of operation.
  - .3 Indicate:
    - .1 Motors, sheaves, bearings, shaft details.
    - .2 Minimum performance achievable with variable speed controllers.

### **1.3 MAINTENANCE MATERIAL SUBMITTALS**

.1 Extra Materials:

.1 Submit in accordance with Section 01 78 00 - Closeout Submittals.

.1 Provide:

.1 Furnish list of individual manufacturer's recommended spare parts for equipment, include:

.1 Bearings and seals.

.2 Addresses of suppliers.

.3 List of specialized tools necessary for adjusting, repairing or replacing.

## **1.4 DELIVERY, STORAGE AND HANDLING**

.1 Deliver, store and handle materials in accordance with Section 01 61 00 - Common Product Requirements and with manufacturer's written instructions.

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

.3 Storage and Handling Requirements:

.1 Store materials off ground, indoors, in dry location and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.

.2 Store and protect HVAC fans from nicks, scratches, and blemishes.

.3 Replace defective or damaged materials with new.

## **2.0 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 in force.

.2 Capacity: flow rate, total static pressure, bhp, efficiency, revolutions per minute, power, model, size, sound power data and as indicated on schedule.

.3 Fans: statically and dynamically balanced, constructed in conformity with ANSI/AMCA Standard 99.

.4 Sound ratings: comply with ANSI/AMCA Standard 301, tested to ANSI/AMCA Standard 300.

.5 Performance ratings: based on tests performed in accordance with ANSI/AMCA Standard 210.

## **2.2 FANS GENERAL**

- .1 Factory primed before assembly in colour standard to manufacturer.
- .2 Bearing lubrication systems plus extension lubrication tubes where bearings are not easily accessible.
- .3 Vibration isolation: Spring Isolation.
- .4 Flexible connections: to Section 23 33 00 - Air Duct Accessories.

## **2.3 CABINET FANS - GENERAL PURPOSE**

- .1 Fan characteristics and construction: as centrifugal fans.
- .2 Cabinet hung single or multiple wheel with DWDI centrifugal fans in factory fabricated casing complete with vibration isolators and seismic control measures, ECM motor, casing.
- .3 Fabricate casing of zinc coated or phosphate treated steel of thickness as indicated reinforced and braced for rigidity. Provide removable panels for access to interior. Paint uncoated, steel parts with corrosion resistant paint to MPI #18. Finish inside and out, over prime coat, with rust resistant enamel.

## **2.4 PROPELLER FANS**

- .1 Fabricate multibladed propellers of aluminum within bell mouth entrance on integral mounts, with grease lubricated ball bearings, with extended lubrication fittings, suited for operating in any position, direct driven, complete with motor as indicated.
- .2 Provide cabinet, bird screen and automatic back draft dampers on discharge, with gasketed edges.

### **3.0 EXECUTION**

#### **3.1 EXAMINATION**

- .1 Verification of Conditions: verify that conditions of substrate previously installed under other Sections or Contracts are acceptable for HVAC fans 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 FAN INSTALLATION**

- .1 Install fans as indicated, complete with resilient mountings specified in Section 23 05 48 - Vibration and Seismic Controls for HVAC Piping and Equipment, flexible electrical leads and flexible connections in accordance with Section 23 33 00 - Air Duct Accessories.
- .2 Provide sheaves and belts required for final air balance.
- .3 Bearings and extension tubes to be easily accessible.
- .4 Access doors and access panels to be easily accessible.

#### **3.3 CLEANING**

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

**END OF SECTION**

## **1.0 GENERAL**

### **1.1 REFERENCES**

- .1 CSA Group
  - .1 CSA C22.2 No.46-13, Electric Air-Heaters.

### **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 duct heaters and include product characteristics, performance criteria, physical size, finish and limitations.
  - .2 Submit product data and include:
    - .1 Element support details.
    - .2 Heater: total kW rating, voltage, phase.
    - .3 Number of stages.
    - .4 Rating of stage: rating, voltage, phase.
    - .5 Heater element watt/density and maximum sheath temperature.
    - .6 Maximum discharge temperature.
    - .7 Unit support.
    - .8 Clearance from combustible materials.
    - .9 Internal components wiring diagrams.
    - .10 Minimum operating airflow.
    - .11 Pressure drop, minimum airflow.

### **1.3 DELIVERY, STORAGE AND HANDLING**

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

## **2.0 PRODUCTS**

### **2.1 DUCT HEATERS**

- .1 Duct heaters: flange type.
- .2 Elements:
  - .1 Helical coils of nickel chrome alloy resistance wire.
- .3 Staging:
  - .1 Staged heaters: balanced line current at each stage.
  - .2 Each stage: uniform face distribution.
- .4 Maximum temperature at discharge: 25 degrees Celsius.
- .5 Controls:
  - .1 Factory mounted and wired in control box. Use terminal blocks for power and control wiring to thermostat and sail switch.
  - .2 Remote mounted as indicated with terminal strips in heater terminal box for power and control wiring.
  - .3 Where controls are mounted in heater, exercise care in mounting contactors to minimize switching noise transmission through ductwork.
  - .4 High temperature cut out and air proving switch.
- .6 Electrical:
  - .1 As noted.
- .7 Main isolation disconnect switch.

## **3.0 EXECUTION**

### **3.1 EXAMINATION**

- .1 Verification of Conditions: verify that conditions of substrate previously installed under other Sections or Contracts are acceptable for duct heaters 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 Make power and control connections to CSA C22.2 No. 46.

### **3.3 FIELD QUALITY CONTROL**

- .1 Perform tests in accordance with Section 01 91 13 - General Commissioning (Cx) Requirements and Section 26 05 00 - Common Work Results for Electrical.
- .2 Perform tests in presence of Departmental Representative.
  - .1 Provide test report and include copy with Operations and Maintenance Manuals.

### **3.4 CLEANING**

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

**END OF SECTION**

Approved: 2005-12-31

**Part 1 General**

**1.1 SUMMARY**

.1 Section Includes:

- .1 Materials, components and installation for heat reclaim devices.

**1.2 REFERENCES**

- .1 American Society of Heating, Refrigeration and Air-Conditioning Engineers (ASHRAE)
  - .1 ASHRAE 84-2020, Method of Testing Air-to-Air Heat Exchangers (ANSI approved).
- .2 Health Canada/Workplace Hazardous Materials Information System (WHMIS)
  - .1 Material Safety Data Sheets (MSDS).

**1.3 ACTION AND INFORMATIONAL SUBMITTALS**

.1 Product Data:

- .1 Submit manufacturer's printed product literature, specifications and datasheet in accordance with Section 01 33 00 - Submittal Procedures. Include product characteristics, performance criteria, and limitations.
  - .1 Submit two copies of Workplace Hazardous Materials Information System (WHMIS) Material Safety Data Sheets (MSDS) in accordance with Section 01 33 00 - Submittal Procedures.

.2 Shop Drawings:

- .1 Submit shop drawings in accordance with Section 01 33 00 - Submittal Procedures.
  - .1 Shop drawings: submit drawings stamped and signed by professional engineer registered or licensed in Province of Alberta, Canada.

.3 Quality assurance submittals: submit following in accordance with Section 01 33 00 - Submittal Procedures.

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

.4 Closeout Submittals:

- .1 Provide operation and maintenance data for incorporation into manual specified in Section 01 78 00 - Closeout Submittals.

.5 Certificates:

- .1 Catalogued or published ratings: obtained from tests carried out by manufacturer or those ordered from independent testing agency signifying adherence to codes and standards in force.
- .2 Provide confirmation of testing.

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**1.4 QUALITY ASSURANCE**

- .1 Health and Safety:
  - .1 Do construction occupational health and safety in accordance with Section 01 35 29.06 - Health and Safety Requirements.

**1.5 DELIVERY, STORAGE, AND HANDLING**

- .1 Packing, shipping, handling and unloading:
  - .1 Deliver, store and handle in accordance with manufacturer's written instructions and Section 01 61 00 - Common Product Requirements.

**1.6 MAINTENANCE**

- .1 Extra Materials:
  - .1 Provide maintenance materials in accordance with Section 01 78 00 - Closeout Submittals.
  - .2 Furnish list of individual manufacturer's recommended spare parts for equipment include:
    - .1 Bearings and seals.
    - .2 Addresses of suppliers.
    - .3 List of specialized tools necessary for adjusting, repairing or replacing.

**Part 2 Products**

**2.1 GENERAL**

- .1 Comply with ASHRAE 84.

**2.2 AIR TO AIR FIXED PLATE EXCHANGER**

- .1 Casing: Painted Galvanized Steel 22GA.
- .2 Heat transfer surfaces: corrugated aluminum, edge sealed and bonded to casing.
- .3 Cross contamination: not permitted.
- .4 Condensate drain: ½"
- .5 Removable access panels.
- .6 Performance characteristics: as indicated.

**Part 3            Execution**

**3.1                MANUFACTURER'S INSTRUCTIONS**

- .1            Compliance: comply with manufacturer's written recommendations or specifications, including product technical bulletins, handling, storage and installation instructions, and datasheet.

**3.2                INSTALLATION**

- .1            Install in accordance with manufacturers recommendations.
- .2            Support independently of adjacent ductwork with flexible connections.

**3.3                FIELD QUALITY CONTROL**

- .1            Tests:
  - .1            Perform tests in accordance with Section 26 05 00 - Common Work Results for Electrical.

**3.4                CLEANING**

- .1            Proceed in accordance with Section 01 74 11 - Cleaning.
- .2            Upon completion and verification of performance of installation, remove surplus materials, excess materials, rubbish, tools and equipment.

**END OF SECTION**

## **1.0 GENERAL**

### **1.1 REFERENCES**

- .1 CSA International
  - .1 CSA C22.2 No.46-M1988R2011, Electric Air-Heaters.
- .2 National Electrical Manufacturers Association (NEMA)
  - .1 NEMA 250-18, Enclosures for Electrical Equipment (1000 V Maximum).

### **2.0 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 unit heaters and include product characteristics, performance criteria, physical size, finish and limitations.

### **2.2 CLOSEOUT SUBMITTALS**

- .1 Submit in accordance with Section 01 78 00 - Closeout Submittals.
- .2 Operation and Maintenance Data: submit operation and maintenance data for unit heaters for incorporation into manual.

### **2.3 DELIVERY, STORAGE AND HANDLING**

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

## **3.0 PRODUCTS**

### **3.1 UNIT HEATERS**

- .1 Unit heater: to CSA C22.2 No.46, horizontal discharge complete with adjustable louvers finished to match cabinet.
- .2 Fan type unit heaters with built-in high-heat limit protection, fan-delay switches.
- .3 Fan motor: totally enclosed, permanently lubricated ball bearing type with resilient mount.
  - .1 Built-in fan motor thermal overload protection.
- .4 Hangers: as indicated.
- .5 Elements: stainless steel.
- .6 Cabinet: steel, 18 gauge, fitted with brackets for rod or wall mounting.
  - .1 Epoxy/polyester powder paint.

### **3.2 CONTROLS**

- .1 Wall mounted thermostats: type line voltage.

### **4.0 EXECUTION**

#### **4.1 EXAMINATION**

- .1 Verification of Conditions: verify that conditions of substrate previously installed under other Sections or Contracts are acceptable for unit heaters 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.

#### **4.2 INSTALLATION**

- .1 Suspend unit heaters from ceiling or mount on wall as indicated.
- .2 Install thermostats in locations indicated.
- .3 Make power and control connections.

#### **4.3 FIELD QUALITY CONTROL**

- .1 Perform tests in accordance with Section 26 05 00 - Common Work Results for Electrical.
- .2 Test cut-out protection when air movement is obstructed.
- .3 Test fan delay switch to assure dissipation of heat after element shutdown.

- .4 Test unit cut-off when fan motor overload protection has operated.
- .5 Ensure heaters and controls operate correctly.

#### **4.4 CLEANING**

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

#### **4.5 PROTECTION**

- .1 Protect installed products and components from damage during construction.
- .2 Repair damage to adjacent materials caused by unit heaters installation.

**END OF SECTION**

**Part 1 General**

**1.1 RELATED REQUIREMENTS**

- .1 Section 01 33 00 - Submittal Procedures.
- .2 Section 01 61 00 - Common Product Requirements
- .3 Section 01 78 00 - Closeout Submittals.

**1.2 REFERENCE STANDARDS**

- .1 CSA Group
  - .1 CSA C22.1-18, Canadian Electrical Code, Part 1 (24<sup>th</sup> Edition), Safety Standard for Electrical Installations.
  - .2 CSA C22.2.
  - .3 CAN3-C235-83 (R2015), Preferred Voltage Levels for AC Systems, 0 to 50,000V.
- .2 Institute of Electrical and Electronics (IEEE)/National Electrical Safety Code Product Line (NESC)
  - .1 IEEE SP1122-2000, The Authoritative Dictionary of IEEE Standards Terms, 7th Edition.

**1.3 DEFINITIONS**

- .1 Electrical and electronic terms: unless otherwise specified or indicated, terms used in these specifications, and on drawings, are those defined by IEEE SP1122.

**1.4 ACTION AND INFORMATIONAL SUBMITTALS**

- .1 Submit in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Product Data:
  - .1 Submit manufacturer's instructions, printed product literature and data sheets and include product characteristics, performance criteria, physical size, finish and limitations.
- .3 Submit for review single line electrical diagrams and locate in:
  - .1 Electrical distribution system in main electrical room.
- .4 Shop drawings:
  - .1 Submit drawings stamped and signed by professional engineer registered or licensed in Alberta, Canada.
  - .2 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.
  - .3 Identify on wiring diagrams circuit terminals and indicate internal wiring for each item of equipment and interconnection between each item of equipment.
  - .4 Indicate of drawings clearances for operation, maintenance, and replacement of operating equipment devices.

- 
- .5 Submit drawings and product data to authority having jurisdiction.
  - .6 If changes are required, notify Consultant and Parks Canada of these changes before they are made.
  - .5 Certificates:
    - .1 Provide CSA certified equipment.
    - .2 Where CSA certified equipment is not available, submit such equipment to inspection authorities for special approval before delivery to site.
    - .3 Submit test results of installed electrical systems and instrumentation.
    - .4 Permits and fees: in accordance with General Conditions of 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 Consultant and Parks Canada.
  - .6 Manufacturer's Field Reports: submit to [Consultant] [Departmental Representative] [DCC Representative] 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.
  - .7 Sustainable Design Submittals:
    - .1 Construction Waste Management:
      - .1 Submit project Waste Management Plan highlighting recycling and salvage requirements.
      - .2 Submit calculations on end-of-project recycling rates, salvage rates, and landfill rates demonstrating that 75% of construction wastes were recycled or salvaged.

## **1.5 CLOSEOUT SUBMITTALS**

- .1 Submit in accordance with Section 01 78 00 - Closeout Submittals.
- .2 Operation and Maintenance Data: submit operation and maintenance data for incorporation into manual.
  - .1 Provide for each system and principal item of equipment as specified in technical sections for use by operation and maintenance personnel.
  - .2 Operating instructions to include following:
    - .1 Wiring diagrams, control diagrams, and control sequence for each principal system and item of equipment.
    - .2 Start up, proper adjustment, operating, lubrication, and shutdown procedures.
    - .3 Safety precautions.
    - .4 Procedures to be followed in event of equipment failure.
    - .5 Other items of instruction as recommended by manufacturer of each system or item of equipment.
  - .3 Print or engrave operating instructions and frame under glass or in approved laminated plastic.

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- .4 Post instructions where directed.
  - .5 For operating instructions exposed to weather, provide weather-resistant materials or weatherproof enclosures.
  - .6 Ensure operating instructions will not fade when exposed to sunlight and are secured to prevent easy removal or peeling.

## **1.6 DELIVERY, STORAGE AND HANDLING**

- .1 Deliver, store and handle materials in accordance with Section 01 61 00 - Common Product Requirements with manufacturer's written instructions.
- .2 Delivery and Acceptance Requirements: deliver materials to site in original factory packaging, labelled with manufacturer's name and address.
- .3 Storage and Handling Requirements:
  - .1 Store materials in dry location and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.
  - .2 Store and protect from nicks, scratches, and blemishes.
  - .3 Replace defective or damaged materials with new.
- .4 Develop Construction Waste Management Plan related to Work of this Section.
- .5 Packaging Waste Management: remove for reuse and return crates, padding, pallets, packaging materials as specified in Construction Waste Management Plan.

## **Part 2 Products**

### **2.1 DESIGN REQUIREMENTS**

- .1 Operating voltages: to CAN3-C235.
- .2 Motors, electric heating, control and distribution devices and equipment to operate satisfactorily at 60 Hz within normal operating limits established by above standard.
  - .1 Equipment to operate in extreme operating conditions established in above standard without damage to equipment.
- .3 Language operating requirements: provide identification labels and nameplates for control items in English.

### **2.2 MATERIALS AND EQUIPMENT**

- .1 Provide equipment in accordance with Section 01 61 00 - Common Product Requirements.
- .2 Equipment to be CSA certified. Where CSA certified equipment is not available, obtain special approval from inspection authorities before delivery to site and submit such approval as described in PART 1 - ACTION AND INFORMATIONAL SUBMITTALS.
- .3 Factory assemble control panels and component assemblies.

## 2.3 ELECTRIC MOTORS, EQUIPMENT AND CONTROLS

- .1 Verify installation and co-ordination responsibilities related to motors, equipment and controls, as indicated.
- .2 Control wiring and conduit: except for conduit, wiring and connections below 50 V which are related to control systems as shown on mechanical drawings] [specified in mechanical sections].

## 2.4 WARNING SIGNS

- .1 Warning Signs: in accordance with requirements of codes, inspection authorities and Parks Canada.
- .2 Outdoors: rivetted lamacoids signs, minimum size [175 x 250 mm].
- .3 Indoors: decal signs, minimum size [175 x 250 mm].

## 2.5 WIRING TERMINATIONS

- .1 Ensure lugs, terminals, screws used for termination of wiring are suitable for either copper or aluminum conductors.

## 2.6 EQUIPMENT IDENTIFICATION

- .1 Identify electrical equipment with nameplates as follows:
  - .1 Nameplates: lamacoid 3mm thick plastic black face, white core, mechanically attached with self tapping screws, lettering accurately aligned and engraved into core.
  - .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
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 to be approved by Consultant and Parks Canada prior to manufacture.
- .4 Allow for minimum of twenty-five (25) letters per nameplate.
- .5 Nameplates for terminal cabinets and junction boxes to indicate system and/or voltage characteristics.
- .6 Identify equipment with Size 3 labels engraved "ASSET INVENTORY NO. [ ]" as directed by Consultant and Parks Canada.
- .7 Disconnects, starters and contactors: indicate equipment being controlled and voltage.
- .8 Terminal cabinets and pull boxes: indicate system and voltage.
- .9 Transformers: indicate capacity, primary and secondary voltages.

## 2.7 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.
- .4 Use colour coded wires in communication cables, matched throughout system.

## 2.8 CONDUIT AND CABLE IDENTIFICATION

- .1 Colour code conduits, boxes and metallic sheathed cables.
- .2 Code with plastic tape or paint at points where conduit or cable enters wall, ceiling, or floor, and at 15m intervals.
- .3 Colours: 25 mm wide prime colour and 20 mm wide auxiliary colour.

Type	Prime	Auxiliary
up to 250 V	Yellow	
up to 600 V	Yellow	Green
up to 5 kV	Yellow	Blue
up to 15 kV	Yellow	Red
Telephone	Green	
Other Communication Systems	Green	Blue
Fire Alarm	Red	
Emergency Voice	Red	Blue
Other Security Systems	Red	Yellow

## 2.9 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 in accordance with Parks Canada standards.
  - .2 Paint indoor panelboards and distribution enclosures light gray.

## 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 Consultant and Parks Canada.
  - .2 Inform Consultant and Parks Canada 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 Consultant and Parks Canada Representative.

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### **3.2 INSTALLATION**

- .1 Do complete installation in accordance with CSA C22.1 except where specified otherwise.
- .2 Do overhead and underground systems in accordance with CAN/CSA-C22.3 No.1 except where specified otherwise.

### **3.3 NAMEPLATES AND LABELS**

- .1 Ensure manufacturer's nameplates, CSA labels and identification nameplates are visible and legible after equipment is installed.

### **3.4 CONDUIT AND CABLE INSTALLATION**

- .1 Install conduit and sleeves prior to pouring of concrete.
  - .1 Sleeves through concrete: PVC plastic, sized for free passage of conduit, and protruding 50 mm.
- .2 If plastic sleeves are used in fire rated walls or floors, remove before conduit installation.
- .3 Install cables, conduits and fittings embedded or plastered over, close to building structure so furring can be kept to minimum.

### **3.5 LOCATION OF OUTLETS**

- .1 Locate outlets in accordance with Section 26 05 32 - Outlet Boxes, Conduit Boxes and Fittings.
- .2 Do not install outlets back-to-back in wall; allow minimum 150 mm horizontal clearance between boxes.
- .3 Change location of outlets at no extra cost or credit, providing distance does not exceed 3000 mm, and information is given before installation.
- .4 Locate light switches on latch side of doors.
  - .1 Locate disconnect devices in mechanical and elevator machine rooms on latch side of floor.

### **3.6 MOUNTING HEIGHTS**

- .1 Mounting height of equipment is from finished floor to centreline of equipment unless specified or indicated otherwise.
- .2 If mounting height of equipment is not specified or indicated, verify before proceeding with installation.
- .3 Install electrical equipment at following heights unless indicated otherwise.
  - .1 Local switches: 1200 mm.
  - .2 Motion detectors: as shown on drawings.
  - .3 Photocells: as shown on drawings.
  - .4 Wall receptacles:
    - .1 General: 300 mm.
    - .2 Above top of continuous baseboard heater: 200 mm.

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- .3 Above top of counters or counter splash backs: 175 mm.
  - .4 In mechanical rooms: 1400mm.
  - .5 Panelboards: as required by Code or as indicated.
  - .6 Telephone and interphone outlets: 300 mm.
  - .7 Wall mounted telephone and interphone outlets: 1200 mm.
  - .8 Access control devices and buttons: 1200mm.

### **3.7 CO-ORDINATION OF PROTECTIVE DEVICES**

- .1 Ensure circuit protective devices such as overcurrent trips, relays and fuses are installed to required values and settings.

### **3.8 FIELD QUALITY CONTROL**

- .1 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 - ACTION AND INFORMATIONAL 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.
- .2 Conduct following tests in accordance with Section 01 45 00 - Quality Control.
  - .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: 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.
- .3 Carry out tests in presence of Consultant and Parks Canada Representative.
- .4 Provide instruments, meters, equipment and personnel required to conduct tests during and at conclusion of project.
- .5 Manufacturer's Field Services:

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- .1 Obtain written report from manufacturer verifying compliance of Work, in handling, installing, applying, protecting and cleaning of product and submit Manufacturer's Field Reports as described in PART 1 - ACTION AND INFORMATIONAL SUBMITTALS.
  - .2 Provide manufacturer's field services consisting of product use recommendations and periodic site visits for inspection of product installation in accordance with manufacturer's instructions.

### **3.9 SYSTEM STARTUP**

- .1 Instruct Parks Canada staff in operation, care and maintenance of systems, system equipment and components.
- .2 Arrange and pay for services of manufacturer's factory service engineer to supervise start-up of installation, check, adjust, balance and calibrate components and instruct operating personnel.
- .3 Provide these services for such period, and for as many visits as necessary to put equipment in operation and ensure that operating personnel are conversant with aspects of its care and operation.

### **3.10 CLEANING**

- .1 Progress Cleaning: clean in accordance with Section 01 74 11 - Cleaning.
  - .1 Leave Work area clean at end of each day.
- .2 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment in accordance with Section 01 74 11 - Cleaning.
- .3 Waste Management: separate waste materials for recycling.
  - .1 Remove recycling containers and bins from site and dispose of materials at appropriate facility.

**END OF SECTION**

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## 1 General

### 1.01 DEFINITIONS

- .1 Demolish: Detach items from existing construction and legally dispose of items off site, unless indicated as removed and salvaged, or removed and reinstalled.
- .2 Remove: Planned deconstruction and disassembly of electrical items from existing construction including removal of conduit, junction boxes, cabling and wiring from electrical component to panel taking care not to damage adjacent assemblies designated to remain; legally dispose of items off site, unless indicated as removed and salvaged, or removed and reinstalled.
- .3 Remove and Salvage: Detach items from existing construction and deliver them to Departmental Representative ready for reuse.
- .4 Remove and Reinstall: Detach items from existing construction, prepare them for reuse, and reinstall them where indicated.
- .5 Existing to Remain: Existing items of construction that are not removed and that are not otherwise indicated as being removed and salvaged, or removed and reinstalled.
- .6 Hazardous Substances: Dangerous substances, dangerous goods, hazardous commodities and hazardous products may include asbestos, mercury and lead, PCB's, poisons, corrosive agents, flammable substances, radioactive substances, or other material that can endanger human health or wellbeing or environment if handled improperly as defined by Federal Hazardous Products Act (RSC 1985) including latest amendments.

### 1.02 RELATED REQUIREMENTS

- .1 Section 01 33 00 - Submittal Procedures.
- .2 Section 01 41 00 - Regulatory Requirements.
- .3 Section 01 51 00 - Temporary Utilities.
- .4 Section 01 74 00 – Cleaning.

### 1.03 REFERENCE STANDARDS

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

### 1.04 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Action Submittals: Provide in accordance with Section 01 33 00 - Submittal Procedures before starting work of this Section:
  - .1 Construction Waste Management Plan (CWM Plan): Submit plan addressing opportunities for reduction, reuse, or recycling of materials prepared.
  - .2 Landfill Records: Indicate receipt and acceptance of selective demolition waste and hazardous wastes by a landfill facility licensed to accept hazardous wastes.

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## **1.05 ADMINISTRATIVE REQUIREMENTS**

- .1 Coordination: Coordinate work of this Section to avoid interference with work by other Sections.
- .2 Scheduling: Account for Departmental Representative's continued occupancy requirements during selective demolition and schedule staged occupancy and worksite activities as defined in Division 01.

## **1.06 QUALITY ASSURANCE**

- .1 Regulatory Requirements: Perform work of this Section in accordance with:
  - .1 Provincial/Territorial Workers' Compensation Boards/Commissions.
  - .2 Provincial/Territorial Occupational Health and Safety Standards and Programs.

## **1.07 SITE CONDITIONS**

- .1 Existing Conditions: Condition of materials identified as being salvaged or demolished are based on their observed condition at time of site examination before tendering.
- .2 Existing Hazardous Substances: Departmental Representative performed a hazardous substances assessment, and it is not expected that hazardous substances will be encountered.
  - .1 Hazardous substances will be removed by a hazardous abatement specialist engaged by Departmental Representative before start of Work.
- .3 Existing Hazardous Substances: Departmental Representative has performed a hazardous substances assessment and identified materials requiring abatement as follows:
  - .1 Hazardous substances are as defined in Hazardous Products Act.
  - .2 Hazardous substances will be removed as a part of Contract before starting Work in accordance with work results described in Related Requirements listed above.
- .4 Discovery of Hazardous Substances: It is not expected that Hazardous Substances will be encountered in Work; immediately notify Departmental Representative if materials suspected of containing hazardous substances are encountered and perform following activities:
  - .1 Refer to Section 01 41 00 - Regulatory Requirements for directives associated with specific material types.
  - .2 Hazardous substances will be as defined in Hazardous Products Act.
  - .3 Stop work in area of suspected hazardous substances.
  - .4 Take preventative measures to limit users' and workers' exposure, provide barriers and other safety devices and do not disturb.
  - .5 Hazardous substances will be removed by Departmental Representative under a separate contract or as a change to Work.
  - .6 Proceed only after written instructions have been received from Departmental Representative.

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## **1.08 SALVAGE AND DEBRIS MATERIALS**

- .1 Demolished items become Contractor's property and will be removed from Project site; except for items indicated as being reused, salvaged, or otherwise indicated to remain Departmental Representative's property.
- .2 Carefully remove materials and items designated for salvage and store in a manner to prevent damage or devaluation of materials.
  - .1 Leave main electrical distribution panel in place; panel can be used for temporary construction power for this and subsequent contracts in accordance with Section 01 51 00 - Temporary Utilities; coordinate temporary power connections with Departmental Representative.
  - .2 Leave main telecommunications services in place; review site with Departmental Representative prior to commencement of work.

## **2 Products**

### **2.01 MATERIALS AND EQUIPMENT**

- .1 Materials and equipment for patching and extending work: As specified in individual Sections.

## **3 Execution**

### **3.01 EXAMINATION**

- .1 Verify field measurements and circuiting arrangements are as shown on Drawings.
- .2 Verify that abandoned wiring and equipment serve only abandoned facilities.
- .3 Demolition Drawings are based on field observation and existing record documents. Report discrepancies to Owner and Architect/Engineer before disturbing existing installation.
- .4 Beginning of demolition means installer accepts existing conditions.

### **3.02 PREPARATION**

- .1 Disconnect electrical systems in walls, floors, and ceilings scheduled for removal.
- .2 Coordinate utility service outages with Utility Company.
- .3 Provide temporary wiring and connections to maintain existing systems in service during construction. When work must be performed on energized equipment or circuits, use personnel experienced in such operations.
- .4 Existing Electrical Service
  - .1 Maintain existing system in service.
  - .2 Disable system only to make switchovers and connections. Obtain permission from Owner at least forty-eight (48) hours before partially or completely disabling system. Minimize outage duration.
  - .3 Make temporary connections to maintain service in areas adjacent to work area.

### **3.03 DEMOLITION AND EXTENSION OF EXISTING ELECTRICAL WORK**

- 
- .1 Demolish and extend existing electrical work as indicated on Drawings.
  - .2 Remove, relocate, and extend existing installations to accommodate new construction.
  - .3 Remove abandoned wiring to source of supply. This includes but is not limited to power conductors, fire alarm cables, intercom cables, voice cables, data cables, coaxial cable, and control wiring unless noted otherwise.
  - .4 Remove exposed abandoned conduit, including abandoned conduit above accessible ceiling finishes. Cut conduit flush with walls and floors, and patch surfaces to match existing adjacent finishes.
  - .5 Disconnect abandoned outlets and remove devices. Remove abandoned outlet boxes if conduit servicing them is abandoned and removed. Provide blank cover for abandoned outlet boxes and flush junction boxes that are not removed.
  - .6 Disconnect and remove abandoned panel boards and distribution equipment.
  - .7 Disconnect and remove electrical devices and equipment serving utilization equipment that has been removed.
  - .8 Disconnect and remove abandoned luminaires. Remove brackets, stems, hangers, and other accessories.
  - .9 Repair adjacent construction and finishes damaged during demolition and extension work to match existing.
  - .10 Maintain access to existing electrical installations that remain active. Modify installation or provide access panel as appropriate.
  - .11 Extend existing installations using materials and methods compatible with existing electrical installations, or as specified.

### **3.04 CLEANING AND REPAIR**

- .1 Clean and repair existing materials and equipment that remain or are to be reused.
- .2 Panel boards: Clean exposed surfaces and check tightness of electrical connections. Replace damaged circuit breakers and provide closure plates for vacant positions. Provide typed circuit directory showing revised circuiting arrangement.
- .3 Progress Cleaning: clean in accordance with Section 01 74 00 – Cleaning.
  - .1 Leave work area clean at end of each day.
- .4 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment in accordance with Section 01 74 00 – Cleaning.
- .5 Waste Management: separate waste materials in accordance with Section 01 74 19 – Waste Management and Disposal.
  - .1 Remove recycling containers and bins from site end disposal of materials at appropriate facility.

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**3.05    INSTALLATION**

- .1        Install relocated materials and equipment as indicated in other specification Sections and on the Drawings.

**END OF SECTION**

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## **1 General**

### **1.01 RELATED REQUIREMENTS**

- .1 Section 01 74 00 – Cleaning

### **1.02 INTENT**

- .1 Except where otherwise specified, arrange and pay for testing, adjusting, balancing and related requirements specified herein.
- .2 If test results do not conform with applicable requirements, repair, replace, adjust or balance equipment and systems. Repeat testing as necessary until acceptable results are achieved.
- .3 Provide all labor, materials, instruments and equipment necessary to perform the tests specified.
- .4 All tests shall be witnessed by persons designated by the Owner, who shall also sign the test documentation.
- .5 Submit procedures proposed in writing for approval two (2) weeks prior to test.

### **1.03 MANUFACTURER'S PRODUCTION TEST RECORDS**

- .1 If requested, submit copies of production test records for production tests required by EEMAC and CSA standards for manufactured electrical equipment

### **1.04 SITE TESTING REPORTS**

- .1 Comply with all Commissioning Requirements contained within the project specifications.
- .2 Electrical Field Review and Compliance Checklist is to be completed by Electrical Contractor and submitted to consultant for review and approval prior to final completion of this project. Submit completed test report forms as specified, immediately after tests are performed.

### **1.05 REFERENCE DOCUMENTS**

- .1 Perform tests in accordance with:
  - .1 The Contract Documents
  - .2 Requirements of authorities having jurisdiction
  - .3 Manufacturer's published instructions
  - .4 Applicable CSA, IEEE, IPCEA, EEMAC and ASTM standards.
- .2 If requirements of any of the foregoing conflict, notify Departmental Representative before proceeding with test and obtain clarification.

### **1.06 SEQUENCING AND SCHEDULING**

- .1 Except where otherwise specified, perform all testing, adjusting, balancing and related requirements specified herein.
- .2 Perform voltage and device testing prior to user occupancy or utilization of facility.

### **1.07 TEST EQUIPMENT**

- 
- .1 Provide all equipment and tools necessary to perform testing, adjusting and balancing specified herein and as otherwise required.

## **2 Execution**

### **2.01 TESTING OF WIRING AND WIRING DEVICES**

- .1 All power wiring #2 AWG and larger shall be tested for insulation resistance value with a 1000-volt megger. Resistance values shall be as recommended by cable manufacturer. Test results shall be properly tabulated, signed, dated and submitted with maintenance manuals.
- .2 Test all wiring devices for correct operation.
- .3 Test all receptacles for proper functionality polarity and circuitry. GFCI function is also to be tested where applicable.
- .4 Test all data devices for proper functionality.
- .5 Test all lighting fixtures and associated control devices for proper functionality.
- .6 Ensure that all wiring devices are adequately labelled upon completion of installation.
- .7 Ensure that all panel schedules are updated in a clear and legible manner upon completion of installation.

### **2.02 LOAD BALANCE TESTING**

- .1 Turn on all possible loads.
- .2 Test load balance on all feeders at distribution centres, motor control centre and panel boards.
- .3 If load balance exceeds 15%, reconnect circuits to balance loads.

### **2.03 VOLTAGE TESTING AND ADJUSTING**

- .1 Test voltage at all panel boards.

### **2.04 CLEANING**

- .1 Progress Cleaning: clean in accordance with Section 01 74 00 – Cleaning.
  - .1 Leave work area clean at end of each day.
- .2 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment in accordance with Section 01 74 00 – Cleaning.
- .3 Waste Management: separate waste materials in accordance with Section 01 74 19 – Waste Management and Disposal.
  - .1 Remove recycling containers and bins from site and disposal of materials at appropriate facility.

**END OF SECTION**

## **1 GENERAL**

### **1.01 SUBMITTALS**

- .1 Submit shop drawings for products and accessories.

## **2 PRODUCTS**

### **2.01 GENERAL POWER CABLES**

- .1 CSA approved, ULC labelled and certified. Unless otherwise noted, conductors to be copper and be suitable for applications as noted in governing local electrical code.
- .2 "RW90" CSA certified, single copper conductor to CSA C22.2 No. 38, 600/1000 volts, maximum 90°C (194°F) conductor temperature, -40°C (-40°F) minimum installation temperature, X-link polyethylene (XLPE) insulation, colour coded.
- .3 "TWU" single copper conductor to CSA C22.2 No. 75, 600 volts, maximum 60°C (140°F) conductor temperature, -40°C (-40°F) minimum installation temperature, PVC insulated suitable for wet and buried installations, colour coded.
- .4 "AC90 ISO-BX" flexible armoured cable with "RW90" conductors with low temperature Exelene insulation and two additional solid copper bonding conductors (one bare, one insulated) and overall interlocked aluminium tape armour, to CSA C22.2 No. 51(R2004).
- .5 Solid conductors to and including No. 10 AWG; stranded conductors in sizes larger than No. 10 AWG; branch circuit conductors constructed of 98% conductive copper; and approved for minimum 600 volts.
- .6 Aluminum alloy conductors to be equivalent to ALCAN "NUAL" AA8030 aluminum alloy conductors. Provide connectors and associated hardware compatible to aluminum alloy conductors. Install aluminum alloy conductors with hardware and connected in accordance with conductor manufacturer's instructions and as per requirements of local governing electrical code.
- .7 "NMD90", to CSA C22.2 No. 48, is not permitted.

### **2.02 CONNECTORS**

- .1 Armoured cable connectors must be proper squeeze type connectors and plastic anti-short bushings at terminations.
- .2 Connectors for conductors connecting to devices as per local governing electrical requirements to be equal to IDI Electric (Canada) Ltd., "Ideal" No. 451, No. 452 and No. 453, "Wing-Nut", CSA certified, 600 volts, rated pressure type connectors.
- .3 For conductors sized 3/0 and greater, provide long barrel double crimp, 2 hole compression type lug connectors, unless otherwise noted.

### **2.03 CONDUCTOR PULLING LUBRICANT**

- .1 IDI Electric (Canada) Ltd., "Ideal Yellow 77" or "Wire Lube" as required.

## **2.04 TECK CABLES**

- .1 Nexans, "Firex II Teck" cables as follows:
  - .1 certified to CAN/CSA C22.2 No.131, Type TECK 90 Cable;
  - .2 rated for outdoor, weather resistant and wet locations applications;
  - .3 600V rated;
  - .4 Conductor: Bare, Soft drawn, Class B Compact or Compressed Stranded Copper conductors per ASTM;
  - .5 insulation: chemically cross linked thermosetting polyethylene (XLPE);
  - .6 bonding conductor (1/C Cable): Soft drawn bare copper;
  - .7 inner jacket: sunlight resistant PVC jacket tightly applied over assembly, to prevent slipping of core in a vertical position;
  - .8 armour: flexible interlocked aluminum armour, over inner jacket for mechanical protection;
  - .9 overall PVC jacket rated -40°C (-40°F).
  - .10 barrier tape over shield.
- .2 Acceptable manufacturers are:
  - .1 Nexans;
  - .2 Prysmian Cables (Pirelli);
  - .3 General Cable;
  - .4 Aetna Cables;
  - .5 Kerite Company.

## **3 EXECUTION**

### **3.01 PROJECT CONDITIONS**

- .1 If identified in documents, verify that field measurements and conditions are as identified.
- .2 Cable routing on drawings is schematic and approximate. Route cable as required to meet project conditions. Determine exact routing and lengths on site.
- .3 Within the site there is a risk of damage from rodent activity; this includes cable installations.

### **3.02 CO-ORDINATION**

- .1 Co-ordinate work with work provided under other electrical work and work of other trades.
- .2 Determine required separation between cable and other work.
- .3 Determine cable routing to avoid interference with other work.
- .4 Submit any alternative cable routing to Parks Canada Representative for review prior to proceeding with work.

### 3.03 INSTALLATION OF CONDUCTORS

- .1 Provide required conductors.
- .2 Conductors, unless otherwise noted, to be as follows:
  - .1 Within the facility, cables shall be protected in accordance with CEC code requirements.
  - .2 Within the facility, all cable within the new washroom building is to be either inside of steel conduit, or the cable must be armoured. No exposed or unprotected insulated cables are permitted.
  - .3 underground inside or outside building and for non-climate controlled areas - "TWU" or "RWU90" which shall be installed in conduit as shown on drawings.
- .3 Support flexible armoured cable in ceiling spaces and in stud wall construction with steel 2 hole cable straps to "Code" requirements. Flexible armoured cables must run in a neat manner parallel to building lines. Utilize centralized conduit runs to maintain maximum permitted runs of flexible armoured cables as specified. Provide insulating grommet at cut ends of flexible armoured cable to protect conductor insulation.
- .4 Low voltage conductors to typically be No. 18 AWG "TEW", unless otherwise noted. Conductors not installed in conduit or raceways to be fire insulated rated in accordance with latest governing Code Flame Spread requirements.
- .5 NMD90 is not permitted.
- .6 Generally, conductor sizes are indicated on drawings. Such sizes are minimum requirements and must be increased, where required, to suit length of run and voltage drop in accordance with applicable conductor voltage drop schedule appended to end of this Section.
- .7 Do not use conductors smaller than No. 12 AWG in systems over 30 volts, unless otherwise noted. Do not use conductors smaller than No. 6 AWG for exterior luminaire wiring unless otherwise noted.
- .8 Colour code conductors throughout to identify phases, neutrals and ground by means of self-laminating coloured tape, coloured conductor insulation, or properly secured coloured plastic discs.

**Commented [MW1]:** All cable within the new washroom building is to be either inside of steel conduit, or the cable must be armour cable. No unprotected insulated cables permitted.

- .9 When pulling wires into conduit use lubricant and ensure that wires are kept straight and are not twisted or abraided.
- .10 Neatly secure exposed wire in apparatus enclosures with approved supports or ties.
- .11 Install low voltage conductors in conduits, unless otherwise noted within Documents.
- .12 Comply with local electrical code requirements and conductor manufacturer's recommendations when terminating and connecting aluminium conductors.

#### **3.04 INSTALLATION OF TECK CABLES**

- .1 Provide cables as required for specific applications. Handle, install, and terminate in accordance with manufacturer's recommendations and instructions and as herein specified.
- .2 When pulling cable, apply pulling tension to conductor not in sheath of cable. Limit cable pulling tension to as recommended by cable manufacturer.
- .3 Terminate cable in equipment with lugs and termination kits as per cable manufacturer's instructions.
- .4 Installation of cable splices and terminations to be made by personnel skilled in this type of work.
- .5 Ground shielding as per cable manufacturer's instructions.
- .6 Take necessary precautions when handling cable on reel to ensure that no damage will result in uncoiling process.
- .7 No splices are allowed unless justified by cable pulling tension calculations and approved in writing by Parks Canada Representative. Obtain approval of splice location from Parks Canada Representative.

**END OF SECTION**

**Part 1            General**

**1.1            RELATED REQUIREMENTS**

- .1        Section 01 33 00 - Submittal Procedures.
- .2        Section 01 61 00 - Common Product Requirements.
- .3        Section 01 74 11 – Cleaning.
- .4        Section 01 78 00 - Closeout Submittals.

**1.2            REFERENCE STANDARDS**

- .1        CSA International
  - .1        CAN/CSA-C22.2 No.18-98 (R2003), Outlet Boxes, Conduit Boxes and Fittings.
  - .2        CAN/CSA-C22.2 No.65-03 (R2008), Wire Connectors (Tri-National Standard with UL 486A-486B and NMX-J-543-ANCE-03).
- .2        National Electrical Manufacturers Association (NEMA)

**1.3            ACTION AND INFORMATIONAL SUBMITTALS**

- .1        Submit in accordance with Section 01 33 00 - Submittal Procedures.
- .2        Product Data:
  - .1        Submit manufacturer's instructions, printed product literature and data sheets for wire and box connectors] and include product characteristics, performance criteria, physical size, finish and limitations.

**1.4            CLOSEOUT SUBMITTALS**

- .1        Submit in accordance with Section 01 78 00 - Closeout Submittals.
- .2        Operation and Maintenance Data: submit operation and maintenance data for wire and box connectors for incorporation into manual.

**1.5            DELIVERY, STORAGE AND HANDLING**

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

## **Part 2 Products**

### **2.1 MATERIALS**

- .1 Pressure type wire connectors to: CAN/CSA-C22.2 No.65, with current carrying parts of copper or copper alloy sized to fit copper and aluminum conductors as required.
- .2 Fixture type splicing connectors to: CAN/CSA-C22.2 No.65, with current carrying parts of copper sized to fit copper conductors 10 AWG or less.
- .3 Bushing stud connectors: to NEMA to consist of:
  - .1 Connector body and stud clamp for aluminum and copper conductors.
  - .2 Clamp for stranded copper conductors.
  - .3 Clamp for stranded aluminum conductors.
  - .4 Stud clamp bolts.
  - .5 Bolts for copper bar and conductors.
  - .6 Bolts for aluminum conductors.
- .4 Clamps or connectors for armoured cable, aluminum sheathed cable, TECK cable, and flexible conduit as required to: CAN/CSA-C22.2 No.18.

## **Part 3 Execution**

### **3.1 EXAMINATION**

- .1 Verification of Conditions: verify that conditions of substrate previously installed under other Sections or Contracts are acceptable for wire and box connectors installation in accordance with manufacturer's written instructions.
  - .1 Visually inspect substrate in presence of Consultant.
  - .2 Inform Consultant of unacceptable conditions immediately upon discovery.
  - .3 Proceed with installation only after unacceptable conditions have been remedied and after receipt of written approval to proceed from Consultant.

### **3.2 INSTALLATION**

- .1 Remove insulation carefully from ends of conductors and cables, and:
  - .1 Apply coat of zinc joint compound on aluminum conductors prior to installation of connectors.
  - .2 Install mechanical pressure type connectors and tighten screws with appropriate compression tool recommended by manufacturer. Installation shall meet secureness tests in accordance with CAN/CSA-C22.2 No.65.
  - .3 Install fixture type connectors and tighten to CAN/CSA-C22.2 No.65. Replace insulating cap.
  - .4 Install bushing stud connectors in accordance with NEMA.

### **3.3 CLEANING**

- .1 Progress Cleaning: clean in accordance with Section 01 74 11 - Cleaning.
  - .1 Leave Work area clean at end of each day.

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

**END OF SECTION**

**Part 1            General**

**1.1               RELATED REQUIREMENTS**

- .1      Section 01 33 00 - Submittal Procedures.
- .2      Section 26 05 00 - Common Work Results for Electrical.
- .3      Section 26 05 20 - Wire and Box Connectors - (0-1000 V).
- .4      Section 26 05 34 - Conduits, Conduit Fastenings and Conduit Fittings.
- .5      Section 31 23 33 - Excavating, Trenching and Backfilling.

**1.2               PRODUCT DATA**

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

**1.3               DELIVERY, STORAGE AND HANDLING**

- .1      Packaging Waste Management: remove for reuse of packaging materials.

**Part 2            Products**

**2.1               FACILITY WIRES**

- .1      Conductors: stranded for 10 AWG and larger. Minimum size: 12 AWG.
- .2      Copper and Aluminum conductors: size as indicated, with minimum 600 V insulation of cross-linked thermosetting polyethylene material rated RW90 XLPE, Non Jacketted.

**2.2               TECK 90 CABLE**

- .1      Cable: in accordance with Section 26 05 00 - Common Work Results for Electrical.
- .2      Conductors:
  - .1          Grounding conductor: copper, as indicated.
  - .2          Circuit conductors: copper unless indicated on drawings, size as indicated on drawings.
- .3      Insulation:
  - .1          Cross-linked polyethylene XLPE.
  - .2          Rating: 600 V.
- .4      Inner jacket: polyvinyl chloride material.
- .5      Armour: interlocking aluminum.
- .6      Overall covering: thermoplastic polyvinyl chloride, compliant to applicable Building Code classification for this project.

- 
- .7 Fastenings:
    - .1 One hole steel straps to secure surface cables 50 mm and smaller. Two hole steel straps for cables larger than 50 mm.
    - .2 Channel type supports for two or more cables at
    - .3 Threaded rods: 6 mm diameter to support suspended channels.
  - .8 Connectors:
    - .1 Watertight approved for TECK cable.

## **2.3 ARMOURED CABLES**

- .1 Conductors: insulated, copper unless indicated on drawings, size as indicated on drawings.
- .2 Type: AC90.
- .3 Armour: interlocking type fabricated from aluminum strip.
- .4 Type: ACWU90 jacket over thermoplastic armour and compliant to applicable Building Code classification for this project wet locations.
- .5 Connectors: anti short connectors.

## **2.4 ALUMINUM SHEATHED CABLE**

- .1 Conductors: copper, size as indicated.
- .2 Insulation: cross linked polyethylene rated 600V.
- .3 Sheath: aluminum applied to form continuous corrugated sheath.
- .4 Outer jacket: thermoplastic applied over sheath and to be compliant to applicable Building Code classification for this project direct burial.
- .5 Fastenings for aluminum sheathed cable:
  - .1 One hole steel straps to secure surface cables 25 mm and smaller. Two hole steel straps for cables larger than 25 mm. Use aluminum strap only with single conductor cable.
  - .2 Channel type supports for two or more cables at
  - .3 Threaded rods: 6 mm diameter to support suspended channels.

## **2.5 COMMUNICATION AND CONTROL CABLE**

- .1 Conductors: copper, in accordance with end-device vendor's requirements.
- .2 Insulation: in accordance with end-device vendor's requirements.
- .3 Armoured where free-run or in tray to protect cables from rodents.

**Part 3            Execution**

**3.1                FIELD QUALITY CONTROL**

- .1      Perform tests in accordance with Section 26 05 00 - Common Work Results for Electrical.
- .2      Perform tests using method appropriate to site conditions and to approval of Consultant and local authority having jurisdiction over installation.
- .3      Perform tests before energizing electrical system.

**3.2                GENERAL CABLE INSTALLATION**

- .1      Install underground cable in conduit, in trenches in accordance with drawings and Section 31 23 33 Excavating, Trenching and Backfilling.
- .2      Terminate cables in accordance with Section 26 05 20 - Wire and Box Connectors - (0-1000 V).
- .3      Cable Colour Coding: to Section 26 05 00 - Common Work Results for Electrical.
- .4      Conductor length for parallel feeders to be identical.
- .5      Lace or clip groups of feeder cables at distribution centres, pull boxes, and termination points.
- .6      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.
- .7      Branch circuit wiring for surge suppression receptacles and permanently wired computer and electronic equipment to be 2-wire circuits only, i.e. common neutrals not permitted.
- .8      Provide numbered wire collars for control wiring. Numbers to correspond to control shop drawing legend. Obtain wiring diagram for control wiring.
- .9      Non-metallic sheathed cable is not permitted, there shall be no exceptions.

**3.3                INSTALLATION OF BUILDING WIRES**

- .1      Install wiring as follows:
  - .1      In conduit systems in accordance with Section 26 05 34 - Conduits, Conduit Fastenings and Conduit Fittings.
  - .2      In conduit installed in underground installations in accordance with drawings, Section 26 05 34 - Conduits, Conduit Fastenings and Conduit Fittings and Section 31 23 33 Excavating, Trenching and Backfilling.

**3.4            INSTALLATION OF TECK90 CABLE (0 -1000 V)**

- .1        Group cables wherever possible on channels.
- .2        Install cable securely supported by hangers and straps.

**3.5            INSTALLATION OF ARMOURED CABLES**

- .1        Group cables wherever possible in trenches and on supports.

**3.6            INSTALLATION OF ALUMINUM SHEATHED CABLE**

- .1        Group cables wherever possible in trenches and on supports.

**3.7            INSTALLATION OF COMMUNICATION AND CONTROL CABLES**

- .1        Install communication cables in underground ducts/conduits, in conduit and in flexible metallic conduit.
- .2        Communication and control cables installed in tray or free-run shall be armoured.
- .3        All Communication cables shall be protected from damage by rodents.
- .4        Ground control cable shield.

**END OF SECTION**

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**1 GENERAL**

**1.1 SECTION INCLUDES**

- .1 Materials and installation for connectors and terminations.

**1.2 RELATED SECTIONS**

- .1 Section 01 33 00 - Submittal Procedures.

**1.3 REFERENCES**

- .1 Canadian Standards Association (CSA International)
  - .1 CSA C22.2 No. 41, Grounding and Bonding Equipment.

**1.4 PRODUCT DATA**

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

**1.5 WASTE MANAGEMENT AND DISPOSAL**

- .1 Separate and recycle waste materials in accordance with Waste Management Plan.
- .2 Remove from site and dispose of all packaging materials at appropriate recycling facilities.
- .3 Collect and separate for disposal paper, plastic corrugated cardboard packaging material for recycling in accordance with Waste Management Plan.

**2 PRODUCTS**

**2.1 CONNECTORS AND TERMINATIONS**

- .1 Copper compression connectors to CSA C22.2 as required sized for conductors.

**3 EXECUTION**

**3.1 INSTALLATION**

- .1 Bond and ground as required to CSA C22.2 No. 41.

**END OF SECTION**

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**1 GENERAL**

**1.01 SUBMITTALS**

- .1 Submit shop drawings for products and accessories.

**2 PRODUCTS**

**2.01 BASIC MATERIALS**

- .1 Ground Rods: Copper-clad steel, 20 mm (3/4") diameter circular cross-sectionalized, with driving cap and bronze tip, overall length of 3 m (10') long.
- .2 Ground Plate Electrodes: copper, surface area 0.2 m<sup>2</sup>, minimum 1.6mm thick.
- .3 Ground Conductors: Solid copper, insulated and bare to suit application and code requirements; and bond conductors.
- .4 Ground Connections:
  - .1 Below Grade: Cadweld as supplied by Erico Products or approved equal, exothermic-welded type connectors.
  - .2 Above Grade or in Manholes: Compression type connectors; Exothermic connections permitted above grade if approved by Parks Canada Representative.
  - .3 When making ground and bonding connections, apply a corrosion inhibitor to contact surfaces. Use corrosion inhibitor appropriate for protecting a connection between metals used.
- .5 Ground Pit: Flush in grade grounding pits with following features:
  - .1 removable cast concrete cover with recessed lifting handle;
  - .2 cast iron or precast concrete pit;
  - .3 ground rod, ground clamps and grounding conductors as required;
  - .4 clay sewer tile for proper drainage.
- .6 Gravel/Stones: Provide gravel and crushed stones as required by local governing authorities to suit application. Layers to be of thickness not less than required by local governing authorities.
- .7 Miscellaneous ancillary components to complete grounding and bonding work to requirements of local governing electrical authority and codes.

### 3 EXECUTION

#### 3.01 GENERAL GROUNDING AND BONDING REQUIREMENTS

- .1 Provide required grounding and bonding work in accordance with drawings, local governing electrical authority, governing authorities having jurisdiction and local governing electrical inspection authority. Confirm requirements with local governing electrical utility.
- .2 Perform ground resistivity testing of soil to determine measurement expressed in ohm meters as defined by IEEE 80-2000 - IEEE Guide for Safety in A.C. Substation Grounding. Use 4-point method with Model 4610 or Model 4500 Ground Tester or equal, and insertion of four equally spaced and in-line electrodes into test area.
- .3 Grounding system for the electrical utility pad mount transformer is within the scope of this project shall and shall be supplied and installed by a Fortis approved contractor.
- .4 As shown on drawings, provide a ground electrode system in accordance with Canadian Electrical Code and Fortis Alberta, driven into grade in an arrangement as required and interconnected with minimum No. 3/0 bare copper conductor. Drive and bury ground rods at depth in accordance with local governing electrical code and suitable for the site conditions.
- .5 Effectively bond metallic pipe services such as, gas mains, water mains, and dry risers, to main grounding terminal at their point of entry. Make connections to services with purpose-made grounding clamps.
- .6 When buses are in place, bolts have been tightened, and lugs have been installed, coat entire installation with two (2) 100% covering coats of suitable shellac to prevent bus from oxidizing.
- .7 Throughout complex, solidly ground systems and make required grounding connections to electrical devices and apparatus. Ground conductors to be insulated copper wire connected with approved fittings in accordance with local governing electrical code.
- .8 Effectively bond building structures to main grounding system (grid).
- .9 Provide separate insulated ground wire for each isolated ground receptacle.
- .10 Ground metal sheathing and any exposed metal vertical structural elements of buildings. Ground metal fences enclosing electrical equipment. Bond any metal equipment platforms which support electrical equipment to equipment ground. Bond rooftop equipment.
- .11 Provide service conductors exceeding 400 amperes with minimum No. 3/0 AWG grounding conductors, unless otherwise noted.
- .12 Make ground connections in slab or buried underground using local governing electrical authority approved welded copper connections.

**Commented [MW1]:** Should this not be outside of the building? I expected us to want to install this a few meters outside of the building. We have provided a conduit out of the mechanical building to support this installation.

- .13 Provide minimum no. 3/0 AWG insulated copper ground conductors and LAN Room copper ground bus mounted on walls with standoff insulators in each LAN room. Connect ground bus to computer equipment racks and to building ground system.
- .14 Ground conductors not sized on drawings are to be sized in accordance with Fortis Alberta for primary grounding and local governing electrical authority requirements for secondary grounding. Ground conductor size is to be no smaller than requirements specified herein this article or on drawings.

**END OF SECTION**

**Part 1            General**

**1.1               RELATED REQUIREMENTS**

- .1      Section 01 33 00 - Submittal Procedures.
- .2      Section 01 45 00 - Quality Control.
- .3      Section 01 74 21 - Construction/Demolition Waste Management and Disposal.
- .4      .

**1.2               REFERENCES**

- .1      American National Standards Institute/Institute of Electrical and Electronics Engineers (ANSI/IEEE)
  - .1      ANSI/IEEE 837-02, Qualifying Permanent Connections Used in Substation Grounding.

**1.3               ACTION AND INFORMATIONAL SUBMITTALS**

- .1      Provide submittals in accordance with Section 01 33 00 - Submittal Procedures.
- .2      Product Data:
  - .1      Provide manufacturer's printed product literature, specifications and datasheet and include product characteristics, performance criteria, physical size, finish and limitations.
- .3      Quality assurance submittals: provide in accordance with Section 01 45 00 - Quality Control.
  - .1      Manufacturer's Instructions: provide manufacturer's written installation instructions and special handling criteria, installation sequence, cleaning procedures.

**1.4               DELIVERY, STORAGE AND HANDLING**

- .1      Deliver, store and handle materials in accordance with manufacturer's written instructions.
- .2      Waste Management and Disposal:
  - .1      Separate waste materials for recycling in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.

**Part 2            Products**

**2.1               MATERIALS**

- .1      Rod electrodes: In accordance with Fortis Alberta Specifications.
- .2      Conductors:.

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- .3 Accessories: non-corroding, necessary for complete grounding system, type, size material in accordance with Fortis Alberta Specifications, including:
    - .1 Grounding and bonding bushings.
    - .2 Protective type clamps.
    - .3 Bolted type conductor connectors.
    - .4 Thermit welded type conductor connectors.
    - .5 Bonding jumpers, straps.
    - .6 Pressure wire connectors.
  - .4 Wire connectors and terminations: In accordance with Fortis Alberta Specifications.

### **Part 3 Execution**

#### **3.1 INSTALLATION**

- .1 All work shall be performed by a Fortis Alberta pre-approved contractor.
- .2 Install continuous grounding system including, electrodes, conductors, connectors and accessories as indicated and to requirements of Fortis Alberta and the local authority having jurisdiction.
- .3 Ground fences to grounding system independent of station ground.
- .4 Install connectors and cadweld in accordance with manufacturer's instructions.
- .5 Protect exposed grounding conductors during and after construction.
- .6 Make connections, and connections to bollards, in accordance with Fortis Alberta Specifications.

#### **3.2 ELECTRODE INSTALLATION**

- .1 Install ground rod electrodes in accordance with Fortis Alberta Specifications
- .2 Install ground rod electrodes at transformer location.
- .3 Make special provision for installing electrodes that will give acceptable resistance to ground value, where rock or sand terrain prevails.

#### **3.3 EQUIPMENT GROUNDING**

- .1 Install grounding connections as indicated to typical building equipment including: metallic water pipes, gas pipes, and neutral bus. Non current carrying parts of: transformers, generators, motors, circuit breakers, current transformers, frames and fuse cutout bases. Cable sheaths, raceways, pipe work, screen guards, panelboards, transformers. Meter and relay cases. Any exposed building metal, within or forming part of enclosure. Fences. 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].

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### **3.4 NEUTRAL GROUNDING**

- .1 Connect transformer neutral and distribution neutral together using Fortis Approved conductors to one side of ground test link, the other side of the test link being connected directly to main ground. Ensure the main distribution neutral is bonded directly to transformer neutral and not to main ground.
- .2 Interconnect electrodes and neutrals at each grounding installation.
- .3 Ground transformer tank with continuous conductor from tank ground lug through connector on ground bus to primary neutral. Connect neutral bushing at transformer in accordance with Fortis Alberta Specifications.

### **3.5 GROUNDING IN PULLBOXES**

- .1 Install conveniently located grounding stud, electrode, in accordance with Fortis Alberta Specifications at in each pullbox.
- .2 Install ground rod with lug for grounding connection in each pullbox so that top projects through bottom of pullbox.

### **3.6 CABLE SHEATH GROUNDING**

- .1 Bonding of single conductor, metallic sheathed cables shall only be performed by Fortis Alberta crews.

### **3.7 FIELD QUALITY CONTROL**

- .1 Perform tests in accordance with Section 26 05 00 - Common Work Results for Electrical.
- .2 Engage Fortis Alberta to inspect grounding and perform ground resistance test before backfill.
- .3 Perform earth loop test and resistance tests using method appropriate to site conditions and to approval of Fortis Alberta and Departmental Representative and local authority having jurisdiction.
- .4 Perform test before energizing electrical system.
- .5 Provide step-and-touch potential calculations using measured station ground resistance measurements. Submit test result and inspection certificate before energizing electrical system.

**END OF SECTION**

**Part 1            General**

**1.1            RELATED REQUIREMENTS**

- .1      Section 01 33 00 - Submittal Procedures.
- .2      Section 01 61 00 - Common Product Requirements.
- .3      Section 01 74 11 - Cleaning.
- .4      Section 01 78 00 - Closeout Submittals.
- .5      Section 26 05 00 - Common Work Results for Electrical.

**1.2            REFERENCES**

- .1      American National Standards Institute /Institute of Electrical and Electronics Engineers (ANSI/IEEE)
  - .1      ANSI/IEEE 837-02, IEEE Standard for Qualifying Permanent Connections Used in Substation Grounding.

**1.3            ACTION AND INFORMATIONAL SUBMITTALS**

- .1      Submit in accordance with Section 01 33 00 - Submittal Procedures.
- .2      Product Data:
  - .1      Submit manufacturer's instructions, printed product literature and data sheets for grounding equipment and include product characteristics, performance criteria, physical size, finish and limitations.
- .3      Sustainable Design Submittals:
  - .1      Construction Waste Management:
    - .1      Submit project Waste Management Plan highlighting recycling and salvage requirements.
    - .2      Submit calculations on end-of-project recycling rates, salvage rates, and landfill rates demonstrating that 50% of construction wastes were recycled or salvaged.

**1.4            CLOSEOUT SUBMITTALS**

- .1      Submit in accordance with Section 01 78 00 - Closeout Submittals.
- .2      Operation and Maintenance Data: submit operation and maintenance data for [grounding equipment] for incorporation into manual.

**1.5            DELIVERY, STORAGE AND HANDLING**

- .1      Deliver, store and handle materials in accordance with Section 01 61 00 - Common Product Requirements 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:

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- .1 Store materials off ground in a dry location and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.
  - .2 Store and protect grounding equipment from nicks, scratches, and blemishes.
  - .3 Replace defective or damaged materials with new.
  - .4 Develop Construction Waste Management Plan related to Work of this Section.
  - .5 Packaging Waste Management: remove for reuse of pallets, crates, padding, packaging materials as specified in Construction Waste Management Plan.

## **Part 2 Products**

### **2.1 EQUIPMENT**

- .1 Clamps for grounding of conductor: size as required to electrically conductive underground water pipe.
- .2 Copper conductor: minimum 6 m long for each electrode, bare, stranded, tinned, soft annealed, in accordance with Fortis Alberta Specifications.
- .3 Rod electrodes: in accordance with Fortis Alberta Specifications.
- .4 Grounding conductors: bare stranded copper, tinned, soft annealed, size as indicated.
- .5 Insulated grounding conductors: green, copper conductors, size in accordance with Canadian Electrical Code (latest edition).
- .6 Ground bus: copper, size as indicated, complete with insulated supports, fastenings, connectors.
- .7 Non-corroding accessories necessary for grounding system, type, size, material as indicated, including but not necessarily limited to:
  - .1 Grounding and bonding bushings.
  - .2 Protective type clamps.
  - .3 Bolted type conductor connectors.
  - .4 Thermit welded type conductor connectors.
  - .5 Bonding jumpers, straps.
  - .6 Pressure wire connectors.

## **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 grounding equipment installation in accordance with manufacturer's written instructions.
  - .1 Visually inspect substrate in presence of Departmental Representative and Parks Canada Staff.
  - .2 Inform Departmental Representative of unacceptable conditions immediately upon discovery.

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- .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 Grounding conductors shall be protected from potential damage from rodents.
- .2 Install complete permanent, continuous grounding system including, electrodes, conductors, connectors, accessories. Where EMT is used, run ground wire in conduit.
- .3 Install connectors in accordance with manufacturer's instructions.
- .4 Protect exposed grounding conductors from mechanical injury and damage from rodents.
- .5 Make buried connections, and connections to conductive water main, electrodes, using permanent mechanical connectors or inspectable wrought copper compression connectors to ANSI/IEEE 837.
- .6 Use mechanical connectors for grounding connections to equipment provided with lugs.
- .7 Soldered joints not permitted.
- .8 Install bonding wire for flexible conduit, connected at one ends to grounding bushing, solderless lug, clamp or cup washer and screw. Neatly cleat bonding wire to exterior of flexible conduit.
- .9 Install flexible ground straps for bus duct enclosure joints, where such bonding is not inherently provided with equipment.
- .10 Install separate ground conductor to outdoor lighting standards.
- .11 Connect building structural steel and metal siding to ground by welding copper to steel.
- .12 Make grounding connections in radial configuration only, with connections terminating at single grounding point. Avoid loop connections.
- .13 Bond single conductor, metallic armoured cables to cabinet at supply end, and load end.
- .14 Ground secondary service pedestals.

### **3.3 MAINTENANCE HOLES**

- .1 Install conveniently located grounding stud, electrode, stranded copper conductor in each maintenance hole.
- .2 Install ground rod in each maintenance hole so that top projects through bottom of maintenance hole. Provide with lug to which grounding connection can be made. Confirm ground resistance meets or exceeds Canadian Electrical Code minimum requirements.

### **3.4 ELECTRODES**

- .1 Make ground connections to continuously conductive underground water pipe on street side of water meter.
- .2 Install water meter shunt.
- .3 Install concrete encased electrodes in building foundation footings, with terminal connected to grounding network.

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- .4 Install rod electrodes and make grounding connections in accordance with Fortis Alberta Specifications.
  - .5 Bond separate, multiple electrodes together.
  - .6 Use size copper conductors sized in accordance with Fortis Specifications for connections to electrodes.
  - .7 Make special provision for installing electrodes that will give acceptable resistance to ground value where rock or sand terrain prevails. Ground as indicated.

### **3.5 SYSTEM AND CIRCUIT GROUNDING**

- .1 Install system & circuit grounding connections to neutral of secondary 120/208V system.

### **3.6 EQUIPMENT GROUNDING**

- .1 Install grounding connections to typical equipment included in, but not necessarily limited to following list. Service equipment, transformers, switchgear, duct systems, frames of motors, motor control centres, starters, control panels, building steel work, generators, elevators and escalators, distribution panels, outdoor lighting, cable trays.

### **3.7 GROUNDING BUS**

- .1 Install copper grounding bus mounted on insulated supports on wall of electrical room and communication equipment room.
- .2 Ground items of electrical equipment in electrical room and IT equipment in communication equipment room to ground bus with individual bare stranded copper connections size 2/0AWG.

### **3.8 COMMUNICATION & INSTRUMENTATION SYSTEMS**

- .1 Install grounding connections for telephone, sound, fire alarm, security systems, intercommunication systems as follows:
  - .1 Make communication, instrumentation & control grounding systems in accordance with instrumentation & control vendors' requirements.
  - .2 Security systems and Intercommunication systems in accordance with Parks Canada's systems requirements.

### **3.9 FIELD QUALITY CONTROL**

- .1 Perform tests in accordance with Section 26 05 00 - Common Work Results for Electrical.
- .2 Perform ground continuity and resistance tests using method appropriate to site conditions and to approval of Departmental Representative and local authority having jurisdiction over installation.
- .3 Perform tests before energizing electrical system.
- .4 Disconnect ground fault indicator during tests.

### **3.10 CLEANING**

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

- 
- .1 Leave Work area clean at end of each day.
  - .2 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment in accordance with Section 01 74 11 - Cleaning.
  - .3 Waste Management: separate waste materials for recycling in accordance with.
    - .1 Remove recycling containers and bins from site and dispose of materials at appropriate facility.

**END OF SECTION**

## **1 General**

### **1.01 REFERENCES**

- .1 American National Standards Institute (ANSI)/Institute of Electrical and Electronics Engineers (IEEE)
  - .1 ANSI/IEEE 837-1989(R2014), Qualifying Permanent Connections Used in Grounding.
- .2 Canadian Standards Association, (CSA International)
  - .1 CSA C22.1-12, Canadian Electrical Code, Part 1 (25<sup>th</sup> Edition), Safety Standard for Electrical Installations.

### **1.02 WASTE MANAGEMENT AND DISPOSAL**

- .1 Separate and recycle waste materials in accordance with Section 01 74 19 – Waste Management and Disposal.

### **1.03 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 grounding equipment and include product characteristics, performance criteria, physical size, finish and limitations.
- .3 Sustainable Design Submittals:
  - .1 Construction Waste Management:
    - .2 Submit project Waste Management Plan highlighting recycling and salvage requirements.
      - .1 Submit calculations on end-of-project recycling rates, salvage rates, and landfill rates demonstrating that 50% of construction wastes were recycled or salvaged.

### **1.04 CLOSEOUT SUBMITTALS**

- .1 Submit in accordance with Section 01 78 00 - Closeout Submittals.
- .2 Operation and Maintenance Data: submit operation and maintenance data for grounding equipment for incorporation into manual.

## **1.05 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 in dry location and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area. Confirm material storage area with general contractor and departmental representative prior to commencement of work on this project
  - .2 Store and protect grounding equipment from nicks, scratches, and blemishes.
  - .3 Replace defective or damaged materials with new.
- .4 Packaging Waste Management: remove for reuse and return as specified in accordance with Section 01 74 19 - Waste Management and Disposal.

## **2 Products**

### **2.01 EQUIPMENT**

- .1 Grounding conductors: bare stranded copper, tinned, soft annealed, size as required by CEC.
- .2 Insulated grounding conductors: green, size as required by CEC.
- .3 Non-corroding accessories necessary for grounding system, type, size, material as indicated, including but not necessarily limited to:
  - .1 Grounding and bonding bushings.
  - .2 Protective type clamps.
  - .3 Bolted type conductor connectors.
  - .4 Bonding jumpers, straps.
  - .5 Pressure wire connectors.

## **3 Execution**

### **3.01 INSTALLATION GENERAL**

- .1 Install complete permanent, continuous grounding system including, electrodes, conductors, connectors, accessories. Where EMT is used, run ground wire in conduit.
- .2 Tie into existing main grounding bus bar. Transformer, CDP, and panel board fed from the main distribution centre shall be grounded by grounding conductors sized in accordance with the Canadian Electrical Code. The ground wire shall be terminated at each end with an appropriate grounding lug which shall be connected to the equipment ground bus. Ground wire to be green. Use mechanical connectors for grounding connections to equipment provided with lugs.
- .3 Sub panel shall be grounded with a green ground wire run back to the panel from which it is fed. The ground conductor shall be sized according to the Canadian Electrical Code or as indicated on drawings.

- .4 All distribution centers, and all panels requiring equipment grounds shall contain a ground bus of adequate size, and tapped for lugs for the ground wire required.
- .5 All bolted connections must be accessible. Soldered joints not permitted.
- .6 Install connectors in accordance with manufacturer's instructions.
- .7 Protect exposed grounding conductors from mechanical injury.
- .8 Use mechanical connectors for grounding connections to equipment provided with lugs.
- .9 Install bonding wire for flexible conduit, connected at one end to grounding bushing, solderless lug, clamp or cup washer and screw. Neatly cleat bonding wire to exterior of flexible conduit.
- .10 Make grounding connections in radial configuration only, with connections terminating at single grounding point. Avoid loop connections.
- .11 Bond single conductor, metallic armoured cables to cabinet at supply end.

### **3.02 SYSTEM AND CIRCUIT GROUNDING**

- .1 Install grounding system to CEC.

### **3.03 EQUIPMENT GROUNDING**

- .1 Install grounding connections to typical equipment included in, but not necessarily limited to following list. Service equipment, duct systems, frames of motors, starters, control panels, building steel work, elevators, distribution panels.

### **3.04 FIELD QUALITY CONTROL**

- .1 Perform tests in accordance with Section 26 05 07 – Inspection of Electrical Installation
- .2 Perform ground continuity and resistance tests using method appropriate to site conditions and to approval of Departmental Representative and local authority having jurisdiction over installation.
- .3 Perform tests before energizing electrical system.
- .4 Disconnect ground fault indicator during tests.

### **3.05 CLEANING**

- .1 Progress Cleaning: clean in accordance with Section 01 74 00 – Cleaning.
  - .1 Leave work area clean at end of each day.
- .2 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment in accordance with Section 01 74 00 – Cleaning.
- .3 Waste Management: separate waste materials in accordance with Section 01 74 19 – Waste Management and Disposal.
  - .1 Remove recycling containers and bins from site and disposal of materials at appropriate facility.

**END OF SECTION**

---

## **1 GENERAL**

### **1.1 RELATED SECTIONS**

- .1 Section 01 74 11 – Cleaning.

### **1.2 WASTE MANAGEMENT AND DISPOSAL**

- .1 Separate and recycle waste materials in accordance with Waste Management Plan.
- .2 Remove from site and dispose of all packaging materials at appropriate recycling facilities.
- .3 Fold up metal banding, flatten and place in designated area for recycling.

## **2 PRODUCTS**

### **3 SUPPORT CHANNELS**

- .1 U-shape, size 41 x 41 mm, 2.5 mm thick, surface mounted or suspended.

## **4 EXECUTION**

### **4.1 INSTALLATION**

- .1 Secure equipment to masonry, tile and plaster surfaces with lead anchors or nylon shields.
- .2 Secure equipment to poured concrete with expandable inserts.
- .3 Secure equipment to hollow masonry walls or suspended ceilings with toggle bolts.
- .4 Support equipment, conduit or cables using clips, spring loaded bolts, cable clamps designed as accessories to basic channel members.
- .5 Fasten exposed conduit or cables to building construction or support system using straps.
  - .1 One-hole steel straps to secure surface conduits and cables 50 mm and smaller.
  - .2 Two-hole steel straps for conduits and cables larger than 50 mm.
  - .3 Beam clamps to secure conduit to exposed steel work.
- .6 Suspended support systems.
  - .1 Support individual cable or conduit runs with 6 mm dia. threaded rods and spring clips.
  - .2 Support two (2) or more cables or conduits on channels supported by 6 mm dia. threaded rod hangers where direct fastening to building construction is impractical.

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- .7 For surface mounting of two or more conduits use channels at 1.5 m on centre spacing.
  - .8 Provide metal brackets, frames, hangers, clamps and related types of support structures where indicated or as required to support conduit and cable runs.
  - .9 Ensure adequate support for raceways and cables dropped vertically to equipment where there is no wall support.
  - .10 Do not use wire lashing or perforated strap to support or secure raceways or cables.
  - .11 Do not use supports or equipment installed for other trades for conduit or cable support except with permission of other trade and approval of Engineer.
  - .12 Install fastenings and supports as required for each type of equipment cables and conduits, and in accordance with manufacturer's installation recommendations.

#### **4.2 CLEANING**

- .2 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**

---

## **1 GENERAL**

### **1.1 RELATED REQUIREMENTS**

- .1 Section 01 33 00 - Submittal Procedures.
- .2 Section 26 05 00 - Common Work Results for Electrical.

### **1.2 REFERENCES**

- .1 Canadian Standards Association (CSA International)
  - .1 CSA C22.1-18, Canadian Electrical Code, Part 1, 24<sup>th</sup> Edition.

### **1.3 ACTION AND INFORMATIONAL SUBMITTALS**

- .1 Provide submittals in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Product Data:
  - .1 Provide manufacturer's printed product literature, specifications and datasheet and include product characteristics, performance criteria, physical size, finish and limitations.
- .3 Provide shop drawings: in accordance with Section 01 33 00 - Submittal Procedures.

### **1.4 DELIVERY, STORAGE AND HANDLING**

- .1 Waste Management and Disposal:
  - .1 Separate waste materials for reuse and recycling in accordance with Waste Management Plan.

## **2 PRODUCTS**

### **2.1 JUNCTION AND PULL BOXES**

- .1 Construction: welded steel enclosure.
- .2 Covers Flush Mounted: 25 mm minimum extension all around.
- .3 Covers Surface Mounted: screw-on covers.

### **2.2 EXECUTION**

### **2.3 JUNCTION AND PULL BOXES INSTALLATION**

- .1 Install pull boxes in inconspicuous but accessible locations.
- .2 Only main junction and pull boxes are indicated. Install additional pull boxes as required by CSA C22.1.

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**2.4 IDENTIFICATION**

- .1 Equipment Identification: to Section 26 05 00 - Common Work Results for Electrical.
- .2 Identification Labels: size 2 indicating system name, voltage and phase, or as indicated.

**END OF SECTION**

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## **1 GENERAL**

### **1.1 RELATED REQUIREMENTS**

- .1 Section 01 33 00 - Submittal Procedures.
- .2 Section 01 61 00 - Common Product Requirements.

### **1.2 REFERENCES**

- .1 Canadian Standards Association (CSA International)
  - .1 CSA C22.1-09, Canadian Electrical Code, Part 1, 21<sup>st</sup> Edition.

### **1.3 SUBMITTALS**

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

### **1.4 DELIVERY, STORAGE AND HANDLING**

- .1 Deliver, store and handle materials in accordance with Section 01 61 00 - Common Product Requirements.
- .2 Waste Management and Disposal:
  - .1 Separate waste materials for reuse and recycling in accordance with Waste Management Plan.

## **2 PRODUCTS**

### **2.1 OUTLET AND CONDUIT BOXES GENERAL**

- .1 Size boxes in accordance with CSA C22.1.
- .2 102 mm square or larger outlet boxes as required.
- .3 Gang boxes where wiring devices are grouped.
- .4 Blank cover plates for boxes without wiring devices.
- .5 Combination boxes with barriers where outlets for more than one system are grouped.

### **2.2 GALVANIZED STEEL OUTLET BOXES**

- .1 One-piece electro-galvanized construction.
- .2 Single and multi-gang flush device boxes for flush installation, minimum size 76 x 50 x 38 mm or as indicated. 102 mm square outlet boxes when more than one conduit enters one side with extension and plaster rings as required.
- .3 Utility boxes for outlets connected to surface-mounted EMT conduit, minimum size 102 x 54 x 48 mm.

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- .4 102 mm square or octagonal outlet boxes for lighting fixture outlets.
  - .5 Extension and plaster rings for flush mounting devices in finished plaster walls.

## **2.3 MASONRY BOXES**

- .1 Electro-galvanized steel masonry boxes for devices flush mounted in exposed block walls.

## **2.4 CONCRETE BOXES**

- .1 Electro-galvanized sheet steel concrete type boxes for flush mount in concrete with matching extension and plaster rings as required.

## **2.5 CONDUIT BOXES**

- .1 Cast FS boxes with factory-threaded hubs and mounting feet for surface wiring of devices.

## **2.6 FITTINGS - GENERAL**

- .1 Bushing and connectors with nylon insulated throats.
- .2 Knock-out fillers to prevent entry of debris.
- .3 Conduit outlet bodies for conduit up to 35 mm and pull boxes for larger conduits.
- .4 Double locknuts and insulated bushings on sheet metal boxes.

## **3 EXECUTION**

### **3.1 INSTALLATION**

- .1 Support boxes independently of connecting conduits.
- .2 Fill boxes with paper, sponges or foam or similar approved material to prevent entry of debris during construction. Remove upon completion of work.
- .3 For flush installations mount outlets flush with finished wall using plaster rings to permit wall finish to come within 6 mm of opening.
- .4 Provide correct size of openings in boxes for conduit, mineral insulated and armoured cable connections. Do not install reducing washers.
- .5 Vacuum clean interior of outlet boxes before installation of wiring devices.
- .6 Identify systems for outlet boxes as required.

**END OF SECTION**

**Part 1 General**

**1.1 RELATED REQUIREMENTS**

- .1 Section 01 74 11 - Cleaning

**1.2 REFERENCES**

- .1 Canadian Standards Association (CSA International)
  - .1 CAN/CSA C22.2 No. 18-98(R2003), Outlet Boxes, Conduit Boxes, Fittings and Associated Hardware, A National Standard of Canada.
  - .2 CSA C22.2 No. 45-M1981(R2003), Rigid Metal Conduit.
  - .3 CSA C22.2 No. 56-04, Flexible Metal Conduit and Liquid-Tight Flexible Metal Conduit.
  - .4 CSA C22.2 No. 83-M1985(R2003), Electrical Metallic Tubing.
  - .5 CSA C22.2 No. 211.2-M1984(R2006), Rigid PVC (Unplasticized) Conduit.
  - .6 CSA C22.2 No. 211.1-M1984(R2016), Rigid types EB1 and DB2/ES2 PVC (Unplasticized) Conduit.
  - .7 CAN/CSA C22.2 No. 227.3-05, Nonmetallic Mechanical Protection Tubing (NMPT), A National Standard of Canada (February 2006).

**1.3 ACTION AND INFORMATIONAL SUBMITTALS**

- .1 Provide submittals in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Product data: submit manufacturer's printed product literature, specifications and datasheets.
  - .1 Submit cable manufacturing data.
- .3 Quality assurance submittals:
  - .1 Test reports: submit certified test reports.
  - .2 Certificates: submit certificates signed by manufacturer certifying that materials comply with specified performance characteristics and physical properties.
  - .3 Instructions: submit manufacturer's installation instructions.

**1.4 WASTE MANAGEMENT AND DISPOSAL**

- .1 Separate waste materials for recycling.
- .2 Place materials defined as hazardous or toxic waste in designated containers.
- .3 Ensure emptied containers are sealed and stored safely for disposal away from children.

**Part 2 Products**

**2.1 CABLES AND REELS**

- .1 Provide cables on reels or coils.

.1 Mark or tag each cable and outside of each reel or coil, to indicate cable length, voltage rating, conductor size, and manufacturer's lot number and reel number.

.2 Each coil or reel of cable to contain only one continuous cable without splices.

.3 Identify cables for exclusively dc applications.

## 2.2 CONDUITS

.1 Epoxy coated conduit: to CSA C22.2 No. 45, with zinc coating and corrosion resistant epoxy finish inside and outside.

.2 Electrical metallic tubing (EMT): to CSA C22.2 No. 83, with couplings.

.3 Type DB2 pvc conduit: to CSA C22.2 No. 211.1 for horizontal underground routes only.

.4 Rigid pvc conduit: to CSA C22.2 No. 211.2.

.5 Flexible pvc conduit: to CAN/CSA-C22.2 No. 227.3.

## 2.3 CONDUIT FASTENINGS

.1 One hole malleable steel straps to secure surface conduits 50 mm and smaller.

.1 Two hole steel straps for conduits larger than 50 mm.

.2 Beam clamps to secure conduits to exposed steel work.

.3 Channel type supports for two or more conduits.

.4 Threaded rods, 6 mm diameter, to support suspended channels.

## 2.4 CONDUIT FITTINGS

.1 Fittings: to CAN/CSA C22.2 No. 18, manufactured for use with conduit specified. Coating: same as conduit.

.2 Ensure factory "ells" where 90 degrees bends for 25 mm and larger conduits.

.3 Watertight connectors and couplings for EMT.

.1 Set-screws are not acceptable.

## 2.5 EXPANSION FITTINGS FOR RIGID CONDUIT

.1 All underground conduits shall have weatherproof expansion fittings with internal bonding assembly suitable for 200 mm linear expansion at distances in accordance with manufactures requirements. Expansion fittings shall be inspected and photographed prior to backfill.

.2 Watertight expansion fittings with integral bonding jumper suitable for linear expansion and 19 mm deflection.

.3 Weatherproof expansion fittings for linear expansion at entry to panel.

## 2.6 FISH CORD

.1 Polypropylene.

.2 Install pull rope inside of all empty conduits not receiving internal conductors as part of this contract.

### Part 3 Execution

#### 3.1 MANUFACTURER'S INSTRUCTIONS

- .1 Compliance: comply with manufacturer's written recommendations or specifications, including product technical bulletins, handling, storage and installation instructions, and datasheets.

#### 3.2 INSTALLATION

- .1 Install conduits to conserve headroom in exposed locations and cause minimum interference in spaces through which they pass.
- .2 Conduits shall be hidden in walls within the washroom areas
- .3 Surface mount conduits within the mechanical room.
- .4 Use electrical metallic tubing (EMT) indoors, where not subject to mechanical injury.
- .5 DB2 pvc conduit is permitted only for horizontal underground installations buried in sand, as also indicated on drawings.
- .6 Use rigid pvc conduit for all underground installations where DB2 pvc conduit is not permitted.
- .7 Install expansion joints for underground conduit installations every 30 metres or in accordance with manufacturers calculated requirements.
- .8 Minimum conduit size for lighting and power circuits: 19 mm.
- .9 Bend conduit cold:
  - .1 Replace conduit if kinked or flattened more than 1/10th of its original diameter.
- .10 Mechanically bend steel conduit over 19 mm diameter.
- .11 Field threads on rigid conduit must be of sufficient length to draw conduits up tight.
- .12 Install fish cord in empty conduits.
- .13 Run 2- 25 mm spare conduits up to ceiling space and 2- 25 mm spare conduits down to ceiling space from each flush panel.
  - .1 Terminate these conduits in 152 x 152 x 102 mm junction boxes in ceiling space or in case of an exposed concrete slab, terminate each conduit in flush concrete and surface type boxes.
- .14 Remove and replace blocked conduit sections.
  - .1 Do not use liquids to clean out conduits.
- .15 Dry conduits out before installing wire.
- .16 For septic system cabling, only Teck cables with suitable hazardous-rated glands will be permitted to provide connections to instruments and pumps. Conduit may not be used as a continuous raceway between septic system devices and local junction boxes. PVC conduit shown on drawing E1.3 may be used to provide a means of pulling Teck cables below grade.
- .17 Areas within 3 metre radius of septic tank vents shall be rated as Zone 2 areas. Where Teck cable cannot be used and continuous electrical raceways are required within these

**Commented [MW1]:** Where is it stated that conduit from the septic tank into junction boxes must have mechanical protection from septic tank gases entering into mechanical room.

**Commented [MW2]:** Conduit inside of new washroom building to be steel conduit, not rigid PVC.

area, the raceways shall meet all requirements listed in the Canadian Electrical Code Section 18 (Hazardous Locations) for Zone 2 within the radius. This includes any continuous raceway that may enter the Zone 2 area at either end.

- .18 Where required, install conduit seals in accordance with Canadian Electrical Code and in accordance with manufacturer's instructions.

### 3.3 SURFACE CONDUITS

- .1 Run parallel or perpendicular to building lines.
- .2 Locate conduits behind infrared or gas fired heaters with 1.5 m clearance.
- .3 Run conduits in flanged portion of structural steel.
- .4 Group conduits wherever possible on [suspended] [surface] channels.
- .5 Do not pass conduits through structural members except as indicated.
- .6 Do not locate conduits less than 75 mm parallel to steam or hot water lines with minimum of 25 mm at crossovers.

### 3.4 CONDUITS IN CAST-IN-PLACE CONCRETE

- .1 Locate to suit reinforcing steel.
  - .1 Install in centre one third of slab.
- .2 Protect conduits from damage where they stub out of concrete.
- .3 Install sleeves where conduits pass through slab or wall.
- .4 Provide oversized sleeve for conduits passing through waterproof membrane, before membrane is installed.
  - .1 Use cold mastic between sleeve and conduit.
- .5 Conduits in slabs: minimum slab thickness 4 times conduit diameter.
- .6 Encase conduits completely in concrete with minimum 25 mm concrete cover.
- .7 Organize conduits in slab to minimize cross-overs.

### 3.5 CONDUITS IN CAST-IN-PLACE SLABS ON GRADE

- .1 Run conduits below slab and encase in 75 mm concrete envelope.
  - .1 Provide 50 mm of sand over concrete envelope below floor slab.

### 3.6 CONDUITS UNDERGROUND

- .1 Sized and in locations as shown on the drawings.
- .2 Slope conduits to provide drainage.
- .3 Install red polyethylene warning tape as shown on drawings.

### 3.7 CLEANING

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

- 
- .2      On completion and verification of performance of installation, remove surplus materials, excess materials, rubbish, tools and equipment.

**END OF SECTION**

**Part 1            General**

**1.1               RELATED REQUIREMENTS**

- .1       Section 01 33 00 - Submittal Procedures.
- .2       Section 01 74 21 - Construction/Demolition Waste Management and Disposal
- .3       Section 26 05 07 – Field Inspection of Electrical Installation.

**1.2               REFERENCES**

- .1       Canadian Standards Association (CSA International)
  - .1       CAN/CSA C22.1 No.126.1-02, Metal Cable Tray Systems.
- .2       National Electrical Manufacturers Association (NEMA)
  - .1       NEMA VE 1-2002, Metal Cable Tray Systems.
  - .2       NEMA VE 2-2001, Cable Tray Installation Guidelines.

**1.3               ACTION AND INFORMATIONAL SUBMITTALS**

- .1       Provide submittals in accordance with Section 01 33 00 - Submittal Procedures.
- .2       Product Data: submit manufacturer's product data sheets for cable tray indicating dimensions, materials, and finishes, including classifications and certifications.
- .3       Shop Drawings: submit shop drawings showing materials, finish, dimensions, accessories, layout, and installation details.
- .4       Identify types of cabletroughs used.
- .5       Show actual cabletrough installation details and suspension system.

**1.4               WASTE MANAGEMENT AND DISPOSAL**

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

**Part 2            Products**

**2.1               CABLETROUGH**

- .1       Cabletroughs and fittings: to CAN/CSA C22.1 No. 126.1.
- .2       wire mesh type to CAN/CSA C22.2 No.126.1.
- .3       Trays: galvanized steel 300mm wide with depth of 50mm.
- .4       Fittings: horizontal elbows, end plates, drop outs, vertical risers and drops, tees, wyes, expansion joints and reducers where required, manufactured accessories for cabletrough supplied.
  - .1       Radii on fittings: 300mm minimum.
- .5       Solid covers for complete cabletrough system including fittings.

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- .6 Barriers where different voltage systems are in same cabletrough.
  - .7 Ground cable trays with #2 AWG bare copper conductor attached to each tray section in accordance with CEC requirements.
  - .8 Provide fire stop material at firewall penetrations.

## **2.2 SUPPORTS**

- .1 Provide splices, supports for a continuously grounded system.

## **Part 3 Execution**

### **3.1 INSTALLATION**

- .1 The Contractor is responsible for coordinating cable tray installations with building mechanical system installations to mitigate conflicts between installations.
- .2 Cable trays are to be installed to maximize headspace within the mechanical room while not interfering with mechanical ducts. Cable trays should change height in room as required to avoid mechanical systems and maximize headspace.
- .3 Prior to beginning cable tray installations, the Contractor shall meet on site with the Departmental Representative to discuss the layout of the proposed cable tray inside of the mechanical room to ensure the cable tray meets the requirements for future electrical and communication system installations outside the scope of this contract.
- .4 Install complete cabletrough system in accordance with NEMA VE 2.
- .5 Support cabletrough on both sides.
- .6 Remove sharp burrs or projections to prevent damage to cables or injury to personnel.

### **3.2 CABLES IN CABLETROUGH**

- .1 Install cables individually.
- .2 Lay cables into cabletrough. Use rollers when necessary to pull cables.
- .3 Secure cables in cabletrough at 3 m centres, with nylon ties.
- .4 Identify cables at both ends with wire tags.

**END OF SECTION**

**Part 1            GENERAL**

**1.1            RELATED REQUIREMENTS**

- .1      Section 01 33 00 - Submittal Procedures.
- .2      Section 01 74 11 - Cleaning
- .3      Section 31 23 33.01 - Excavating, Trenching and Backfilling

**1.2            REFERENCES**

- .1      CSA International
  - .1      CAN/CSA-Z809-16, Sustainable Forest Management.
- .2      Forest Stewardship Council (FSC)
  - .1      FSC-STD-01-001-(latest edition), FSC Principle and Criteria for Forest Stewardship.
- .3      Insulated Cable Engineers Association, Inc. (ICEA)
- .4      Sustainable Forestry Initiative (SFI)
  - .1      SFI-2014 Standard.

**1.3            ACTION AND INFORMATIONAL SUBMITTALS**

- .1      Submit in accordance with Section 01 33 00 - Submittal Procedures.
- .2      Product Data:
  - .1      Submit manufacturer's instructions, printed product literature and data sheets for cables and include product characteristics, performance criteria, physical size, finish and limitations.
  - .2      Wood Certification: submit vendor's and manufacturer's Chain-of-Custody Certificate number for CAN/CSA-Z809 or FSC or SFI certified wood.

**1.4            DELIVERY, STORAGE AND HANDLING**

- .1      Deliver, store and handle materials in accordance with manufacturer's written instructions.
- .2      Delivery and Acceptance Requirements: deliver materials to site in original factory packaging, labelled with manufacturer's name and address.
- .3      Storage and Handling Requirements:
  - .1      Store materials off ground, in dry location and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.
  - .2      Store and protect cables from nicks, scratches, and blemishes.
  - .3      Replace defective or damaged materials with new.
- .4      Develop Waste Reduction Workplan related to Work of this Section.

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- .5 Packaging Waste Management: remove for reuse of pallets, crates, padding, packaging materials as specified in Waste Reduction Workplan in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal

## **Part 2 Products**

### **2.1 CABLE PROTECTION**

- .1 38 x 140 mm planks pressure treated with clear, coloured, or copper naphthenate or 5% pentachlorophenol solution, water repellent preservative.

### **2.2 MARKERS**

- .1 For Fortis Alberta Electric lines: warning method in accordance with Fortis Alberta Standards.
- .2 For electric 120 or 240V lines: Red 150mm wide polyethylene warning tape with black lettering, wording to be: "CAUTION: Buried Electric Line Below". To be buried 450mm to 600mm above conduit.
- .3 For Communication lines: Orange 150mm wide polyethylene warning tape with black lettering, wording to be: "CAUTION: Buried Communications Line Below". To be buried 450mm to 600mm above conduit.

## **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 cable installation in accordance with manufacturer's written instructions.
- .1 Visually inspect substrate in presence of Parks Canada Representative.
- .2 Inform Parks Canada 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 Parks Canada Representative.

### **3.2 DIRECT BURIAL OF CABLES**

- .1 Direct burial conductor cables are not to be installed as part of this project.
- .2 After sand bed in accordance with Section 31 23 33.01 - Excavating, Trenching and Backfilling, is in place, lay cables maintaining a minimum 75 mm clearance from each side of trench to nearest cable.
- .1 Do not pull cable into trench.
- .3 Include offsets for thermal action and minor earth movements.
- .1 Offset cables 150 mm minimum for each 60m run, maintaining minimum cable separation and bending radius requirements.

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- .4 Make termination and splice only as indicated leaving 0.6 m minimum of surplus cable in each direction.
    - .1 Make splices and terminations in accordance with manufacturer's written recommendations using approved splicing kits.
  - .5 Underground cable splices not acceptable.
  - .6 Minimum permitted radius at cable bends for rubber, plastic or lead covered cables, 8 times diameter of cable or in accordance with manufacturer's written recommendations; for metallic armoured cables, 12 times diameter of cables or in accordance with manufacturer's instructions.
  - .7 Cable separation:
    - .1 Maintain minimum separation between cables as shown on drawings.
    - .2 Maintain 300 mm minimum horizontal separation between low and high voltage cables.
    - .3 When low voltage cables cross high voltage cables maintain 300 mm vertical separation with low voltage cables in upper position.
    - .4 At crossover, maintain 75 mm minimum vertical separation between low voltage cables and 150 mm between high voltage cables.
    - .5 Maintain 300 mm minimum lateral and vertical separation for fire alarm and control cables when crossing other cables, with communication cables in upper position.
    - .6 Install treated planks on lower cables 0.6 m minimum in each direction at crossings.
  - .8 After sand protective cover specified in Section 31 23 33.01 - Excavating, Trenching and Backfilling, is in place, install continuous red polyethylene warning tape as indicated on drawings to cover length of run.

### **3.3 CABLE INSTALLATION IN DUCTS**

- .1 Install cables as indicated in ducts.
- .2 Do not pull spliced cables inside ducts.
- .3 Install multiple cables in duct simultaneously.
- .4 Use CSA approved lubricants of type compatible with cable jacket to reduce pulling tension.
- .5 To facilitate matching of colour coded multiconductor control cables reel off in same direction during installation.
- .6 Before pulling cable into ducts and until cables are properly terminated, seal ends of lead covered cables with wiping solder; seal ends of non-leaded cables with moisture seal tape.
- .7 After installation of cables, seal duct ends with duct sealing compound.

### **3.4 MARKERS**

- .1 Install warning tape in accordance with drawings.

- 
- .2 Mark underground splices.
  - .3 Where markers are removed to permit installation of additional cables, reinstall existing markers.
  - .4 Lay tape flat and centred over cable at depth from finish grade as indicated on drawings.

### **3.5 FIELD QUALITY CONTROL**

- .1 Perform tests in accordance with Section 26 05 00 - Common Work Results for Electrical.
- .2 Perform tests using qualified personnel.
  - .1 Include necessary instruments and equipment.
- .3 Check phase rotation and identify each phase conductor of each feeder.
- .4 Check each feeder for continuity, short circuits and grounds.
  - .1 Ensure resistance to ground of circuits is not less than 50 megohms.
- .5 Pre-acceptance tests:
  - .1 After installing cable but before splicing and terminating, perform insulation resistance test with 1000 V megger on each phase conductor.
  - .2 Check insulation resistance after each splice and/or termination to ensure that cable system is ready for acceptance testing.
- .6 Acceptance Tests:
  - .1 Ensure that terminations and accessory equipment are disconnected.
  - .2 Ground shields, ground wires, metallic armour and conductors not under test.
  - .3 High Potential (Hipot) Testing.
    - .1 Conduct hipot testing to original factory test voltage in accordance with manufacturer's recommendations.
  - .4 Leakage Current Testing:
    - .1 Raise voltage in steps from zero to maximum values as specified by manufacturer for type of cable being tested.
    - .2 Hold maximum voltage specified time period by manufacturer.
    - .3 Record leakage current at each step.
- .7 Provide Parks Canada Representative a list of test results showing location at which each test was made, circuit tested and result of each test.
- .8 Remove and replace entire length of cable if cable fails to meet any of test criteria.

### **3.6 CLEANING**

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

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- .3 Waste Management: separate waste materials for recycling in accordance with Waste Management Plan.
    - .1 Remove recycling containers and bins from site and dispose of materials at appropriate facility.
- 3.7 PROTECTION**
- .1 Repair damage to adjacent materials caused by cables installation.

**END OF SECTION**

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**1 General**

**1.1 WORK INCLUDED**

- .1 General inspection of all electrical equipment.
- .2 Specific equipment testing as specified herein or in other sections of the specifications.
- .3 Power Distribution System testing including insulation resistance testing, load balance, and voltage testing.
- .4 Building Systems testing.
- .5 Submittal of test reports.
- .6 Instruction for the Owner's staff in the cleaning, maintenance and operation of the building systems, equipment, and finishes.

**2 Products**

- .1 Provide all instruments, meters, and equipment required to conduct tests during and at the conclusion of the project.

**3 Execution**

**3.1 GENERAL EQUIPMENT INSPECTION**

- .1 Visually inspect all equipment delivered to the site, to identify damage due to transportation, handling, or placing into position. Verify the content of the equipment with the bill of material and note any missing items. Document all defects or damage noted and submit to the Electrical Consultant.
- .2 Check all bus connections, wiring, and other joints that are made at equipment shipping splits and ensure that the equipment sections are properly bolted together.
- .3 Ensure that the equipment is clean and free of debris before proceeding with testing or energization of the equipment.
- .4 Verify the phasing connections of the incoming and / or outgoing connections to the equipment.
- .5 Visually check air gap and surface clearances, phase to phase and phase to ground. Document any clearances that appear to be below the CSA standard for the equipment.
- .6 Ensure that ground connections are provided to C.E.C. requirements and as specified.

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### **3.2 LOW VOLTAGE SWITCHGEAR AND SWITCHBOARDS**

- .1 Randomly check 10% of bus connections for proper torque. If any connections fail the test, check another 10% until all of the samples pass.
- .2 Test and calibrate all component parts including air or power circuit breakers, instruments and control devices and instrument transformers.

### **3.3 POWER FACTOR CORRECTION**

- .1 Assist the manufacturer's representative with the testing and commissioning of the power factor correction unit.

### **3.4 POWER CIRCUIT BREAKERS**

- .1 Inspect the breaker for any physical damage, inspect all linkages and wiring and ensure that the breaker is properly lubricated.
- .2 Close the breaker and verify that it cannot be removed or inserted into its cell in the closed position.
- .3 Check operation of mechanical interlocks, racking mechanism, position indicators and other mechanical parts.
- .4 Check all contacts and current carrying parts for corrosion, dirt, other foreign matter. Clean as required.
- .5 Operate the breaker open and closed, first in the test position and then in the connected position. Exercise both the manual and electrical operating mechanisms.
- .6 Set the overcurrent trip device to the settings specified by the Electrical Consultant and verify the operation by using secondary current injection.

### **3.5 INTERRUPTER SWITCHES AND FUSES**

- .1 Check the switch for any physical damage, inspect all insulators and barriers, and ensure that the switch is properly lubricated.
- .2 Check fuse mounts, clamps, and holders for tightness and alignment.
- .3 Operate the switch and check safety interlocks for proper operation.

### **3.6 MOTOR STARTERS**

- .1 Coordinate all motor starter installations with mechanical contractor and instrumentation & control contractor.
- .2 Verify that motor starters are configured as shown on electrical, mechanical and instrumentation & control drawings.

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- .2 Perform operational checks with the load disconnected to ensure correct operation of motor starters and all interlocks. Check all motor starters provided. If any starters fail the test, inform Departmental Representative and Parks Canada Staff.
  - .3 Confirm proper overload heaters are provided to match the motor horsepower rating.
  - .4 Take voltage and ampere readings on all phases of each motor feeder with motors operating under full load conditions.

### **3.7 ADJUSTABLE FREQUENCY DRIVES**

- .1 Assist the manufacturer's representative with the verification and testing of all of the AFD's installed by this Contract.
- .2 The AFD manufacturer shall supply on site start-up, commissioning and operator training. Allow for all cost and labour for as many trips as necessary to complete these requirements.
- .3 Upon completion of installation of the system, a factory trained manufacturer's representative shall perform a completion verification and inspection of all installed equipment. A certificate of verification confirming that the commissioning and inspection have been performed, shall be submitted.
- .4 The factory trained manufacturer's representative shall witness all connections between building automated controls system (BACS) and the AFD and shall assist the controls contractor with all input and output connections between the AFD and the BACS.

### **3.8 MANUAL TRANSFER SWITCH**

- .1 Complete the following manual transfer switch tests on site:
  - .1 Operation of switch with a Parks Canada supplied generator feeding the facility.
  - .2 Transfer to loads back to normal power, and shutdown of portable generator.
- .2 Submit certified copy of test results to Electrical Consultant.
- .3 Operate each breaker and monitor the output to confirm that all of the contacts are operating properly.
- .4 Observe that loads on UPS are not affected by the operation of the manual transfer switch.

### **3.9 DISTRIBUTION SYSTEM ELECTRICAL TESTING**

- .1 Take voltage readings at all power distribution points including service switchgear motor control centres, distribution panels, transformer primary and secondary terminals, and lighting panelboards.
- .2 Insulation Resistance Testing
  - .1 Megger test all branch circuits, feeders, and equipment buswork prior to energization. Insulation resistance shall conform to the requirements of the

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Canadian Electrical Code, the local inspection authority, and the Electrical Consultant.

.1 Test circuits and equipment rated up to 350 volt with a 500 volt instrument.

.2 Load Balance

.1 Measure phase current to panelboards and distribution centres with all possible loads operating. Adjust branch circuit connections as required to obtain best balance of current between phases and record final measurements after adjustments have been completed. Load unbalance shall not exceed fifteen percent (15%).

.2 Measure phase voltages at loads and adjust transformer taps to within 2% of rated voltage of equipment.

.3 Submit, on completion of work, a report listing phase and neutral currents on panelboards, operating under normal load. State hour and date on which each load was measured, and voltage at time of test.

### **3.10 UPS SYSTEM**

.1 Assist the manufacturer's representative with the verification and testing of the UPS units installed in this contract.

.2 Demonstrate that the UPS can supply the loads for the required run-time specified by the design.

### **3.11 BUILDING SYSTEMS TESTING**

.1 Functionally test all building systems components including lighting switches, power outlet receptacles, photoelectric controls, panelboard breakers, contactors, lighting fixtures, emergency battery packs, hand dryers, manual motor starters, etc.

.2 Assist the Parks Canada Representative and their Security Contractor with the verification and testing of the security systems fire and/or smoke detection devices.

### **3.12 EMERGENCY AND EXIT LIGHTING**

.1 Confirm operation of all emergency lighting units, remote emergency lights. Record the following for each emergency light remote head:

- room location
- which emergency lighting unit energizes the head
- status of operation (pass or fail test)

.2 Confirm operation of all exit lights on both normal, and emergency power. Record the following for each exit light:

- room locations
- which emergency lighting unit energizes the exit light
- status of operation on normal power (pass or fail)
- status of operation on emergency power (pass or fail)

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### **3.13 TEST REPORTING**

- .1 Submit general equipment inspection report to confirm that all equipment defined within this section and shown on the drawings has been tested and noting any damage or defects.
- .2 Submit distribution system electrical test reports including:
  - insulation resistance test results for all feeders and equipment except for 120/208 volt branch circuit wiring,
  - power distribution system voltage readings,
  - load balance readings,
  - motor starters,
  - motors,
  - Lighting luminaire performance and lighting control performance,
  - Certified data cable test reports,
  - Security System functionality,
  - Communication Systems functionality,
  - Instrumentation & Control equipment,
  - UPS functionality testing,
  - Manual transfer switch and portable generator inter-functionality.

**END OF SECTION**

**1 GENERAL**

**1.01 SUBMITTALS**

- .1 Submit shop drawings for products specified in this Section.

**1.02 LOCAL ELECTRICAL UTILITY REQUIREMENTS**

- .1 Comply with latest conditions of supply requirements of local governing electrical utility. Confirm exact requirements with Fortis Alberta (AKA: local governing electric utility) and coordinate Fortis Alberta requirements with respective Divisions of Work providing such work. Provisions to accommodate local governing electrical utility requirements generally include but are not limited to following:
  - .1 preconstruction meeting;
  - .2 inspection: on site access for local governing electrical utility inspector to be on duty for duration of work;
  - .3 underground inspection: submission of approval drawings and application for inspection prior to any inspection of work;
  - .4 approval of work and materials by local governing electrical utility inspector prior to any backfilling work.
- .2 In case of discrepancies or conflicts between Drawings and Specifications and local governing authority standards, contact Parks Canada Representative and obtain direction. If direction is not available prior to close of Bids, include for most costly arrangement, but ensure that direction is obtained prior to start of Work.
- .3 All work related to electric utilities shall be completed by a Fortis Alberta approved contractor.

**1.03 INCOMING ELECTRIC SERVICE WORK**

- .1 Included in Division 01 is a cash allowance to cover costs for local governing electrical utility to extend their electrical system to service property. Local governing electrical utility work to include but not be limited to provision of following:
  - .1 primary conductors and secondary conductors installed below ground;
  - .2 required primary and secondary connections to main power transformer;
  - .3 pad mounted main power transformer;
  - .4 testing of primary conductors, main power transformer and connections;
  - .5 required off site work to incoming system;
  - .6 low voltage metering components.

#### **1.04 SERIES RATED COMBINATIONS**

- .1 Series rated combinations of over-current protective devices are not permitted.

#### **1.05 PROTECTIVE COORDINATION AND EQUIPMENT WITHSTAND RATINGS**

- .1 Obtain results of coordination study and short circuit calculations reports and Parks Canada Representative comments and incorporate into shop drawings of electrical distribution equipment (high voltage and low voltage equipment as applicable). Do not order equipment until shop drawings submission process has been completed to satisfaction of Parks Canada Representative.
- .2 Provide ratings for electrical equipment, circuit protective devices and bussing to interrupt and withstand short circuit faults greater than available fault current at source of supply.

#### **1.06 BREAKERS**

- .1 Breakers to be NEMA rated types, and for switchboards and distribution panelboards, breakers when frame sized 225 amperes and greater, to be provided with solid state adjustable trip units with long time, short time and instantaneous time (LSI) functions and time delays. Set trip units at ratings as per coordination study as required for proper selective coordination. Provide ground fault alarm and trip functions at breaker trip rating above 600A, as coordinated with results of coordination study and as confirmed with Parks Canada Representative.
- .2 Size breakers as per drawings and/or schedules, but in absence of direction, size breakers to suit intended application, to suit coordination study requirements and in accordance with local governing electrical code.

### **2 PRODUCTS**

### **3 EXECUTION**

#### **3.01 INCOMING ELECTRIC SERVICE WORK**

- .1 As confirmed with local governing electrical utility, include for but not be limited to provision of following:
  - .1 provision of secondary conductors installed underground in DB2 conduit for horizontal runs in sand beds and rigid PVC conduit elsewhere;
  - .2 coordinate secondary connections to main power transformer with Fortis Alberta;
  - .3 testing of secondary conductors in accordance with Fortis Alberta requirements;
  - .4 coordination with Fortis Alberta Metering for installation of metering components.

#### **3.02 ELECTRICAL CONNECTIONS FOR OWNER EQUIPMENT**

- .1 Provide wiring to all locations shown on drawings.

**END OF SECTION**

**1 GENERAL**

**1.01 SUBMITTALS**

- .1 Submit shop drawings for products specified in this Section.

**2 PRODUCTS**

**2.01 DISTRIBUTION PANELBOARDS**

- .1 Panelboards as per drawing schedules, manufactured to CSA Standard C22.2. No. 29. Generally, interrupting capacities are scheduled, but in absence of direction, provide to capacity to suit intended application to suit local governing electrical code.
- .2 Circuit breaker type distribution panelboards to be single or double row as required and complete with moulded case, bolt-on circuit breakers calibrated for 40°C (104°F) ambient temperature and conforming to CSA Standard C22.2 No. 5 (Note No. 1). Locate both main lugs and neutral bar at same end. Shield main lugs through a removable cover. Identify each circuit breaker adjacent breaker handle. Group mount circuit breakers.
- .3 A solidly bonded equipment ground bar and a neutral bar to be provided.
- .4 Bus bars (phases, grounds and neutrals) to be hard drawn electrical grade copper, silver plated and extend throughout panel.
- .5 Interior trim to be of dead-front construction to shield user from energized parts. Main circuit breaker and main lug interiors to be field convertible for top or bottom incoming feed.
- .6 Panelboard boxes to be constructed of code gauge, galvanized steel constructed in accordance with UL 50 requirements, complete with removable ends and wiring gutter space on sides in accordance with CSA requirements.
- .7 Include main breakers for panelboards as scheduled. Main breakers to be automatic moulded case breakers with solid state trip units.
- .8 Enclosures to be minimum NEMA 3R. Surface mounted panelboards to be complete with drip shield. Ventilation louvres to be designed to prevent penetration of water spray onto live components. Conduit entries to be sealed watertight. Units to be factory painted in ANSI grey enamel.
- .9 Panelboard enclosure shall be equipped with full length gasketed door with hidden piano hinge and 3 point pad lockable handle. Supply 2 keys with each lock.

- .10 Panelboards to include for future breaker provisions as noted on schedules. Make provision for space for breakers, bussing for full panel size and where spare breakers are scheduled, breakers with required connector kits. Unused spaces provided, unless otherwise specified, to be fully equipped for future devices, including appropriate connectors and mounting hardware.
- .11 Panelboards as scheduled to be complete with integral surge protective devices (SPDs). Unit to be factory installed and connected onto bussing through integral disconnect/breaker as recommended by manufacturer. Unit to include diagnostic package with status indicators on each phase, audible alarm and Form C alarm contacts. Unit to be maintenance free. SPD features include:
  - .1 in accordance with ANSI/UL 1449 3rd Edition, IEEE C62.41, C62.45, UL 1283, and CSA Standards;
  - .2 maximum voltage protection rating to not exceed 700 V (120/208 V) (L-N, L-G, N-G);
  - .3 minimum nominal discharge current rating of 10 kA;
  - .4 minimum short circuit current rating of 100 kA;
  - .5 peak surge current 150 KA per phase;
  - .6 indicator LED on units to identify protection integrity status of metal-oxide varistors; indicator to be visible on front of panelboard;
  - .7 high-performance EMI/RFI noise rejection filter;
  - .8 standard manufacturer's minimum 5 years parts and labour warranty.
- .12 Acceptable manufacturers:
  - .1 Eaton (Cutler-Hammer);
  - .2 Schneider Electric (Square D);
  - .3 Approved Equivalent

### **3 EXECUTION**

#### **3.01 INSTALLATION OF DISTRIBUTION PANELBOARDS**

- .1 Provide distribution panelboards and install into locations and connect complete. Ensure adequate clearance is provided as per code requirements and as required for access for operation and maintenance.
- .2 Install pad mounted panelboards on concrete bases. Provide seismic restraints as required by local governing authorities and codes. Surface wall mount other panelboards, unless otherwise noted, independent of connecting conduit.

- .3 Equip each panelboard with suitable lugs to accommodate main and branch conductors as scheduled. Identify panelboard and breakers with Lamacoid identification nameplate with nomenclature to Parks Canada Representative's approval.
- .4 Connect SPD in accordance with manufacturer's instructions and with dedicated breaker.
- .5 Ground and bond equipment as per local governing electrical code and inspection authority requirements. Refer also to requirements of grounding and bonding article.
- .6 Additionally, refer to testing, coordination and verification requirements in Section entitled Electrical Work Analysis and Testing and include applicable requirements.

**END OF SECTION**

## **1 GENERAL**

### **1.01 SUBMITTALS**

- .1 Submit shop drawings for products specified in this Section.

## **2 PRODUCTS**

### **2.01 BRANCH CIRCUIT PANELBOARDS**

- .1 Eaton (Cutler-Hammer), "Pow-R-Line" series, factory assembled dead front panelboards as per schedules, manufactured to CSA Standard C22.2 No. 29 and local governing electrical code, and designed for sequence phase connection of branch circuit breakers.
- .2 As scheduled, panelboards are of types:
  - .1 "Pow-R-Line 1", 120/208 V, 3-phase and single phase with minimum "BAB" frame, bolt-on moulded case circuit breakers with a minimum interrupting capacity of 10 KA symmetrical at 208 V, unless otherwise scheduled. Where panelboards are schedule to include series rated provisions, provide breakers as recommended by panel manufacturer;
  - .3 Where ground fault circuit interrupting (GFCI) type breakers are required by code and/or scheduled, provide "Quicklag" ground fault, CSA Class "A", Group 1, combination thermal magnetic bolt-on circuit breakers with solid-state ground fault interrupters.
  - .4 Panelboards to be equipped with one (1) continuous bus bar per phase. Each bus bar to have sequentially phased branch circuit connectors limited to bolt-on branch circuit breakers. Bussing to be fully rated and of plated copper construction.
- .5 Panelboards are to be complete with:
  - .1 NEMA 3R, box constructed of code gauge galvanized steel with removable box ends, wiring gutter space on sides; conduit entries sealed water-tight;
  - .2 dead-front construction to shield user from energized parts;
  - .3 enclosure constructed of code gauge, hot zinc dipped galvanized steel constructed in accordance with UL 50 requirements; trim for flush or surface wall mounting as shown; front panel to not be removable with the door locked;
  - .4 hinged door with concealed fasteners, concealed hinge, chrome plated door latch and keyed alike lock with key;
  - .5 a steel frame holder and circuit directory card protected by clear acetate and secured to back of door, and Mylar circuit breaker identification strips;
  - .6 drip shield for surface mounted panelboards;
  - .7 copper neutral bars;
  - .8 200% sized neutrals for panels equipped with SPD units and for panels as scheduled;

- .9 solidly bonded equipment copper ground bar;
- .10 high strength, set screw type, anti-turning wire connectors;
- .11 current-carrying parts be insulated from ground and phase-to-phase by high dielectric strength thermoplastic;
- .12 isolated ground bus for panelboards feeding electrically sensitive equipment;
- .13 filler plates covering unused mounting space;
- .14 non-automatic and automatic main breaker to function as an isolating switch, where shown and as required;
- .15 ground fault circuit interrupting (GFCI) type breakers to feed devices as scheduled and for applications required by local governing codes;
- .16 arc fault circuit interrupter (AFCI) type breakers to feed devices as scheduled and for applications required by local governing codes.
- .6 Panels, doors and trim are to be factory painted with ANSI grey enamel finish. Recessed backboxes (tubs) need not be finished painted.
- .7 Equip breakers of frame size 225 amperes and greater, with solid state adjustable trip units.
- .8 Equip circuit breakers connected to dedicated equipment or devices with handle locks.
- .9 Include spare breakers as sized on schedules and future breaker provisions as noted on schedules. Future breaker provisions to include space for breakers, bussing for full panel size and where future breaker sizes are scheduled, required breaker connector kits.
- .10 Acceptable manufacturers are:
  - .1 Eaton (Cutler-Hammer);
  - .2 Schneider Electric (Square D);
  - .3 Approved equivalent

## **2.02 LOAD CENTRES**

- .1 Eaton (Cutler-Hammer), CSA approved, type BR load centres as follows:
  - .1 NEMA 1 enclosure manufactured from cold rolled 16 gauge steel and complete with ANSI grey enamel finish;
  - .2 front panel with hinge door and locking operator; front cover with trim to mount flush with wall onto recessed enclosure;
  - .3 single phase, 3-wire, 120/240 VAC; 10 KA IC;

- .4 copper bussing and bars;
  - .5 main non-automatic breaker;
  - .6 plug in type BR series breakers;
  - .7 60 amp main bussing rating;
  - .8 minimum sized to accommodate at least 20 breakers;
  - .9 Type BR-AFCI arc fault circuit interrupting type breakers to feed devices as scheduled and as required by local governing codes;
  - .10 Type BR-GFCI ground fault circuit interrupting type to feed devices as scheduled and as required by local governing codes;
  - .11 twin neutral with insulated cross strap for bonding applications as required by Code;
  - .12 drip shield for panels;
  - .13 typed circuit directing card.
- .2 Acceptable manufacturers are:
- .1 Eaton (Cutler-Hammer);
  - .2 Schneider Electric (Square D);
  - .3 Approved equivalent.

## **2.03 ENCLOSED CIRCUIT BREAKERS**

- .1 Eaton (Cutler-Hammer), moulded case, front operated, surface mounted, non-automatic circuit breakers sized on drawings, each secured in NEMA 3R wall mounting enclosure with steel front panel and arranged so that circuit breaker can be padlocked in OFF position. Cover interlocked such that cover cannot be opened if breaker is in ON position.
- .2 Acceptable manufacturers are:
  - .1 Eaton (Cutler-Hammer);
  - .2 Schneider Electric (Square D);
  - .3 Approved equivalent.

### **3 EXECUTION**

#### **3.01 INSTALLATION OF PANELBOARDS**

- .1 Provide factory assembled branch circuit panelboards and install into locations and connect complete. Ensure adequate clearance is provided as per code requirements and as required for access for operation and maintenance. Load panels with breakers as scheduled.
- .2 Support cabinets and enclosures independent of connecting conduit, and accurately install with reference to wall finishes.
- .3 Equip panelboards with suitable lugs or provisions to accommodate main and branch conductors scheduled.
- .4 Ground and bond equipment as per local governing electrical code and inspection authority requirements. Refer also requirements of Section entitled – Grounding and Bonding.
- .5 Conduits and cables shall enter the panels from the bottom only with weather-proof fittings.
- .6 Turn over to Parks Canada Representative, prior to application for a Certificate of Substantial Performance of Work, a quantity of two (2) panelboard cabinet or enclosure keys per panelboard.
- .7 Where two (2) or more panelboards are installed in one (1) cabinet, equip panelboards with double lugs and increase gutter capacity to accommodate additional cabling.
- .8 Identify panelboard breakers in a permanent manner, and complete typed panelboard circuit directories identifying circuit number and type and location of loads supplied from each breaker to Parks Canada Representative's approval.
- .9 Include for spaces for future breakers, spare breakers and additional breakers for miscellaneous mechanical loads are included as per schedules and as specified.
- .10 Test and verify ground fault circuit interrupting breakers as follows:
  - .1 demonstrate in presence of Parks Canada Representative that protected circuits will "trip" when a simulated ground fault is applied to "load" side of each circuit breaker/ground fault interrupter combination;
  - .2 megger load side neutral on GFCI protected branch circuits to ensure that neutral is not grounded on load side of GFCI;
  - .3 verify GFCI operation with a temporary load (100 watt lamp in an insulated socket with pigtail leads);
  - .4 provide a written report confirming that tests have been performed and that system is functioning properly.

- .11 Ground and bond panel as per local electrical code requirements. Refer also to requirements of grounding and bonding article.
- .12 Additionally, refer to testing, coordination and verification requirements in Section entitled Electrical Work Analysis and Testing and include applicable requirements.

### **3.02 INSTALLATION OF LOAD CENTRES**

- .1 Provide factory assembled load centres and connect complete. Ensure adequate clearance is provided as per code requirements and as required for access for operation and maintenance. Load panels with breakers as scheduled.
- .2 Support enclosures independent of connecting conduit, and accurately install with reference to wall finishes.
- .3 Equip enclosures with suitable lugs or provisions to accommodate main and branch conductors scheduled.
- .4 Identify breakers in a permanent manner, and complete typed panelboard circuit directories identifying circuit number and type and location of loads supplied from each breaker to Parks Canada Representative's approval.
- .5 Include for spaces for future breakers and spare breakers as per schedules.
- .6 Test and verify ground fault interrupting breakers as follows:
  - .1 demonstrate in presence of Parks Canada Representative that protected circuits will "trip" when a simulated ground fault is applied to "load";
  - .2 side of each circuit breaker/ground fault interrupter combination;
  - .3 megger load side neutral on GFI protected branch circuits to ensure that neutral is not grounded on load side of GFI;
  - .4 verify GFI operation with a temporary load (100 watt lamp in an insulated socket with pigtail leads);
  - .5 provide a written report confirming that tests have been performed and that system is functioning properly.
- .7 Ground and bond panel as per local electrical code requirements. Refer also to requirements of grounding and bonding article.
- .8 Additionally, refer to testing, coordination and verification requirements in Section entitled Electrical Work Analysis and Testing and include applicable requirements.

### **3.03      INSTALLATION OF ENCLOSED CIRCUIT BREAKERS**

- .1    Provide wall mounted enclosed, circuit breakers for equipment. Include required accessories. Secure to wall construction and connect complete.
- .2    Confirm exact locations prior to roughing-in.
- .3    Ground and bond equipment as per local governing electrical code and inspection authority requirements. Refer also to requirements of grounding and bonding article.
- .4    Provide a lamacoid identification nameplate for each enclosure. Confirm exact nomenclature with Parks Canada Representative prior to manufacturer.
- .5    Additionally, refer to testing, coordination and verification requirements in Section entitled Electrical Work Analysis and Testing and include applicable requirements.

**END OF SECTION**

**1. GENERAL**

**1.1 RELATED REQUIREMENTS**

- .1 Section 01 33 00 - Submittal Procedures.
- .2 Section 01 61 00 - Common Product Requirements.
- .3 Section 01 74 11 - Cleaning.
- .4 Section 01 78 00 - Closeout Submittals.
- .5 Section 26 05 00 - Common Work Results for Electrical.

**1.2 REFERENCE STANDARDS**

- .1 CSA International
  - .1 CAN/CSA C22.2 No.94.1-07, Enclosures for Electrical Equipment, Non Environment Considerations.
- .2 National Electrical Manufacturers Association (NEMA)
  - .1 NEMA 250-2008, Enclosures for Electrical Equipment (1000 Volts Maximum).
- .3 The Munsell System of Colour Notation

**1.3 ACTION AND INFORMATIONAL SUBMITTALS**

- .1 Submit in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Product Data:
  - .1 Submit manufacturer's instructions, printed product literature and data sheets for electrical cabinets and enclosures 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.

**1.4 CLOSEOUT SUBMITTALS**

- .1 Submit in accordance with Section 01 78 00 - Closeout Submittals.
- .2 Operation and Maintenance Data: submit operation and maintenance data for electrical cabinets and enclosures for incorporation into manual.

**1.5 DELIVERY, STORAGE AND HANDLING**

- .1 Deliver, store and handle materials in accordance with Section 01 61 00 - Common Product Requirements and with manufacturer's written instructions.
- .2 Delivery and Acceptance Requirements: deliver materials to site in original factory packaging, labelled with manufacturer's name and address.
- .3 Storage and Handling Requirements:

- .1 Store materials in a dry location and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.
- .2 Store and protect electrical cabinets and enclosures from nicks, scratches, and blemishes.
- .3 Replace defective or damaged materials with new.
- .4 Packaging Waste Management: remove for reuse by manufacturer and return of packaging materials as specified in Waste Management Plan.

## **2. PRODUCTS**

### **2.1 MATERIALS**

- .1 Enclosure constructed with 2.7 mm thick minimum steel, with weather and corrosion resistant finish to CAN/CSA C22.2, Munsell Notation 7.5GY3.5/1.5, size as indicated.
- .2 Entire enclosure to be capable of withstanding maximum impact force of 86 MN/m<sup>2</sup> area without rupture of material.
- .3 Removable enclosure panels with formed edges, galvanized steel external fasteners removable only from inside enclosure.
- .4 Equip enclosure with hot dipped galvanized mounting rails adjustable horizontally and vertically to enable mounting of equipment at any location within housing.
  - .1 Rails: 14 mm holes and 50 x 14 mm slots on 100 mm centres for horizontal adjustment.
  - .2 Holes in side panel flanges in 60 mm increments for vertical adjustment.
- .5 Cover: tamperproof, bolt-on, domed to shed water.
- .6 Door: 3 point latching, with padlocking means.
- .7 Ventilation panel constructed to allow air circulation yet preventing entry of foreign objects, wild life, and vermin.
- .8 Enclosure construction such as to allow configuration of single or ganged enclosures.
- .9 Enclosure capable of being shipped in knocked-down condition.

## **3. EXECUTION**

### **3.1 EXAMINATION**

- .1 Verification of Conditions: verify that conditions of substrate previously installed under other Sections or Contracts are acceptable for electrical cabinet and enclosure installation in accordance with manufacturer's written instructions.
  - .1 Visually inspect substrate in presence of Consultant and Parks Representative.
  - .2 Inform Consultant and Parks 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 Consultant and Parks Representative.

### **3.2 INSTALLATION**

- .1 Assemble enclosure in accordance with manufacturer's instructions and securely mount on building structure with channels, supports and fastenings.
- .2 Mount equipment in enclosure.
- .3 Label electrical cabinets and enclosure to Section 26 05 00 - Common Work Results for Electrical.

### **3.3 CLEANING**

- .1 Progress Cleaning: clean in accordance with Section 01 74 11 - Cleaning.
  - .1 Leave Work area clean at end of each day.
- .2 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment in accordance with Section 01 74 11 - Cleaning.
- .3 Waste Management: separate waste materials for recycling in accordance with the Waste Management Plan.
  - .1 Remove recycling containers and bins from site and dispose of materials at appropriate facility.

**END OF SECTION**

## **1 GENERAL**

### **1.01 SUBMITTALS**

- .1 Submit shop drawings for products specified in this Section.

## **2 PRODUCTS**

### **2.01 SWITCHES**

- .1 Switches to be CSA approved, ULC listed and labelled devices.
- .2 Hubbell Canada Inc., HBL 1221 Series, CSA approved, heavy duty, industrial grade, back, and side wired, AC quiet action toggle type, 20 ampere, 120-277 V switches. Switches to include steel-nickel plated bridge, nylon toggle, one piece rivetless copper alloy spring contact arm and terminal plate, silver cadmium oxide contacts, brass binding head screws, one piece integral grounding terminal and stainless steel automatic grounding clips. Provide single way, 2-way, 3-way, and key type to suit specific application requirements.
- .3 Acceptable manufacturers are:
  - .1 Hubbell Canada Inc.;
  - .2 Cooper Wiring Devices (Arrow Hart);
  - .3 Legrand - Pass & Seymour;
  - .4 Leviton.

### **2.02 RECEPTACLES**

- .1 Receptacles to be CSA approved, ULC listed, certified and labelled devices.
- .2 Hubbell Canada Inc., No. HBL5262 / HBL5362 CSA approved, ULC listed, extra heavy duty, specification grade, back and side wired, flush, nylon face/body construction, duplex U-ground, 15/20 ampere, 125 V, 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 base.
- .3 Hubbell Canada, No. GFR 5262TR / GFR 5362TR "CIRCUIT GUARD" Series, extra heavy duty grade, 15/20 ampere, 125 V, duplex, ULC Class "A", Group One, tamper resistant, weather resistant ground fault circuit interrupting receptacles complete with red ground fault LED and 10ka short circuit current rating.
- .4 Hubbell Canada Inc., No. DR15TR / DR20TR "Commercial Style Line" tamper resistant, specification grade, decorator series, CSA approved, ULC listed, back and side wired, nylon face/body construction, 15/20 ampere, 125 V, 2 pole, 3 wire grounding, duplex receptacles complete with wrap around galvanized steel mounting strip and oversize terminal screws.

## **2.03 FACEPLATES**

- .1 In Public areas: phenolic (urea thermosetting plastic) faceplates, ivory, complete with matching screws.
- .2 Mechanical, service and janitor rooms: galvanized flat faceplates suitable for surface mount installations.
- .3 Outdoor installations: Hubbell Canada Inc., No. WP26E/WP26EH while-in-use (WIU), NEMA 3R rated, CSA approved, ULC listed and labelled, single gang, vertical/horizontal mounting, weather-proof in-use, gasketed, cast aluminium faceplates for GFI receptacles in wet locations.

## **3 EXECUTION**

### **3.01 INSTALLATION OF SWITCHES**

- .1 Provide switches and install in electrical outlet boxes. Refer to drawings to determine flush or surface mounting requirements. Generally, flush mount devices in finished areas. Size electrical boxes to suit device requirements as per device manufacturer's recommendations. Properly ground device to box and ground system as per code requirements and manufacturer's instructions.
- .2 Illuminated operation of lighted switches to suit specific applications as confirmed with Parks Canada Representative.
- .3 Ensure that switches located adjacent to doors are located at strike side of door. Confirm door swing requirements on architectural drawings, not on electrical drawings.
- .4 Coordinate installation of door switches with trades responsible for provision of doors and frames. Confirm exact locations of switches with Parks Canada Representative to ensure optimum operation of switch to door position.
- .5 Confirm final switch finishes with Parks Canada Representative.
- .6 Additionally, refer to testing and verification requirements in Section entitled Electrical Work Analysis and Testing and include applicable requirements.

### **3.02 INSTALLATION OF RECEPTACLES**

- .1 Provide receptacles and install in electrical outlet boxes. Refer to drawings to determine flush or surface mounting requirements. Generally, flush mount devices in finished areas. Size electrical boxes to suit device requirements as per device manufacturer's recommendations. Properly ground device to box and ground system as per code requirements and manufacturer's instructions.
- .2 Receptacles to be ivory colour.
- .3 Safety shutter type receptacles to be located where shown and required by code.

- .4 Where receptacles are indicated in counters and benches, box cut-out to be provided in counter and bench. Provide a box, receptacle, plate and branch circuit wiring. Branch circuit wiring within counters and benches to be flexible armoured cable, under requirements of local governing electrical code and standards. Install and connect complete.
- .5 Confirm final receptacle finishes with Parks Canada Representative.
- .6 Additionally, refer to testing and verification requirements in Section entitled Electrical Work Analysis and Testing and include applicable requirements.

### **3.03 INSTALLATION OF FACEPLATES**

- .1 Provide each switch and receptacle with a faceplate with an opening or openings suitable for device it conceals and covers openings around boxes. Secure faceplates to device frames with screws to match faceplates.
- .2 In public spaces; install nylon type standard size faceplates for flush mounted switches and receptacles circuited to normal power.
- .3 Provide weatherproof insulated faceplates with hinged and gasketed receptacle access flaps for while-in-use operation for weatherproofed receptacles denoted "WP" on drawings.
- .4 Generally, oversized faceplates to be provided where engraved lettering is required.

**END OF SECTION**

**1. GENERAL**

**1.1 RELATED REQUIREMENTS**

- .1 Section 01 33 00 - Submittal Procedures
- .2 Section 01 61 00 - Common Product Requirements.
- .3 Section 01 74 11 - Cleaning.

**1.2 REFERENCE STANDARDS**

- .1 CSA International
  - .1 CSA C22.2 No. 5-09, Molded-Case Circuit Breakers, Molded-Case Switches and Circuit-Breaker Enclosures (Tri-national standard with UL 489, and NMX-J-266-ANCE-2010).

**1.3 ACTION AND INFORMATIONAL SUBMITTALS**

- .1 Submit in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Product Data:
  - .1 Submit manufacturer's instructions, printed product literature and data sheets for circuit breakers and include product characteristics, performance criteria, physical size, finish and limitations.
- .3 Include time-current characteristic curves for breakers with interrupting capacity of 22,000 A symmetrical (rms) and over at system voltage.
- .4 Certificates:
  - .1 Prior to installation of circuit breakers in either new or existing installation, Contractor must submit copies of a production certificate of origin from the manufacturer. Production certificate of origin must be duly signed by factory and local manufacturer's representative certifying that circuit breakers come from this manufacturer and are new and meet standards and regulations.
    - .1 Production certificate of origin must be submitted to Consultant and Parks Canada Representative for approval.
  - .2 Delay in submitting production of certificate of origin will not justify any extension of contract and additional compensation.
  - .3 Any work of manufacturing, assembly or installation to begin only after acceptance of production certificate of origin by Consultant and Parks Canada Representative. Unless complying with this requirement, Consultant and Parks Canada Representative reserves the right to mandate manufacturer listed on circuit breakers to authenticate new circuit breakers under the contract, and to Contractor's expense.
  - .4 Production certificate of origin must contain:
    - .1 Manufacturer's name and address and person responsible for authentication. Person responsible must sign and date certificate.

- .2 Licensed dealer's name and address and person of distributor responsible for Contractor's account.
- .3 Contractor's name and address and person responsible for project.
- .4 Local manufacturer's representative name and address. Local manufacturer's representative must sign and date certificate.

#### **1.4 DELIVERY, STORAGE AND HANDLING**

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

### **2. PRODUCTS**

#### **2.1 BREAKERS GENERAL**

- .1 Circuit breakers, Moulded-case circuit breakers, 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 Plug-in moulded case circuit breakers: quick- make, quick-break type, for manual and automatic operation with temperature compensation for 40 degrees C ambient.
- .4 Common-trip breakers: with single handle for multi-pole applications.
- .5 Magnetic instantaneous trip elements in circuit breakers to operate only when value of current reaches setting.
  - .1 Trip settings on breakers with adjustable trips to range from 3-8 times current rating.
- .6 Service entrance circuit breakers to have minimum 22kAIC symmetrical rms interrupting capacity rating.

#### **2.2 THERMAL MAGNETIC BREAKERS**

- .1 Moulded case circuit breaker to operate automatically by means of thermal and magnetic tripping devices to provide inverse time current tripping and instantaneous tripping for short circuit protection.

### **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 Consultant and Parks Canada Representative.
  - .2 Inform Consultant and Parks Canada 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 Consultant and Parks Canada Representative.

#### **3.2 INSTALLATION**

- .1 Install circuit breakers as indicated.

#### **3.3 CLEANING**

- .1 Progress Cleaning: clean in accordance with Section 01 74 11 - Cleaning.
  - .1 Leave Work area clean at end of each day.
- .2 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment in accordance with Section 01 74 11 - Cleaning.
- .3 Waste Management: separate waste materials for recycling in accordance with Waste Management Plan.
  - .1 Remove recycling containers and bins from site and dispose of materials at appropriate facility.

**END OF SECTION**

## **1 GENERAL**

### **1.1 RELATED REQUIREMENTS**

- .1 Section 01 33 00 - Submittal Procedures.
- .2 Section 01 45 00 - Quality Control.
- .3 Section 01 61 00 - Common Product Requirements.
- .4 Section 01 74 11 – Cleaning.
- .5 Section 01 78 00 - Closeout Submittals.
- .6 Section 26 05 00 - Common Work Results for Electrical.
- .7 Section 26 27 26 - Wiring Devices.

### **1.2 REFERENCES**

- .1 CSA International
  - .1 CAN/CSA C22.2 No. 144, Ground Fault Circuit Interrupters.
- .2 National Electrical Manufacturers Association (NEMA)
  - .1 NEMA PG 2.2, Application Guide for Ground Fault Protection Devices for Equipment.

### **1.3 ACTION AND INFORMATIONAL SUBMITTALS**

- .1 Submit in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Product Data:
  - .1 Submit manufacturer's instructions, printed product literature and data sheets for ground fault circuit interrupters and include product characteristics, performance criteria, physical size, finish and limitations.
- .3 Shop Drawings:
  - .1 Submit drawings.
- .4 Test and Evaluation Reports: submit test report for field testing of ground fault equipment to Departmental Representative and certificate that system as installed meets criteria specified.

### **1.4 CLOSEOUT SUBMITTALS**

- .1 Submit in accordance with Section 01 78 00 - Closeout Submittals.

- .2 Operation and Maintenance Data: submit operation and maintenance data for ground fault circuit interrupters for incorporation into manual.

## **1.5 DELIVERY, STORAGE AND HANDLING**

- .1 Deliver, store and handle materials in accordance with Section 01 61 00 - Common Product Requirements and with manufacturer's written instructions.
- .2 Delivery and Acceptance Requirements: deliver materials to site in original factory packaging, labelled with manufacturer's name and address.
- .3 Storage and Handling Requirements:
  - .1 Store materials off ground, indoors, in dry location, and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.
  - .2 Store and protect ground fault circuit interrupters from nicks, scratches, and blemishes.
  - .3 Replace defective or damaged materials with new.
- .4 Packaging Waste Management: remove for reuse packaging materials.

## **2 PRODUCTS**

### **2.1 MATERIALS**

- .1 Equipment and components for ground fault circuit interrupters (GFCI): to CAN/CSA C22.2 No. 144.
- .2 Components comprising ground fault protective system to be of same manufacturer.

### **2.2 BREAKER TYPE GROUND FAULT INTERRUPTER**

- .1 Single pole ground fault circuit interrupter for 120 V, 1 phase circuit c/w test and reset facilities.
- .2 Two pole ground fault circuit interrupters for 208 V, 1 phase circuit c/w test and reset facilities.

### **2.3 GROUND FAULT PROTECTOR UNIT**

- .1 Self-contained with 15 A, 120 V circuit interrupter and duplex receptacle complete with:
  - .1 Solid state ground sensing device.
  - .2 Facility for testing and reset.
  - .3 CSA Enclosure 1, flush mounted with stainless steel face plate.

### **3 EXECUTION**

#### **3.1 EXAMINATION**

- .1 Verification of Conditions: verify that conditions of substrate previously installed under other Sections or Contracts are acceptable for ground fault circuit interrupters installation in accordance with manufacturer's written instructions.
  - .1 Visually inspect substrate.
  - .2 Proceed with installation only after unacceptable conditions have been remedied.

#### **3.2 INSTALLATION**

- .1 Do not ground neutral on load side of ground fault relay. Pass phase conductors including neutral through zero sequence transformers.
- .2 Connect supply and load wiring to equipment in accordance with manufacturer's recommendations.

#### **3.3 FIELD QUALITY CONTROL**

- .1 Perform tests in accordance with Section 26 05 00 - Common Work Results for Electrical and coordinate with Section 01 45 00 - Quality Control if required.
- .2 Arrange for field testing of ground fault equipment by Contractor before commissioning service.
- .3 Demonstrate simulated ground fault tests.

#### **3.4 CLEANING**

- .1 Progress Cleaning: clean in accordance with Section 01 74 11 - Cleaning.
  - .1 Leave Work area clean at end of each day.
- .2 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment in accordance with Section 01 74 11 - Cleaning.
- .3 Waste Management: separate waste materials for reuse and recycling in accordance with Waste Management Plan.
  - .1 Remove recycling containers and bins from site and dispose of materials at appropriate facility.

**END OF SECTION**

**PART 1        GENERAL**

**1.1            SECTION INCLUDES**

- .1        Materials and installation for non-fused disconnect switches.

**1.2            RELATED SECTIONS**

- .1        Section 01 00 50 – Submittal Procedures.
- .2        Section 01 35 30 – Health & Safety Requirements.
- .3        Section 26 05 00 – Common Work Results - Electrical.

**1.3            REFERENCES**

- .1        Canadian Standards Association (CSA International).
  - .1        CAN/CSA C22.2 No.4-M89 (R2000), Enclosed Switches.
  - .2        CSA C22.2 No.39-M89 (R2003), Fuseholder Assemblies.

**1.4            SUBMITTALS**

- .1        Submit product data in accordance with Section 01 00 50 - Submittal Procedures.

**1.5            HEALTH AND SAFETY**

- .1        Do construction occupational health and safety in accordance with Section 01 35 30 – Health & Safety Requirements.

**1.6            WASTE MANAGEMENT AND DISPOSAL**

- .1        Remove from site and dispose of packaging materials at appropriate recycling facilities.
- .2        Collect and separate for disposal paper plastic polystyrene corrugated cardboard packaging material in appropriate on-site bins for recycling in accordance with Waste Management Plan.
- .3        Separate for reuse and recycling and place in designated containers Steel Metal Plastic waste in accordance with Waste Management Plan.
- .4        Fold up metal banding, flatten and place in designated area for recycling.

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**PART 2 PRODUCTS**

**2.1 DISCONNECT SWITCHES**

- .1 Non-fusible, horsepower rated disconnect switch in CSA Enclosure, to CAN/CSA C22.2 No.4 size as required.
- .2 NEMA 3R.
- .3 Provision for padlocking in on-off switch position by three locks.
- .4 Mechanically interlocked door to prevent opening when handle in ON position.
- .5 Quick-make, quick-break action.
- .6 ON-OFF switch position indication on switch enclosure cover.

**2.2 EQUIPMENT IDENTIFICATION**

- .1 Provide equipment identification in accordance with Section 26 05 00 - Common Work Results - Electrical.
- .2 Indicate name of load controlled on size 4 nameplate.

**PART 3 EXECUTION**

**3.1 INSTALLATION**

- .1 Install disconnect switches complete with fuses if applicable.

**END OF SECTION**

**Part 1            General**

**1.1               RELATED REQUIREMENTS**

- .1      Section 01 33 00 - Submittal Procedures.
- .2      Section 01 61 00 - Common Product Requirements.
- .3      Section 01 74 11 - Cleaning
- .4      Section 01 78 00 - Closeout Submittals.
- .5      Section 26 05 00 - Common Work Results for Electrical.

**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 transfer switches 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.
    - .1              Indicate on drawings:
      - .1                  Make, model and type.
      - .2                  Single line diagram showing control.
      - .3                  Description of equipment operation including:
        - .1                      Automatic starting and transfer to standby unit and back to normal power.
        - .2                      Test control.
        - .3                      Manual control.
        - .4                      Automatic shutdown.

**1.3               CLOSEOUT SUBMITTALS**

- .1      Submit in accordance with Section 01 78 00 - Closeout Submittals.
- .2      Operation and Maintenance Data: submit operation and maintenance data for transfer switches for incorporation into manual.
- .3      Detailed instructions to permit effective operation, maintenance and repair.
- .4      Technical data:
  - .1          Schematic diagram of components, controls and relays.
  - .2          Illustrated parts lists with parts catalogue numbers.
  - .3          Certified copy of factory test results.

#### **1.4 DELIVERY, STORAGE AND HANDLING**

- .1 Deliver, store and handle materials in accordance with Section 01 61 00 - Common Product Requirements with manufacturer's written instructions.
- .2 Delivery and Acceptance Requirements: deliver materials to site in original factory packaging, labelled with manufacturer's name and address.
- .3 Storage and Handling Requirements:
  - .1 Store materials in dry location and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.
  - .2 Store and protect transfer switches from nicks, scratches, and blemishes.
  - .3 Replace defective or damaged materials with new.
- .4 Packaging Waste Management: remove for reuse and return of packaging materials.

#### **Part 2 Products**

##### **2.1 SYSTEM DESCRIPTION**

- .1 Provide safe and convenient means of connecting portable generator cables to standby side of transfer switch.
- .2 Manual load transfer equipment to:
  - .1 Transfer load from normal supply to standby unit.
  - .2 Transfer load from standby unit to normal power supply.
  - .3 Shut down standby unit after running unloaded to cool down using adjustable time delay relay.

##### **2.2 MATERIALS**

- .1 Instrument transformers: to CAN/CSA C60044-1.
- .2 Contactors: to NEMA ICS2.

##### **2.3 CONTACTOR TYPE TRANSFER EQUIPMENT**

- .1 Two-[single] [3] [4] pole contactors mounted on common frame, in double throw arrangement, break-before-make within a CSA enclosure.
- .2 Rated: 240V, 60Hz, 400A. 3 wire.
- .3 Main contacts: silver surfaced, protected by arc disruption means.
- .4 Switch accessible for inspection and maintenance from front of panel without removal of switch panel or disconnection of power conductors.
- .5 Fault withstand rating: 22kA symmetrical for 3 cycles with maximum peak value to be confirmed by contractor prior to procurement; consult Fortis Alberta.
- .6 Lever to operate switch manually when switch is isolated.
- .7 Neutral switched.

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## **2.4 EQUIPMENT IDENTIFICATION**

- .1 Identify equipment in accordance with Section 26 05 00 - Common Work Results for Electrical.
- .2 Panel:
  - .1 For identification of selector switch normal and generator sides rivetted lamacoids, size 5.

## **2.5 SOURCE QUALITY CONTROL**

- .1 Complete equipment, including transfer mechanism, controls, relays and accessories factory assembled and tested in presence of Consultant and Parks Canada Representative.
- .2 Notify Consultant and Parks Canada Representative 10 days minimum in advance of date of factory test.
- .3 Tests:
  - .1 Operate equipment mechanically to ensure proper performance.
  - .2 Check selector switch and record results.

## **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 transfer switches installation in accordance with manufacturer's written instructions.
  - .1 Visually inspect substrate in presence of Consultant and Parks Canada Representative.
  - .2 Inform Consultant and Parks Canada 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 Consultant and Parks Canada Representative.

### **3.2 INSTALLATION**

- .1 Locate, install and connect transfer equipment as indicated on drawings.
- .2 Check and adjust as required to ensure correct operation.

### **3.3 FIELD QUALITY CONTROL**

- .1 Perform tests in accordance with Section 26 05 00 - Common Work Results for Electrical.
- .2 Energize transfer equipment from normal power supply.
- .3 Set selector switch in normal position and ensure proper transfer and retransfer. Return selector switch normal position.

**3.4 CLEANING**

- .1 Progress Cleaning: clean in accordance with Section 01 74 11 - Cleaning.
  - .1 Leave Work area clean at end of each day.
- .2 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment in accordance with Section 01 74 11 - Cleaning.
  - .1 Remove recycling containers and bins from site and dispose of materials at appropriate facility.

**END OF SECTION**

## **1 GENERAL**

### **1.01 SUBMITTALS**

- .1 Submit shop drawings for products of this Section, and on Schedule of Luminaires on drawings.
- .2 For exterior site areas and parking areas, where luminaires are proposed that are not from based specified manufacturer, provide luminaire manufacturer's computer prepared detailed photometric layout drawings with complete photometry showing performance levels of proposed luminaires. Clearly identify lighting levels, quantity, locations, mounting heights, etc. Identify variances from base design.

### **1.02 WARRANTY**

- .1 Warranty requirements are as follows:
  - .1 unless otherwise noted, LED and LED drivers for a period of five (5) years from date of acceptance of Work by Parks Canada Representative for its intended use;
  - .2 include costs for personnel, equipment and labour for replacing entire luminaires covered under warranty;

### **1.03 SUBSTITUTIONS**

- .1 Provide luminaires as specified in Schedule of Luminaires and as per documented List of Manufacturers, where applicable. During construction period, no substitutions are permitted unless compelling reasons are given and accepted by Parks Canada Representative. A delay caused by Contractor's failure to order luminaires to meet construction schedule is not a valid reason.
- .2 Make requests for proposed substitutions as per requirements of Section entitled Electrical Work General Instructions and Division 01.
- .3 Consideration of any proposed substitutions after Bid Period to be at Parks Canada Representative's sole discretion.

## **2 PRODUCTS**

### **2.01 LUMINAIRES**

- .1 Supply luminaires in accordance with Schedule of Luminaires. Luminaires are to be CSA approved or have special local electrical authority approval.
- .2 Where luminaires may be noted or directed by Parks Canada Representative or identified in other Division documents to be supplied by Owner or under another Division of Work. Include in Bid, Work and materials to accommodate such fixtures, including:
  - .1 receiving and inspecting fixtures;
  - .2 complete installation;

- .3 providing basic installation hardware not supplied by luminaire manufacturer;
  - .4 aiming and connecting;
  - .5 providing power feeders and conduit/boxes;
  - .6 cleaning, adjusting and testing;
  - .7 providing lamps where documented or as scheduled, unless otherwise noted or directed by Parks Canada Representative or supplied with fixture by fixture manufacturer;
  - .8 provide required power connections and where luminaires are controlled via remote low voltage controller;
  - .9 include for installation of controller and providing required low voltage wiring in conduit and necessary connections;
  - .10 coordination of exact requirements with supplier of fixtures and Parks Canada Representative prior to installation.
- 
- .3 Provide neoprene or silicone gasketting, barriers and stops where required to prevent light leaks or water/water vapour penetration.
  - .4 Fabricate housings to allow for easy accessibility and replacement of parts.
  - .5 Luminaires to be factory assembled and tested prior to delivery on site.
  - .6 Exposed parts and hardware of luminaires located in non-climate controlled areas to be corrosion resistant and weather resistant. Hardware to be tamper-proof. Manufacturer exterior luminaire poles with corrosion resistant finish and construction.
  - .7 Confirm exact colours and finishes of luminaires with Parks Canada Representative after award of contract but prior to ordering. Obtain information in time to meet installation schedule.
  - .8 Products of same specified type to be of same manufacturer.

## **2.02 LEDS AND DRIVERS**

- .1 General features include:
  - .1 CSA approved, ULC listed and labelled;
  - .2 Operating temperature:
    - .1 Luminaires for applications in non-climate controlled area: operating temperature range through -40°C (-40°F) to 60°C (140°F);
    - .2 Luminaires for applications in climate controlled area: operating temperature range through -20°C (-4°F) to 50°C (122°F);

- .3 With rapid and changing development of LED technology, provide most technically proven and most advanced and successfully tested LED technology at time of installation;
- .4 Specification standards to meet requirements of IES LM 79 and LM-80.
- .2 Light emitting diodes (LEDs) features to include:
  - .1 LEDs to be selected from same colour bin size for consistency in chromaticity and meet ANSI C78 377A as a minimum;
  - .2 generally, colour temperature range to be from 2700 K to 3500 K; specific temperature requirements are identified on Schedule of Luminaires;
  - .3 minimum CRI of 80;
  - .4 rated life (based on 70% lumen depreciation level) from 50,000 to 70,000 hours.
- .3 Driver features to include:
  - .1 Operate from 60 Hz input source of 120 VAC with sustained variations of  $\pm 10\%$  (voltage and frequency) with no damage to driver;
  - .2 Output regulated to  $\pm 5\%$  across load range;
  - .3 Power factor greater than 0.90;
  - .4 Total harmonic distortion less than 20%;
  - .5 Class A sound rating;
  - .6 Comply with ANSI C62.41 Category A for transient protection.
- .4 Acceptable alternative manufacturers must meet or exceed the specified products.

## **2.03 STEEL POLES**

- .1 Steel poles: to CSA C22.2 No.206 designed for underground wiring and:
  - .1 Mounting on concrete anchor base
  - .2 Style: monotube, minimum 3.0 mm thick, to match existing on site; refer to luminaire schedule.
  - .3 Access handhole above pole base for wiring connections, with welded-on reinforcing frame and bolted-on cover.
  - .4 Anchor bolts: four with steel with shims, nuts and covers, refer to detail on drawings.
  - .5 Finish: match existing on site.
  - .6 Grounding lug.

### **3 EXECUTION**

#### **3.01 INSTALLATION**

- .1 Install interior luminaires as indicated on drawings and in accordance with manufacturer's instructions.
- .2 Install poles true and plumb in accordance with manufacturer's instructions.
- .3 Install luminaires on pole and install lamps.
- .4 Check luminaire orientation, level and tilt.
- .5 Connect luminaire to lighting circuit.
- .6 Provide luminaires as required. Install products in accordance with manufacturer's instructions to suit specific installation requirements.
- .7 Before placing luminaire orders:
  - .1 verify quantity requirements;
  - .2 thoroughly review ceiling types, finishes and construction details; verify ceiling types with latest Architectural Drawings; order luminaires to suit correct ceiling type;
  - .3 ensure that required mounting assemblies, frames, rings and similar features are included;
  - .4 confirm colours and finishes with Parks Canada Representative.
- .8 Include for assembly and mounting of luminaires and lamps, complete with:
  - .1 wiring and connections;
  - .2 fittings and hangers;
  - .3 aligners;
  - .4 box covers;
  - .5 other accessories required for a complete, safe and fully operational assembly.
- .9 Where outlet boxes locations are shown on drawings, they are diagrammatic only. Position outlet boxes to coincide with suspension hangers and knockouts.
- .10 Mount surface ceiling luminaires perfectly level or plumb, tightly to ceiling without showing a space or light leak between frame and ceiling.
- .11 Support luminaires directly by ceiling structure and not to formed ceiling hangers, ductwork, piping, cable trays, etc.
- .12 Do not tighten wing nuts, bolts, or screws that allow fixture adjustment for recessed adjustable fixtures.

- .13 Use cloth gloves when handling reflector cones, louvers, halogen lamps, glass, sconces and all exposed surfaces of fixtures.
- .14 Co-ordinate luminaire installation with work of other trades to ensure that necessary recessing depths and mounting spaces are provided.
- .15 Install luminaires in accordance with applicable architectural drawing reflected ceiling plans and/or wall elevations and/or field instructions issued by Parks Canada Representative. Confirm luminaire locations prior to roughing-in. In equipment rooms, shafts and similar secondary areas, install luminaires after mechanical and other major work is roughed in and adjust luminaire locations as required.
- .16 Align and position all adjustable luminaires, and ensure that luminaires with adjustable lamp holders are properly positioned to correspond to lamps specified.
- .17 Comply with requirements of local governing electrical code regarding support of luminaires in suspended ceilings.
- .18 Connect luminaires to power circuits and controls as required. Refer to drawings notes and schedules.
- .19 Notify Parks Canada Representative immediately and relocate if necessary as directed by Parks Canada Representative, if:
  - .1 fixture placement is in conflict with a structural beam, mechanical duct, plumbing pipe, etc.;
  - .2 space above ceiling is not sufficient;
  - .3 any reason that a fixture cannot be located where it is dimensioned or shown on construction documents.
- .20 Provide seismic restraints to suspended luminaires, in accordance with latest local governing building code requirements.
- .21 Ground and bond luminaires as per local governing electrical code requirements.
- .22 Prior to turn over of Work to Parks Canada, clean luminaires in manner recommended by manufacturer and to satisfaction of Parks Canada Representative.
- .23 Lamps to be new and intact when project is complete and ready for acceptance.
- .24 Include a full lamp listing in Operating and Maintenance Instruction Manuals.
- .25 Additionally, refer to testing and verification requirements in Section entitled Electrical Work Analysis and Testing and include applicable requirements.

**END OF SECTION**

**1. GENERAL**

**1.1 RELATED REQUIREMENTS**

- .1 Section 01 33 00 - Submittal Procedures.
- .2 Section 01 61 00 - Common Product Requirements.
- .3 Section 01 74 11 - Cleaning
- .4 Section 01 78 00 - Closeout Submittals.
- .5 Section 26 05 21 - Wires and Cables (0-1000 V)
- .6 Section 26 05 34 - Conduits, Conduit Fastenings and Conduit Fittings.

**1.2 REFERENCE STANDARDS**

- .1 CSA C22.2 No.141-10, Emergency Lighting Equipment.

**1.3 ACTION AND INFORMATIONAL SUBMITTALS**

- .1 Submit in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Product Data:
  - .1 Submit manufacturer's instructions, printed product literature and data sheets for emergency lighting and include product characteristics, performance criteria, physical size, finish and limitations.

**1.4 CLOSEOUT SUBMITTALS**

- .1 Submit in accordance with Section 01 78 00 - Closeout Submittals.
- .2 Operation and Maintenance Data: submit operation and maintenance data for [emergency lighting] for incorporation into manual.

**1.5 DELIVERY, STORAGE AND HANDLING**

- .1 Deliver, store and handle materials in accordance with Section 01 61 00 - Common Product Requirements and with manufacturer's written instructions.
- .2 Delivery and Acceptance Requirements: deliver materials to site in original factory packaging, labelled with manufacturer's name and address.
- .3 Storage and Handling Requirements:
  - .1 Store materials indoors and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.
  - .2 Store and protect emergency lighting from nicks, scratches, and blemishes.
  - .3 Replace defective or damaged materials with new.
- .4 Packaging Waste Management: remove for reuse by manufacturer of packaging materials.

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## **1.6 WARRANTY**

- .1 For batteries in this Section, 12 months warranty period is extended to 24 months.

## **2. PRODUCTS**

### **2.1 EQUIPMENT**

- .1 Emergency lighting equipment: to CSA C22.2 No.141.
- .2 Supply voltage: 120 VAC.
- .3 Output voltage: 6 VDC.
- .4 Operating time: 30 minutes.
- .5 Battery: sealed, maintenance free.
- .6 Charger: solid state, multi-rate, voltage/current regulated, inverse temperature compensated, short circuit protected with regulated output of plus or minus 0.01 V for plus or minus 10% input variations.
- .7 Solid state transfer circuit.
- .8 Low voltage disconnect: solid state, modular, operates at 80% battery output voltage.
- .9 Signal lights: solid state, for 'AC Power ON' and 'High Charge'.
- .10 Lamp heads: integral on unit and remote, 345 degrees horizontal and 180 degrees vertical adjustment. Lamp type: LED, wattage as indicated on drawings.
- .11 Cabinet: suitable for direct or shelf mounting to wall and c/w knockouts for conduit. Removable or hinged front panel for easy access to batteries.
- .12 Finish: as indicated on luminaire schedule.
- .13 Auxiliary equipment:
  - .1 Ammeter.
  - .2 Voltmeter.
  - .3 Test switch.
  - .4 Time delay relay.
  - .5 Battery disconnect device.
  - .6 AC input and DC output terminal blocks inside cabinet.
  - .7 Bracket.
  - .8 Cord and single plug connection for AC.
  - .9 RFI suppressors.

### **2.2 WIRING OF REMOTE HEADS**

- .1 Conduit: in accordance with Section 26 05 34 - Conduits, Conduit Fastenings and Conduit Fittings.
- .2 Conductors: in accordance with Section 26 05 21 - Wires and Cables (0-1000 V).

### **3. EXECUTION**

#### **3.1 EXAMINATION**

- .1 Verification of Conditions: verify that conditions of substrate previously installed under other Sections or Contracts are acceptable for emergency lighting installation in accordance with manufacturer's written instructions.
  - .1 Visually inspect substrate in presence of Consultant and Parks Canada Representative.
  - .2 Inform Consultant and Parks Canada 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 Consultant and Parks Canada Representative.

#### **3.2 INSTALLATION**

- .1 Install unit equipment and remote mounted fixtures.
- .2 Direct heads.
- .3 Connect exit lights to unit equipment.

#### **3.3 CLEANING**

- .1 Progress Cleaning: clean in accordance with Section 01 74 11 - Cleaning.
  - .1 Leave Work area clean at end of each day.
- .2 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment in accordance with Section 01 74 11 - Cleaning.
  - .1 Remove recycling containers and bins from site and dispose of materials at appropriate facility.

#### **3.4 PROTECTION**

- .1 Protect installed products and components from damage during construction.
- .2 Repair damage to adjacent materials caused by emergency lighting installation.

**END OF SECTION**

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## **1 GENERAL**

### **1.1 RELATED REQUIREMENTS**

- .1 Section 01 33 00 - Submittal Procedures.
- .2 Section 01 45 00 - Quality Control.
- .3 Section 01 74 11 – Cleaning.

### **1.2 REFERENCES**

- .1 Canadian Standards Association (CSA International)
  - .1 CSA C22.2 No.141-15 (R2019), Emergency Lighting Equipment.
  - .2 CSA C860-11(R2016), Performance of Internally-Lighted Exit Signs.
- .2 National Building Code 2015 (Alberta Edition).
- .3 Local Authority Having Jurisdiction.

### **1.3 SUBMITTALS**

- .1 Provide submittals in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Product Data:
  - .1 As per luminaire schedule.
  - .1 Submit shop drawings for review by Departmental Representatives.
- .3 Quality Assurance Submittals: submit following in accordance with Section 01 45 00 - Quality Control.

### **1.4 WASTE MANAGEMENT AND DISPOSAL**

- .1 Separate waste materials for reuse and recycling.

## **2 PRODUCTS**

### **2.1 STANDARD UNITS**

- .1 Exit lights: match requirements listed on luminaire schedule.
- .4 Wall or ceiling mounted as found shown on locations on drawings. Repair any related electrical apparatus that may have been found to be deficient.

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### **3 EXECUTION**

#### **3.1 MANUFACTURER'S INSTRUCTIONS**

- .1 Compliance: comply with manufacturer's written recommendations or specifications, including product technical bulletins, handling, storage and installation instructions, and datasheets.

#### **3.2 INSTALLATION**

- .1 Install exit lights to manufacturer's recommendations, listing requirements, NFPA standard and local regulatory requirements.
- .5 Connect new exit signs to exit lighting circuits fed from lighting circuit breaker on electrical panel.
- .6 Ensure that exit light circuit breaker is the same as lighting circuit.

#### **3.3 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**

**PART 1 GENERAL**

**1.1 REFERENCES**

- .1 American Society for Testing and Materials (ASTM)
  - .1 ASTM D4791-99, Standard Test Method for Flat Particles, Elongated Particles, or Flat and Elongated Particles in Coarse Aggregate.

**1.2 SAMPLES**

- .1 Submit samples in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Provide the Departmental Representative with access to source and processed material for sampling.
- .3 Pay cost of sampling and testing of aggregates which fail to meet specified requirements.

**1.3 WASTE MANAGEMENT AND DISPOSAL**

- .1 Divert unused granular materials from landfill to local facility as approved by the Departmental Representative.

**PART 2 PRODUCTS**

**2.1 MATERIALS**

- .1 Aggregate quality: sound, hard, durable material free from soft, thin, elongated or laminated particles, organic material, clay lumps or minerals, or other substances that would act in deleterious manner for use intended.
- .2 Flat and elongated particles of coarse aggregate: to ASTM D4791.
  - .1 Greatest dimension to exceed five times least dimension.
- .3 Fine aggregates satisfying requirements of applicable section to be one, or blend of following:
  - .1 Natural sand.
  - .2 Manufactured sand.
  - .3 Screenings produced in crushing of quarried rock, boulders, gravel or slag.
- .4 Coarse aggregates satisfying requirements of applicable section to be one of or blend of following:
  - .1 Crushed rock.
  - .2 Gravel and crushed gravel composed of naturally formed particles of stone.
  - .3 Light weight aggregate, including slag and expanded shale.

## **2.2 SOURCE QUALITY CONTROL**

- .1 Inform the Departmental Representative of proposed source of aggregates and provide access for sampling at least 4 weeks prior to commencing production.
- .2 If, in opinion of the Departmental Representative, materials from proposed source do not meet, or cannot reasonably be processed to meet, specified requirements, locate an alternative source or demonstrate that material from source in question can be processed to meet specified requirements.
- .3 Advise the Departmental Representative 4 weeks in advance of proposed change of material source.
- .4 Acceptance of material at source does not preclude future rejection if it fails to conform to requirements specified, lacks uniformity, or if its field performance is found to be unsatisfactory.

## **PART 3 EXECUTION**

### **3.1 PREPARATION**

- .1 Handling
  - .1 Handle and transport aggregates to avoid segregation, contamination and degradation.
- .2 Stockpiling
  - .1 Stockpile aggregates on site in locations as indicated unless directed otherwise by the Departmental Representative. Do not stockpile on completed pavement surfaces.
  - .2 Stockpile aggregates in sufficient quantities to meet Project schedules.
  - .3 Stockpiling sites to be level, well drained, and of adequate bearing capacity and stability to support stockpiled materials and handling equipment.
  - .4 Except where stockpiled on acceptably stabilized areas, provide compacted sand base not less than 150 mm in depth to prevent contamination of aggregate. Stockpile aggregates on ground but do not incorporate bottom 150 mm of pile into Work.
  - .5 Separate different aggregates by strong, full depth bulkheads, or stockpile far enough apart to prevent intermixing.
  - .6 Do not use intermixed or contaminated materials. Remove and dispose of rejected materials as directed by the Departmental Representative within 48 h of rejection.
  - .7 Stockpile materials in uniform layers of thickness as follows:
    - .1 Max 1.5 m for coarse aggregate and base course materials.
  - .8 Uniformly spot-dump aggregates delivered to stockpile in trucks and build up stockpile as specified.
  - .9 Do not cone piles or spill material over edges of piles.
  - .10 Do not use conveying stackers.
  - .11 During winter operations, prevent ice and snow from becoming mixed into stockpile or in material being removed from stockpile.

**3.2 CLEANING**

- .1 Leave aggregate stockpile site in tidy, well drained condition, free of standing surface water.
- .2 Leave any unused aggregates in neat compact stockpiles at a site directed by the Departmental Representative.

**END OF SECTION**

## **PART 1        GENERAL**

### **1.1            REFERENCES**

- .1        Alberta Environmental Protection
  - .1        Storm Water Management Guidelines for the Province of Alberta, 1999.
- .2        National Parks Act.
- .3        Canadian Environmental Assessment Act.

### **1.2            DEFINITIONS**

- .1        Clearing consists of cutting off trees and brush vegetative growth to not more than specified height above ground and disposing of felled trees, previously uprooted trees and stumps, and surface debris.
- .2        Close-cut clearing consists of cutting off standing trees, brush, scrub, roots, stumps and embedded logs, removing at, or close to, existing grade and disposing of fallen timber and surface debris.
- .3        Clearing isolated trees consists of cutting off to not more than specified height above ground of designated trees, and disposing of felled trees and debris.
- .4        Underbrush clearing consists of removal from treed areas of undergrowth, deadwood, and trees smaller than 50 mm trunk diameter and disposing of fallen timber and surface debris.
- .5        Grubbing consists of excavation and disposal of stumps and roots to not less than specified depth below existing ground surface.
- .6        All clearing and grubbing to be done according to the Canadian Environmental Assessment Act and National Parks Act as well. Where the above Acts and this specification disagrees, the above Acts will govern.

### **1.3            SUBMITTALS**

- .1        Provide submittals in accordance with Section 01 33 00 - Submittal Procedures.
- .2        Samples:
  - .1        Submit 3 samples of each material listed below for approval prior to delivery of materials to project site.
  - .2        Tree wound paint: one litre can with manufacturer's label.
- .3        Submit certificates signed by manufacturer certifying that materials comply with specified performance characteristics and physical properties.
- .4        Submit manufacturer's installation instructions.

### **1.4            QUALITY ASSURANCE**

- .1        Safety Requirements: worker protection.

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- .1 Workers must wear gloves, eye protection and protective clothing.
  - .2 Clean up spills of preservative materials immediately with absorbent material and safely discard to landfill.

## **1.5 STORAGE AND PROTECTION**

- .1 Prevent damage to fencing, trees, bench marks, existing buildings, utility lines, root systems of trees which are to remain.
  - .1 Repair damaged items to approval of the Departmental Representative.
  - .2 Replace trees designated to remain, if damaged, as directed by the Departmental Representative.

## **1.6 WASTE MANAGEMENT AND DISPOSAL**

- .1 Separate waste materials for reuse and recycling.
- .2 Consider felled timber from which saw logs, pulpwood, posts, poles, ties, or fuel wood can be produced as saleable timber.
  - .1 Stockpile adjacent to site.

## **PART 2 PRODUCTS**

### **2.1 MATERIALS**

- .1 Bituminous based paint of standard manufacture specially formulated for tree wounds.
- .2 Soil Material for Fill:
  - .1 Excavated soil material: free of debris, roots, wood, scrap material, vegetable matter, refuse, soft unsound particles, deleterious, or objectionable materials.
  - .2 Remove and store soil material for reused.

## **PART 3 EXECUTION**

### **3.1 TEMPORARY EROSION AND SEDIMENTATION CONTROL**

- .1 Provide temporary erosion and sedimentation control measures to prevent soil erosion and discharge of soil-bearing water runoff or airborne dust to adjacent properties and walkways, according to requirements of authorities having jurisdiction.
- .2 Inspect, repair, and maintain erosion and sedimentation control measures during construction until permanent vegetation has been established.
- .3 Remove erosion and sedimentation controls and restore and stabilize areas disturbed during removal.

### **3.2 PREPARATION**

- .1 Inspect site and verify with the Departmental Representative, items designated to remain.
- .2 Locate and protect utility lines: preserve in operating condition active utilities traversing site.

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- .1 Notify the Departmental Representative immediately of damage to or when unknown existing utility lines are encountered.
  - .2 When utility lines which are to be removed are encountered within area of operations, notify the Departmental Representative in ample time to minimize interruption of service.
  - .3 Notify utility authorities before starting clearing and grubbing.
  - .4 Keep roads and walks free of dirt and debris.
  - .5 Contract vegetation specialist to identify and spray or remove all non-native vegetation on site prior to beginning work.

### **3.3 APPLICATION**

- .1 Manufacturer's instructions: comply with manufacturer's written recommendations or specifications, including product technical bulletins, handling, storage and installation instructions, and datasheet.

### **3.4 CLEARING**

- .1 Clearing includes felling, trimming, and cutting of trees into sections and satisfactory disposal of trees and other vegetation designated for removal, including downed timber, snags, brush, and rubbish occurring within cleared areas.
- .2 Clear as directed by the Departmental Representative, by cutting at height of not more than 300mm above ground. In areas to be subsequently grubbed, height of stumps left from clearing operations to be not more than 150mm above ground surface.
- .3 Shrubs, grasses, mosses and small trees are to be salvaged whenever possible for reuse on site. The Contractor shall make a strong effort to salvage plant material from the proposed septic field area to be used in the restoration of other affected areas of the site, with priority going to reuse in the Old Washroom building restoration area.
- .4 Cut off unsound branches on trees designated to remain as directed by the Departmental Representative.
- .5 Do not cut Douglas Fir trees for any reason whatsoever.

### **3.5 CLOSE CUT CLEARING**

- .1 Close cut clearing to ground level.

### **3.6 ISOLATED TREES**

- .1 Cut off isolated trees as directed by the Departmental Representative at height of not more than 1500mm above ground surface.
- .2 Grub out isolated tree stumps.

### **3.7 UNDERBRUSH CLEARING**

- .1 Clear underbrush from areas as indicated at ground level.

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**3.8 GRUBBING**

- .1 Remove and dispose of roots larger than 5cm in diameter, matted roots, and designated stumps from indicated grubbing areas.
- .2 Grub out stumps and roots to not less than 200mm below ground surface.
- .3 Grub out visible rock fragments and boulders, greater than 300mm in greatest dimension, but less than 0.25m<sup>3</sup>.
- .4 Fill depressions made by grubbing with suitable material and to make new surface conform with existing adjacent surface of ground.

**3.9 REMOVAL AND DISPOSAL**

- .1 Remove cleared and grubbed materials off site and as designated by Departmental Representative.
- .2 Cut timber greater than 125 mm diameter to 4500mm lengths and stockpile. Stockpiled timber becomes property of the Departmental Representative.

**3.10 FINISHED SURFACE**

- .1 Leave ground surface in condition suitable for immediate grading and topsoil placement operations to approval of the Departmental Representative.

**3.11 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**

## **PART 1 GENERAL**

### **1.1 REFERENCES**

- .1 U.S. Environmental Protection Agency (EPA)/Office of Water
  - .1 EPA 832R92005, Storm Water Management for Construction Activities: Developing Pollution Prevention Plans and Best Management Practices.

### **1.2 EXISTING CONDITIONS**

- .1 Refer to Geotechnical Report for site details.

## **PART 2 PRODUCTS**

### **2.1 NOT USED**

- .1 Not Used.

## **PART 3 EXECUTION**

### **3.1 TEMPORARY EROSION AND SEDIMENTATION CONTROL**

- .1 Provide temporary erosion and sedimentation control measures to prevent soil erosion and discharge of soil-bearing water runoff or airborne dust to adjacent properties and walkways, according to requirements of authorities having jurisdiction.
- .2 Erosion control measures are not to include any wildlife attractants. The Contractor shall submit proposed erosion control materials to the Departmental Representative for approval.
- .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 STRIPPING OF TOPSOIL**

- .1 Ensure that procedures are conducted in accordance with applicable Parks Canada requirements.
- .2 Remove all organic surface materials prior to commencing work or excavation.
- .3 Remove surface vegetation and immediately relocate or stockpile prior to stripping topsoil material.
  - .1 All surface vegetation from Proposed Septic Field Area is to be relocated to and placed in Old Washroom restoration area within 7 days of being initially stripped.
- .4 Remove topsoil before construction procedures commence to avoid compaction of topsoil.

- .1 Immediately relocate topsoil from Proposed Septic Field Area to Old Washroom Restoration area for restoration efforts; do not stockpile material prior to placing.
- .2 Topsoil salvaged from all other areas are to be stockpiled immediately adjacent to where the material is removed from.
- .5 Handle topsoil only when it is dry and warm.
- .6 Remove vegetation from targeted areas by non-chemical means and dispose of stripped vegetation outside the park.
- .7 Remove brush from targeted area by non-chemical means and dispose outside the park.
- .8 Strip topsoil to depths as directed by the Departmental Representative.
  - .1 Avoid mixing topsoil with subsoil.
- .9 Pile topsoil in berms in locations as directed by the Departmental Representative.
  - .1 Stockpile height not to exceed 2.5 m.
- .10 Stripped topsoil shall not be destroyed or mixed with subsoils, or topsoil stockpiles from other areas of the site.
- .11 All stockpiled soil must be salvaged for re-use.
- .12 Dispose of unused topsoil off-site as directed by Departmental Representative.
- .13 Protect stockpiles from contamination and compaction.
- .14 Cover topsoil that has been piled for long term storage, with trefoil or grass to maintain agricultural potential of soil.
- .15 All topsoil imported from outside of the campground has to be approved by the Environmental Department. Supply a sample as per Section 01 33 00 to be approved by Parks Canada.

### **3.3 PREPARATION OF GRADE**

- .1 Verify that grades are correct and notify the Departmental Representative if discrepancies occur. Do not begin work until instructed by the Departmental Representative.
  - .1 Grade area only when soil is dry to lessen soil compaction.
  - .2 Grade soil establishing natural contours and eliminating uneven areas and low spots, ensuring positive drainage.

### **3.4 PLACING OF TOPSOIL**

- .1 Place topsoil only after the Departmental Representative has accepted subgrade.
- .2 Areas must be properly prepared and have topsoil placed within 14 days after all subsurface work is completed within the area. The Contractor shall restore areas of the site as work in the respective areas are completed to allow the site to be restored in stages as work is completed.

- .3 Spread topsoil during dry conditions in uniform layers not exceeding 150mm, over unfrozen subgrade free of standing water.
- .4 Establish traffic patterns for equipment to prevent driving on topsoil after it has been spread to avoid compaction.
- .5 Cultivate soil following spreading procedures.
- .6 Immediately seed areas after topsoil has been placed.
- .7 Topsoil shall not be placed on top of snow or frozen ground without written approval by the Departmental Representative.

### **3.5 CLEANING**

- .1 Proceed in accordance with Section 01 74 11 - Cleaning.
- .2 On completion and verification of performance of installation, remove surplus materials, excess materials, rubbish, tools and equipment.

**END OF SECTION**

**Part 1 General**

**1.1 DESCRIPTION**

- .1 The work shall consist of excavating earth materials, hauling, compacting and fine grading for the washroom area, parking areas and campground landscaping features. The work shall be completed to the lines, grades and dimensions as shown on the Drawings or as designated by the Departmental Representative.

**1.2 REFERENCES**

- .1 ASTM International
  - .1 ASTM D698, Test Method for Laboratory Compaction Characteristics of Soil Using Standard Effort (600 kN-m/m<sup>3</sup>).

**1.3 ACTION AND INFORMATIONAL SUBMITTALS**

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

**1.4 EXISTING CONDITIONS**

- .1 Examine geotechnical investigation report for subsurface conditions.
- .2 Contractor to confirm underground and surface utility lines and buried objects before work commencement.

**Part 2 Products**

**2.1 MATERIALS**

- .1 Excavated or graded material existing on site suitable to use as fill for grading work if approved by Departmental Representative.
- .2 Any unsuitable material to be disposed as directed by Departmental Representative.
- .3 Imported material suitable to use as fill for grading work if approved by Departmental Representative.

**Part 3 Execution**

**3.1 EXAMINATION**

- .1 Verification of Conditions: verify that conditions are acceptable for rough grading.
  - .1 Visually inspect substrate in presence of Departmental Representative.
  - .2 Inform Departmental Representative of unacceptable conditions immediately upon discovery.
  - .3 Proceed with Work only after unacceptable conditions have been remedied and after receipt of written approval to proceed from Departmental Representative.

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**3.2 GRADING**

- .1 Grade to levels, profiles, and contours allowing for surface treatment as indicated.
- .2 Areas proposed for vegetation restoration are to be rough graded to mimic the surrounding ground surfaces; this includes providing rolling and uneven surfaces.
- .3 Grade to follow design grades as specified in Design Drawings.
- .4 Grade ditches to depth required for maximum run-off as indicated in Drawings.
- .5 Compact filled and disturbed areas to corrected maximum dry density, as follows:
  - .1 95% under growing mediums within landscaped areas.
  - .2 100% under paved and walk areas.
  - .3 Benching as per Alberta Transportation Standard Specifications for Highway Construction Section 2.3 Grading
- .6 Do not disturb soil within branch spread of trees or shrubs to remain.
- .7 All rough grading shall be approved by the Departmental Representative prior to placing topsoil, pathways, driveways, or other final surface coverings.

**3.3 TESTING**

- .1 Inspection and testing of soil compaction will be carried out by testing laboratory designated by the Contractor for all quality control testing.

**3.4 CLEANING**

- .1 Progress Cleaning
  - .1 Leave Work area clean at end of each day.
- .2 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment.

**3.5 PROTECTION**

- .1 Protect natural features, benchmarks, buildings, pavement, surface or underground utility lines which are to remain as directed by Departmental Representative. If damaged, restore to original or better condition unless directed otherwise.
- .2 Maintain access roads to prevent accumulation of construction related debris on roads.

**END OF SECTION**

## **Part 1 General**

### **1.1 REFERENCES**

- .1 American Society for Testing and Materials International (ASTM):
  - .1 ASTM D698, Test Method for Laboratory Compaction Characteristics of Soil Using Standard Effort (600 kN m/m<sup>3</sup>).

### **1.2 DEFINITIONS**

- .1 Reshaping subgrade: scarifying, pulverizing, blading, reshaping and recompacting existing subgrade surface.

## **Part 2 Products**

Not Used.

## **Part 3 EXECUTION**

### **3.1 SUBGRADE PREPARATION**

- .1 In areas where excavation is to subgrade or in any case less than 300 mm below that elevation, the subgrade will be scarified to a depth of 300 mm and the scarified material windrowed to the side.
- .2 Subgrade in all vegetation restoration areas, including those which are not otherwise disturbed as part of the new infrastructure installations shall be scarified to 300mm below the finished subgrade and loosely repacked surface prior to placing topsoil.
- .3 Subgrade to be finished to support final finished elevation to be as shown on the drawings, once all final surface treatments have been installed; this includes gravel or concrete surfaces and topsoil.
- .4 The exposed surface shall then be brought to its optimum moisture content and compacted to 100% of Standard Proctor Density ASTM D698 over paved and walk surfaces.
- .5 Subgrade in vegetation restoration areas are to be graded with a rolling surface to mimic the surface of surrounding undisturbed areas. Topsoil is not to be used to create final rolling surface.
- .6 Remove or thaw any frozen subgrade material prior to installing new infrastructure overtop of frozen material.

### **3.2 COMPACTING**

- .1 Compact to density not less than 95% corrected maximum dry density in landscape areas below growing medium, 98% corrected maximum dry density under gravel pathways, roadways and other areas, and 100% corrected maximum dry density under outside concrete slabs and building slabs.
- .2 If any soft spot is identified, replace unsuitable material with approved engineered fill.

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- .3 Shape and roll alternately to obtain smooth, even and uniformly compacted subgrade surface.
  - .4 Apply water as necessary during compaction to obtain specified density.
  - .5 If material is excessively moist, aerate by scarifying with suitable equipment until moisture content is corrected to value not greater than 2% moisture above optimum value for compaction.

### **3.3 SITE TOLERANCES**

- .1 Reshape compacted surface to be within plus or minus 25 mm of elevation as indicated but not uniformly high or low.
- .2 Blade finished surfaces in cut and fill areas free from ruts, depressions, rocks in excess of 50 mm and debris.
- .3 Roll finished surfaces to a tight, dense condition.
- .4 Finished surface to provide positive drainage and be free from standing water.
- .5 The Departmental Representative will inspect the site upon completion of the rough grading to the design grades, and provide direction to the contractor on any grading changes to be made to allow the site to be restored.

### **3.4 PROTECTION**

- .1 If the Subgrade is properly compacted per specs and tested to certify same, the Contractor will be responsible for protection until such time as the Contractor completes required pavement over said surfaces and through final acceptance of the project.

### **3.5 CLEANING**

- .1 Upon completion of installation, remove surplus materials, rubbish, tools and equipment barriers.

**END OF SECTION**

## **Part 1            General**

### **1.1            REFERENCE STANDARDS**

- .1 American Society for Testing and Materials International (ASTM)
  - .1 ASTM C117, Standard Test Method for Material Finer than 0.075 mm (No.200) Sieve in Mineral Aggregates by Washing.
  - .2 ASTM C136, Standard Test Method for Sieve Analysis of Fine and Coarse Aggregates.
  - .3 ASTM D422, Standard Test Method for Particle-Size Analysis of Soils.
  - .4 ASTM D698, Test Method for Laboratory Compaction Characteristics of Soil Using Standard Effort (600 kN-m/m<sup>3</sup>).
  - .5 ASTM D4318, Standard Test Methods for Liquid Limit, Plastic Limit, and Plasticity Index of Soils
- .2 Canadian General Standards Board (CGSB)
  - .1 CAN/CGSB-8.2, Sieves, Testing, Woven Wire, Metric.
- .3 Canadian Standards Association (CSA International)
  - .1 CAN/CSA-A3000, Cementitious Materials Compendium (Consists of A3001, A3002, A3003, A3004 and A3005).
    - .1 CSA-A3001 Cementitious Materials for Use in Concrete.
  - .2 CSA-A23.1/A23.2, Concrete Materials and Methods of Concrete Construction/Methods of Test and Standard Practices for Concrete.

### **1.2            DEFINITIONS**

- .1 Excavation classes: Two classes of excavation will be recognized; common excavation and rock excavation.
  - .1 Rock: Excavation of material from solid masses of igneous, sedimentary or metamorphic rock which can be ripped using a Group 12 Dozer or equivalent excavation equipped with a single shank ripper or equivalent, as defined in the ARHCA Equipment Rental Guidelines, and excavated using conventional earth moving equipment.
  - .2 Common excavation: excavation of materials of whatever nature, which are not included under definitions of rock excavation.
- .2 Topsoil:
  - .1 Material capable of supporting good vegetative growth and suitable for use in top dressing, landscaping and seeding.
  - .2 Material reasonably free from subsoil, clay lumps, brush, objectionable weeds, and other litter, and free from cobbles, stumps, roots, and other objectionable material larger than 25 millimeters in any dimension.
- .3 Waste material: excavated material unsuitable for use in Work or surplus to requirements.
- .4 Borrow material: material obtained from locations outside area to be graded, and required for construction of fill areas or for other portions of Work.

- .5 Unsuitable materials:
- .1 Weak, chemically unstable, and compressible materials.
  - .2 Frost susceptible materials:
    - .1 Fine grained soils with plasticity index less than 10 when tested to ASTM D4318, and gradation within limits specified when tested to ASTM D422-63]: Sieve sizes to CAN/CGSB-8.2.
    - .2 Table:

Sieve Designation	% Passing
2.00 mm	100
0.10 mm	45 - 100
0.02 mm	10 - 80
0.005 mm	0 - 45
    - .3 Coarse grained soils containing more than 20 % by mass passing 0.075 mm sieve.

### 1.3 EXISTING CONDITIONS

- .1 Examine Geotechnical Investigation for soil conditions.
- .2 Buried services:
  - .1 Before commencing work verify location of buried services on and adjacent to site.
  - .2 Size, depth and location of existing utilities and structures as indicated are for guidance only. Completeness and accuracy are not guaranteed.
  - .3 Prior to beginning excavation Work, notify applicable authorities having jurisdiction establish location and state of use of buried utilities and structures. Contractor to clearly mark such locations to prevent disturbance during Work.
  - .4 Confirm locations of buried utilities by careful soil hydrovac methods/test excavations.
  - .5 Maintain and protect from damage, water, sewer, electric, telephone and other utilities and structures encountered.
  - .6 Where utility lines or structures exist in area of excavation, notify the Departmental Representative before removing or re-routing.
  - .7 Record location of maintained, re-routed and abandoned underground lines.
  - .8 Confirm locations of recent excavations adjacent to area of excavation.
- .3 Existing buildings and surface features:
  - .1 Conduct condition survey of existing buildings, trees and other plants, lawns, fencing, service poles, wires, rail tracks, pavement, survey bench marks and monuments which may be affected by Work. Forward records of the condition survey to the Departmental Representative. Photograph, document and notify the Departmental Representative of any pre-existing signs of settlement to structures prior to beginning work.
  - .2 Protect existing buildings and surface features from damage while Work is in progress. In event of damage, immediately make repair to restore damaged features to the same or better condition than prior to construction commencement.
  - .3 Where required for excavation, cut roots or branches.

## Part 2 Products

### 2.1 MATERIALS

#### .1 Backfill materials:

Percent Passing Sieve Size	Granular Fill		Granular Drainage Rock		Granular Pipe Bedding and Surround Material
	25mm Minus Crushed Granular Base	Granular Sub-Base	40 mm minus	50 mm minus	
80		100			
50		55-100		100	
40			100	90-100	
25	100	38-100			
20	82-97		95-100	35-70	
16	70-94	32-85	25-60		
10	52-79			10-30	100
5	35-64	20-65	0-10	0-5	95-100
2.5			0-5		80-100
1.25	18-43				50-85
0.630	12-34				25-60
0.314	8-26	6-30			10-30
0.160	5-18				2-10
0.080	2-10	2-10			

- .2 Granular Fill: well graded, granular material free from organic matter, frozen lumps, weeds, sod, roots, logs, stumps or any other unsuitable material:
  - .1 Gradation shall comply with the above table when tested in accordance with ASTM C117 and ASTM C136.
  - .2 Liquid Limit: to ASTM D4318, Max 2.
- .3 Granular Drainage rock: manufactured aggregate, well graded, screened material free from organic matter, frozen lumps, weeds, sod, roots, logs, stumps or any other unsuitable material:
  - .1 Gradation shall comply with the above table when tested in accordance with ASTM C117 and ASTM C136.
  - .2 Liquid limit: to ASTM D4318, Max 25.
  - .3 Plasticity index: to ASTM D4318, Max 6.
- .4 Granular pipe bedding and surround material: granular material free from organic matter, frozen lumps, weeds, sod, roots, logs, stumps or any other unsuitable material:
  - .1 Gradation shall comply with the above table when tested in accordance with ASTM C117 and ASTM C136.
  - .2 Liquid limit: to ASTM D4318, max 25.
  - .3 Plasticity index: to ASTM D4318, Max 6.
- .5 Native Fill: selected material from excavation areas, unfrozen and free from rocks larger than 75 mm, cinders, ashes, sods, organic matter, refuse or other deleterious materials.
- .6 Borrow Material: selected material from offsite borrow pits, unfrozen and free from rocks larger than 75 mm, cinders, ashes, sods, organic matter, refuse or other deleterious materials.

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**Part 3            Execution**

**3.1                TEMPORARY EROSION AND SEDIMENTATION CONTROL**

- .1      Provide temporary erosion and sedimentation control measures to prevent soil erosion and discharge of soil-bearing water runoff or airborne dust to adjacent properties and walkways, according to requirements of authorities having jurisdiction.
- .2      Inspect, repair, and maintain erosion and sedimentation control measures during construction until permanent vegetation has been established.
- .3      Remove erosion and sedimentation controls and restore and stabilize areas disturbed during removal.

**3.2                SITE PREPARATION**

- .1      Remove obstructions, ice and snow, from surfaces to be excavated within limits indicated.
- .2      Cut pavement or sidewalk neatly along limits of proposed excavation in order that surface may break evenly and cleanly.

**3.3                PREPARATION/PROTECTION**

- .1      Protect existing features in accordance with applicable local regulations.
- .2      Protect existing buildings from direct or indirect damage caused by nearby excavations.
  - .1      Do not excavate below a 1:1 slope below existing building foundations or slabs on grade, measured outwards from the lowest and closest point of the foundation to the excavation, unless approved in writing by the Departmental Representative.
  - .2      In areas where the Contractor must excavate below a 1:1 slope area from the existing foundation or slab, do not complete excavation in wet conditions, and backfill the excavation with no shrink fill to above the 1:1 slope line within 48 hours of initiating the trenching.
- .3      Keep excavations clean, free of standing water, and loose soil.
- .4      Where soil is subject to significant volume change due to change in moisture content, cover and protect.
- .5      Protect natural and man-made features required to remain undisturbed. Unless otherwise indicated or located in an area to be occupied by new construction, protect existing trees from damage.
- .6      Protect buried services that are required to remain undisturbed.

**3.4                STRIPPING OF TOPSOIL**

- .1      Begin topsoil stripping of areas as indicated after area has been cleared of grasses and removed from site.
- .2      Complete topsoil stripping according to 31 14 13 – Soil Stripping and Stockpiling.
- .3      Strip topsoil to depths as indicated.
  - .1      Do not mix topsoil with subsoil.
- .4      Stockpile in locations as directed by Departmental Representative.

- .1 Stockpile height not to exceed 2 m and should be protected from erosion.
- .5 Dispose of unused topsoil off site.
- .6 All topsoil must be stripped prior to beginning excavation of subsoils. The Contractor shall immediately notify the Departmental Representative if topsoil thickness is greater than 150mm and will result in additional stripping costs.

### **3.5 STOCKPILING**

- .1 Stockpile fill materials in areas directed by Parks Canada Agency.
  - .1 Stockpile granular materials in manner to prevent segregation.
- .2 Stockpile material on existing hardened surfaces only unless otherwise directed by the Departmental Representative.
- .3 Protect fill materials from contamination.
- .4 Implement sufficient erosion and sediment control measures to prevent sediment release off construction boundaries and into water bodies.

### **3.6 SHORING, BRACING AND UNDERPINNING**

- .1 Excavation to be carried out within the confines of construction limits indicated on drawings. Provide shoring, bracing and underpinning as required to remain within these limits. Maintain sides and slopes of excavations in accordance with the Alberta Occupational Health and Safety Act, Regulation and Code (latest edition).
- .2 Construct temporary Works to depths, heights and locations as required.
- .3 During backfill operation:
  - .1 Unless otherwise indicated or directed by Departmental Representative, remove sheeting and shoring from excavations.
  - .2 Do not remove bracing until backfilling has reached respective levels of such bracing.
  - .3 Pull sheeting in increments that will ensure compacted backfill is maintained at elevation at least 500 mm above toe of sheeting.
- .4 Professional Engineer responsible for design of temporary structures to submit proof of insurance coverage for professional liability except where engineer is employee of Contractor, in which case Contractor shall submit proof that work by Professional Engineer is included in Contractor's insurance coverage.

### **3.7 DEWATERING AND HEAVE PREVENTION**

- .1 Keep excavations free of water while Work is in progress.
- .2 Provide for Departmental Representative's review details of proposed dewatering or heave prevention methods, including dikes and well points.
- .3 Avoid excavation below groundwater table if quick condition or heave is likely to occur.
  - .1 Prevent piping or bottom heave of excavations by groundwater lowering, sheet pile cut-offs, or other means.
- .4 Protect open excavations against flooding and damage due to surface run-off.
- .5 Dispose of water in a manner not detrimental to public and private property, or portion of

Work completed or under construction.

- .1 Provide and maintain temporary drainage ditches and other diversions outside of excavation limits.
- .6 Provide flocculation tanks, settling basins, or other treatment facilities to remove suspended solids or other materials before discharging to storm sewers, watercourses or drainage areas.

### **3.8 EXCAVATION**

- .1 Fence all excavations in accordance with 01 56 00 – Temporary Barriers and Enclosures.
- .2 Excavate to lines, grades, elevations and dimensions as indicated.
- .3 Excavation must not interfere with bearing capacity of adjacent foundations.
- .4 Do not disturb soil within branch spread of trees or shrubs that are to remain.
  - .1 If excavating through roots, excavate by hand and cut roots with sharp axe or saw.
- .5 Keep excavated and stockpiled materials safe distance away from edge of trench in accordance with the Alberta Occupational Health and Safety Act, Regulations and Code (latest edition).
- .6 Restrict vehicle operations directly adjacent to open trenches.
- .7 Dispose of surplus and unsuitable excavated material off site.
- .8 Do not obstruct flow of surface drainage or natural watercourses.
- .9 Base of excavations to be undisturbed soil, level, free from loose, soft or organic matter.
- .10 Base of excavations for utility or foundation installations to be free of frozen material.
- .11 Remove unsuitable material from trench bottom including those that extend below required elevations to extent and depth as directed by Departmental Representative.
- .12 Correct unauthorized over-excavation as follows:
  - .1 Fill with Granular Fill compacted to minimum 98% of corrected maximum dry density at no additional cost to Parks Canada Agency.
- .13 Hand trim, make firm and remove loose material and debris from excavations.
  - .1 Where material at bottom of excavation is disturbed, compact foundation soil to density at least equal to undisturbed soil.

### **3.9 FILL TYPES AND COMPACTION**

- .1 Use types of fill as indicated or specified above.
- .2 Compact filled and disturbed areas to standard proctor density, as follows:
  - .1 100% under building area and outdoor concrete slabs..
  - .2 98% under roadway and parking areas.
  - .3 95% under landscaped areas.

### **3.10 BEDDING AND SURROUND OF UNDERGROUND SERVICES**

- .1 Place and compact granular material for bedding and surround of underground services as

indicated and as specified in other sections.

- .2 Place bedding and surround material in unfrozen condition and against unfrozen surfaces.

### **3.11 BACKFILLING**

- .1 Do not proceed with backfilling operations until completion of following:
  - .1 The Contractor has taken pictures of the installation and forwarded the information to the Departmental Representative.
  - .2 Inspection, testing, approval, and recording location of underground utilities.
  - .3 Removal of concrete formwork.
  - .4 Removal of shoring and bracing; backfilling of voids with satisfactory soil material.
- .2 Areas to be backfilled to be free from debris, snow, ice, water and frozen ground.
- .3 Do not use backfill material which is frozen or contains ice, snow or debris.
- .4 Place backfill material in uniform layers not exceeding 150 mm compacted thickness up to grades indicated. Compact each layer before placing succeeding layer.
- .5 Backfilling around installations:
  - .1 Place bedding and surround material as specified elsewhere.
  - .2 Do not backfill around or over cast-in-place concrete within 24 hours after placing of concrete.
  - .3 Place layers simultaneously on both sides of installed Work to equalize loading. Difference not to exceed 300 mm.
- .6 Place unshrinkable fill in areas as indicated.
- .7 Consolidate and level unshrinkable fill with internal vibrators.
- .8 In freezing weather conditions, complete backfill of excavations within 48 hours of beginning the excavation unless otherwise approved by the Departmental Representative.
- .9 Provide Quality Control compaction testing for all backfill on site. Compaction testing shall be:
  - .1 Completed in accordance with 01 45 00 – Quality Control
  - .2 Completed by a certified third party testing agency.
  - .3 At a minimum frequency of one test for each 150mm lift placed over each 150m piece of linear trench for trenched areas.
  - .4 At a minimum frequency of one test for each 150mm lift place over each 500m<sup>2</sup> area in non-trenched areas.

### **3.12 RESTORATION**

- .1 Upon completion of Work, remove waste materials.
- .2 Replace topsoil to the satisfaction of the Departmental Representative.
- .3 Reinstatement to elevations which existed before excavation.
- .4 Clean and reinstate areas affected by Work to the satisfaction of the Departmental Representative.

- .5 Use temporary plating to support traffic loads over unshrinkable fill for initial 24 hours.
- .6 Protect newly graded areas from traffic and erosion and maintain free of trash or debris.

**END OF SECTION**

## **PART 1 GENERAL**

### **1.1 REFERENCES**

- .1 American Society for Testing and Materials (ASTM)
  - .1 ASTM C117, Standard Test Methods for Material Finer Than 0.075 mm Sieve in Mineral Aggregates by Washing.
  - .2 ASTM C117, Standard Test Methods for Material Finer Than 0.075 mm Sieve in Mineral Aggregates by Washing.
  - .3 ASTM C136, Standard Test Method for Sieve Analysis of Fine and Coarse Aggregates
  - .4 ASTM D698, Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort (600kN-m/m<sup>3</sup>).
  - .5 ASTM D1883, Standard Test Method for CBR (California Bearing Ratio) of Laboratory Compacted Soils
  - .6 ASTM D4318, Standard Test Methods for Liquid Limit, Plastic Limit and Plasticity Index of Soils.
- .2 Canadian General Standards Board (CGSB)
  - .1 CAN/CGSB-8.1, Sieves, Testing, Woven Wire, Inch Series.
  - .2 CAN/CGSB-8.2, Sieves, Testing, Woven Wire, Metric.

### **1.2 DELIVERY, STORAGE, AND HANDLING**

- .1 Deliver and stockpile, aggregates as noted below.
  - .1 Handle and transport aggregates to avoid segregation, contamination and degradation
  - .2 Stockpiling of aggregate to be permitted in locations approved by the Departmental Representative only. Do not stockpile outside of existing gravel or pavement surfaces.
  - .3 Stockpile aggregates in sufficient quantities to meet project schedules.

### **1.3 WASTE MANAGEMENT AND DISPOSAL**

- .1 Remove from site any unused granular material to outside the Park or as directed by the Departmental Representative to a location inside the Park.

## **PART 2 PRODUCTS**

### **2.1 MATERIALS**

- .1 Granular base and sub-base: material in accordance Alberta Transportation Standard Specifications for Highway Construction.

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**PART 3 EXECUTION**

**3.1 SEQUENCE OF OPERATION**

- .1 Place granular base only after sub-base or subgrade surface is inspected and approved by Engineer.
- .2 Placing:
  - .1 Construct granular base to depth and grade in areas indicated.
  - .2 Ensure no frozen material is placed.
  - .3 Do not place aggregate on surfaces with ponding water or which are saturated and soft.
  - .4 Place material only on clean unfrozen surface properly shaped and compacted, and free from snow and ice.
  - .5 Begin spreading base material on crown line or on high side of one-way slope.
  - .6 Place material using methods which do not lead to segregation or degradation of aggregate.
  - .7 Place material to full width in uniform layers not exceeding 150 mm compacted thickness. Departmental Representative may authorize thicker lifts (layers) if specified compaction can be achieved.
  - .8 Shape each layer to smooth contour and compact to specified density before succeeding layer is placed.
  - .9 Remove and replace that portion of layer in which material becomes segregated during spreading.
- .3 Compaction Equipment:
  - .1 Compaction equipment to be capable of obtaining required material densities.
  - .2 Efficiency of equipment not specified to be proved at least as efficient as specified equipment at no extra cost and written approval must be received from Departmental Representative before use.
  - .3 Equipped with device that records hours of actual work, not motor running hours.
- .4 Compacting:
  - .1 Compact to density not less than 100% of Standard Proctor Density ASTM D698 at optimum moisture content.
  - .2 Shape and roll alternately to obtain smooth, even and uniformly compacted base.
  - .3 Apply water as necessary during compacting to obtain specified density. If material is excessively moist, aerate by scarifying with suitable equipment until moisture content is corrected.
  - .4 In areas not accessible to rolling equipment, compact to specified density with approved mechanical tampers.
  - .5 Correct surface irregularities by loosening and adding or removing material until surface is within specified tolerance.
  - .6 The top of the finished base shall exhibit a smooth, continuously dense surface.
- .5 Proof Rolling:

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- .1 For proof rolling use standard roller of 45400 kg gross mass with four pneumatic tires each carrying 11350 kg and inflated to 620 kPa. Four tires arranged abreast with centre to centre spacing of 730 mm.
  - .2 Obtain approval from Departmental Representative to use non- standard proof rolling equipment.
  - .3 Proof roll at level in granular base as indicated. If use of non- standard proof rolling equipment is approved, Departmental Representative to determine level of proof rolling.
  - .4 Make sufficient passes with proof roller to subject every point on surface to three separate passes of loaded tire.
  - .5 Where proof rolling reveals areas of defective subgrade:
    - .1 Remove base, sub-base and subgrade material to depth and extent as directed by Engineer.
    - .2 Replace sub-base material and compact.
  - .6 Where proof rolling reveals defective base or sub-base, remove defective materials to depth and extent as directed by Departmental Representative and replace with new materials in accordance with this section at no extra cost.

### **3.2 SITE TOLERANCES**

- .1 Finished base surface to be finished to tie-in neatly with adjacent existing gravel surfaces and vegetated areas.
- .2 Correct surface irregularities and adding or removing material until surface is within specified tolerance.

**END OF SECTION**

## **PART 1 GENERAL**

### **1.1 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 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.

### **1.2 SUBMITTALS**

- .1 Provide submittals in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Include in the EPP, erosion and sedimentation control plan for areas where topsoil is to be placed as part of the site restoration work.
- .3 Should topsoil importation be required, submit all testing results identified below minimum of 15 business days prior to planned importation of material.

## **PART 2 PRODUCTS**

### **2.1 TOPSOIL**

- .1 The contractor shall only utilize topsoil material salvaged from the site as part of the site restoration scope unless otherwise directed by the Departmental Representative.
- .2 Importing of topsoil or substitute organic materials will not be permitted unless approved by the Departmental Representative.
- .3 The contractor shall notify the Departmental Representative as soon as possible if they suspect there may be a shortage of topsoil salvaged from the site to allow for restoration.

### **2.2 TOP SOIL TESTING**

- .1 Importing of topsoil or substitute organic materials will be subject to strict testing requirements to be identified by Parks Canada.
- .2 Testing consists of chemical, particle size and seed analysis at a frequency to be determined by the Departmental Representative. Specific requirements to be provided to the contractor upon request. The contractor shall submit testing results to the Departmental Representative a minimum of 14 days prior to planned importation to site.

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- .3 The importation of topsoil material, including all costs associated with testing, will be addressed using the Contemplated Change Notice and Change Order process established under the General Conditions.

## **PART 3 EXECUTION**

### **3.1 TEMPORARY EROSION AND SEDIMENTATION CONTROL**

- .1 Provide temporary erosion and sedimentation control measures to prevent soil erosion and discharge of soil-bearing water runoff or airborne dust to adjacent properties and walkways, according to requirements of authorities having jurisdiction.
- .2 Inspect, repair, and maintain erosion and sedimentation control measures during construction until permanent vegetation has been established.
- .3 Remove erosion and sedimentation controls and restore and stabilize areas disturbed during removal.

### **3.2 PREPARATION OF SUBGRADE**

- .1 Coordinate with the Departmental Representative to confirm that grades are correct. Do not begin placing of topsoil over subgrade until instructed by the Departmental Representative.
- .2 Grade area only when soil is dry to lessen soil compaction. Otherwise mechanically loosen subgrade and hand rake to level prior to placing topsoil unless directed by the Departmental Representative.
- .3 Grade soil establishing natural contours and mimicking natural rolling nature. Should not produce low spots, ensuring positive drainage away from buildings and roadways.
- .4 Remove debris, roots, branches, stones in excess of 50 mm diameter and other deleterious materials.
- .5 Cultivate entire area which is to receive topsoil to minimum depth of 150 mm.
- .1 Cross cultivate those areas where equipment used for hauling and spreading has compacted soil.

### **3.3 PLACING OF TOPSOIL**

- .1 Place topsoil after Departmental Representative has accepted subgrade.
- .2 Spread topsoil in uniform layers not exceeding 150 mm, over unfrozen subgrade free of standing water.
- .3 Place topsoil in dry, loose condition to minimize the production of mud, or resulting in unnecessary compaction or rutting from equipment.
- .4 Topsoil is to be placed in total thickness matching the pre-construction thickness identified for each area unless otherwise directed by the Departmental Representative.

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- .5 Establish traffic patterns for equipment to prevent driving on topsoil after it has been spread to avoid compaction.
  - .6 Establish traffic patterns for equipment to prevent mixing of topsoil with subsoils during the topsoil placement process.
  - .7 Cultivate soil following spreading procedures.
  - .8 Manually spread topsoil/planting soil around trees, shrubs and obstacles.
  - .9 Remove debris which does not support growth or effort to return area to original condition including large clumps, excessive cobbles or boulders, or excessive woody debris.
  - .10 Do not stockpile salvaged topsoil material unless approved by the Departmental Representative. Salvaged topsoil is to be immediately placed in it's permanent new resting location to maintain native seed bank and soil microbial condition.

### **3.4 FINISH GRADING**

- .1 Grade to eliminate rough spots and low areas within 3 meters of building and ensure positive drainage away from buildings and roadways.
  - .1 Prepare loose friable bed by means of cultivation and subsequent raking.
- .2 Consolidate topsoil to required bulk density using equipment approved by Departmental Representative.
  - .1 Leave surfaces smooth, uniform and firm against deep footprinting.
- .3 Topsoiled areas are not to be seeded or sodded within seven days of topsoil placement unless otherwise directed in writing by the Departmental Representative.
- .4 Following the placement of topsoil, the contractor shall place by hand coarse woody debris to mimic the surrounding undisturbed areas and discourage foot or vehicle traffic through those areas.

### **3.5 ACCEPTANCE**

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

### **3.6 SURPLUS MATERIAL**

- .1 Surplus topsoil material is not anticipated to be produced.

### **3.7 CLEANING**

- .1 Upon completion of installation, remove surplus materials, rubbish, tools and equipment barriers.
- .2 Equipment shall be thoroughly cleaned before moving from work areas with known non-native vegetation growth to areas with no known non-native vegetation growth. A map of those areas will be provided to the contractor during the start up meeting.

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**END OF SECTION**

**Part 1           General**

**1.1           GENERAL**

- .1       This specification covers preparation of the area to be seeded, the supply and application of seed and fertilizer, and the finishing of seeded areas. Areas to be seeded shall include any disturbed or exposed earth surfaces within the right-of-way, borrow and waste areas, and as determined by the Departmental Representative.

**Part 2           Products**

**2.1           GRASS SEED**

- .1       Grass seed shall meet the minimum requirements for Common No. 1 Seed as defined by the Grade Tables under the Canada Seeds Act & Regulations, and shall be of the composition specified in the Special Provisions. The seed shall be mixed by a conditioner and bulk storage facility approved by the Authority responsible for Canada Seeds Act & Regulations. All seed shall be tested by a Registered Seed Lab, and each bag shall be clearly marked with the name of the supplier and the mixture composition. Prior to the use on the project, the Contractor shall provide the Departmental Representative with a Certificate of Analysis for each lot of seed supplied. Test results from the Certificate of Seed Analysis shall specify the germination, or for native seeds that are not a part of the seed tables the Tetrazolium, and purity for each seed species of the mix as well as the seed mix composition expressed as a percentage of each seed species by dry mass for each seed mix specified.
- .2       See Drawing C104A for seed mix requirements.

**2.2           FERTILIZER**

- .1       To Canada "Fertilizers Act" and Fertilizers Regulations".
- .2       Fertilizer shall be stored in standard containers clearly marked with the name of the Manufacturer, weight and specified composition.
- .3       To be used only with the prior written approval of the Departmental Representative.

**Part 3           Execution**

**3.1           WATER**

- .1       Water supplied by the Contractor shall be free of any impurities that might inhibit germination of the seed.

**3.2           WORKMANSHIP**

- .1       Do 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.
- .2       Remove and dispose of weeds; debris; stones 50 mm in diameter and larger; soil contaminated by oil, gasoline and other deleterious materials; off site.

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**3.3 SEED BED PREPARATION**

- .1 Verify that grades are correct. If discrepancies occur, notify Departmental Representative and do not commence work until instructed by Departmental Representative.
- .2 Fine grade surface free of humps and hollows to smooth, even grade, and to tolerance of plus or minus 15 mm, surface draining naturally.
- .3 Cultivate fine grade approved by 25 mm depth immediately prior to seeding.

**3.4 SEED PLACEMENT**

- .1 Seeding is to be completed using broadcast seeding or mechanical seeding followed by hydro-mulching.

**3.5 APPLICATION RATES**

- .1 Broadcast Seeding: 40 kg/ha
- .2 Brillion Drill Seeding: 20 kg/ha
- .3 Hydro-mulching: Mulching rate is to be as per supplier's recommendations.

**3.6 FERTILIZER**

- .1 Fertilizer applications are only permitted when using agronomic/forage mixtures. Fertilizer shall not to be used when using native seed mixtures. Formulation and application rates of fertilizers will be as specified in the Special Provisions.

**3.7 MAINTENANCE DURING ESTABLISHMENT PERIOD**

- .1 The landscape maintenance period shall last a duration of two calendar years from the date of substantial completion.
- .2 Provide maintenance records to verify maintenance work is completed as required.
- .3 Perform following operations from time of seed application until acceptance by Departmental Representative.
  - .1 Water seeded area to maintain optimum soil moisture level for germination and continued growth of grass. Control watering to prevent washouts.
  - .2 Water seeded areas minimum two times each week between June 15 to September 15.
  - .3 Repair and reseed dead or bare spots to allow establishment of seed prior to acceptance.
  - .3 Cut grass to 60 mm whenever it reaches a height of 75 mm.
  - .4 Fertilize seeded areas after first cutting in accordance with fertilizing program. Spread half of required amount of fertilizer in one direction and remainder at right angles.

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- .5 Eliminate weeds by mechanical or chemical means.
  - .4 The landscape maintenance period shall be extended into the following growing season by the same duration of time that the Contractor is not able to produce accurate maintenance records for.
  - .5 The Contractor is required to complete non-native vegetation control each spring and fall, as well as once monthly during summer months during the maintenance period.

### **3.8 ACCEPTANCE**

- .1 Seeded areas will be accepted by Departmental Representative provided that:
  - .1 Areas are uniformly established and turf is free of rutted, eroded, bare or dead spots and free of weeds.
  - .2 Areas have been cut at least once.
  - .3 Areas have been fertilized.

### **3.9 MAINTENANCE DURING WARRANTY PERIOD**

- .1 Perform following operations from time of acceptance until end of warranty period:
  - .1 Water seeded area to maintain optimum solid moisture level for continued growth of grass. Control watering to prevent washouts.
  - .2 Repair and reseed dead or bare spots to satisfaction of Departmental Representative.
  - .3 Cut grass to 60 mm whenever it reaches a height of 75 mm.
  - .4 Fertilize seeded areas in accordance with fertilizing program; Spread half of required amount of fertilizer in one direction and remainder at right angles.
  - .5 Eliminate weeds by mechanical or chemical means.

**END OF SECTION**

## **Part 1            General**

### **1.1                REFERENCES**

- .1    Agriculture and Agri-Food Canada:
  - .1        Plant Hardiness Zones in Canada, 2000.
- .2    Canadian Nursery Landscape Association (CNLA):
  - .1        Canadian Standards for Nursery Stock, 2006.
- .3    Vegetation Removal and Restoration/Reclamation Guidelines. Banff National Park. Parks Canada.
- .4    Woody/Vegetative Debris Management Guidelines, 2017, Parks Canada.

### **1.2                DEFINITIONS**

- .1    Topsoil: The top layer of soil containing organic material capable of supporting good vegetative growth and suitable for use in top dressing, landscaping and seeding.
- .2    Mycorrhiza: association between fungus and roots of plants. This symbiosis, enhances plant establishment in newly landscaped and imported soils.

### **1.3                ADMINISTRATIVE REQUIREMENTS**

- .1    Scheduling: obtain approval from Departmental Representative of schedule seven (7) days in advance of shipment of plant material. Schedule to include:
  - .1        Quantity and type of plant material.
  - .2        Shipping dates.
  - .3        Arrival dates on site.
  - .4        Planting Dates.

### **1.4                SUBMITTALS**

- .1    Submit accordance with as Division 01.
- .2    Product Data:
  - .1        Submit manufacturer's instructions, printed product literature and data sheets for trees, shrubs, ground cover, mycorrhiza, anti-desiccant, anchoring equipment, and include product characteristics, performance criteria, physical size, finish and limitations.
    - .1            Submit two (2) copies of WHMIS Safety Data Sheets.
    - .2            Submit the Certificate of Analysis for all seed.
- .3    Samples:
  - .1        Submit samples of mycorrhiza.

### **1.5                QUALITY ASSURANCE**

- .1    Qualifications:

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- .1 Landscape Contractor: to be a Member in Good Standing of Landscape Alberta Nursery Trades Association (LANTA).
  - .2 Landscape Planting Supervisors: "Landscape Industry Certified" Technician with Softscape Installation Specialization as regulated by Canadian Nursery Landscape Association (CNLA).

## **1.6 PRODUCT DELIVERY, STORAGE AND HANDLING**

- .1 Deliver, store and handle materials in accordance with Division 01.
- .2 Delivery and Acceptance Requirements: deliver materials to site in original factory packaging, labelled with manufacturer's name and address.
  - .1 Protect plant material from frost, excessive heat, wind and sun during delivery.
  - .2 Protect plant material from damage during transportation:
    - .1 Delivery distance is less than 30 km and vehicle travels at speeds under 80 km/h, tie tarpaulins around plants or over vehicle box.
    - .2 Delivery distance exceeds 30 km or vehicle travels at speeds over 80 km/h, use enclosed vehicle where practical.
    - .3 Protect foliage and root balls using anti desiccants and tarpaulins, where use of enclosed vehicle is impractical due to size and weight of plant material.
    - .4 Pad all points of contact between plant material and equipment.
- .3 Unload and inspect all plants immediately upon arrival to site and water as required. Trees with cracked or broken root balls or leaders will not be accepted.
- .4 Storage and Handling Requirements:
  - .1 Immediately store and protect plant material which will not be installed within twenty-four (24) hours in accordance with supplier's written recommendations and after arrival at site in storage location approved by Departmental Representative.
  - .2 Protect stored plant material from frost, wind and sun and as follows:
    - .1 For bare root plant material, preserve moisture around roots by burying roots in topsoil and watering to full depth of root zone.
    - .2 For pots and containers, maintain moisture level in containers.
    - .3 For balled and burlapped and/or wire basket root balls, place to protect branches from damage. Maintain moisture level in root zones.
    - .4 For live cuttings, obtain necessary permit from Parks Canada Agency prior to harvest, collect in dormant season only, soak and install immediately after harvest; ensure cuttings are not left in direct sun between soaking and installation. If immediate installation is not possible, cuttings shall be sent to nursery to be rooted.
  - .3 Store and manage manufactured materials in a weatherproof location in accordance with manufacturer's written instructions.
  - .4 Packaging Waste Management:
    - .1 Collect and separate for disposal and recycling all palettes, crates, padding and packaging materials.

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.2 Dispose / recycle materials at appropriate facilities.

## 1.7 SUBSTITUTION

- .1 All substitutions shall be made through a change order to the Contract.

## 1.8 WARRANTY

- .1 Contractor hereby warrants that plant materials as itemized on the plant list will remain free of defects, but for two (2) full growing season following installation.
- .2 End of warranty inspection will be conducted by Parks Canada Vegetation Specialist.
- .3 Departmental Representative reserves the right to extend the Contractor's warranty responsibilities for an additional one year if, at the end of the initial warranty period, leaf development and growth is not sufficient to ensure future survival.

## Part 2 Products

- .1 Trembling Aspen (*Populus Tremuloides*)
- .1 Planted in rough and loose soil with woody debris at 100 m<sup>3</sup>/ha. Woody debris to be sourced from material on site and should comprise a wide range of sizes, with an average diameter of at least 10 cm and average length of at least 2 m.
- .2 Plant where disturbance occurs due to shelter removal, trail braiding, and open areas near river as shown on Drawings.
- .3 Install watering bags on planted trees which are #3 pot or greater.
- .2 Shrub Planting
- .1 Plant shrubs as shown on Drawings including prickly rose (*Rosa acicularis*), Grey Leaved Willow (*salix glauca*) and Common Bearberry/Kinnikinnik (*Arctostaphylos uva-ursi*) at 0.3 m spacing in remaining areas of shrub planting zone.
- .2 Plant in existing non-forested areas to be disturbed that are not required to be returned to grass as shown on Drawings.
- .3 Grass restoration within areas of native grass species:
- .1 Plant in existing native grass dominated areas to be disturbed.
- .2 Seed mix to include the following species:
- .1 29% Hairy Wild Rye (*Leymus innovatus*)
- .2 25% Bluebunch Wheatgrass (*Agropyron Spicatum*)
- .3 14% Fringed Bromegrass (*Bromus Ciliatus*)
- .4 26% Northern Wheatgrass (*Agropyron Dasystachyum*)
- .5 6% Prairie June grass (*Koeleria macrantha*)
- .4 Natural Revegetation
- .1 In the majority of areas where utility line removal and replacement will occur, a maximum trench width of 3 m will be required and native topsoil will be replaced to create a rough and loose surface with woody debris. These conditions

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will allow natural revegetation to achieve a native plant community through the native seed bank and natural recruitment.

- .2 Old Washroom Area to be restored with salvaged topsoil from Proposed Septic Field Area in a manner which preserves the native seedbank in the topsoil material. Any salvaged surface cover plant material is also to be replanted in the Old Washroom Building Restoration Area to expedite the restoration process.

## **2.1 PLANT MATERIAL**

- .1 Type of root preparation, sizing, grading and quality: comply to Canadian Standards for Nursery Stock.
  - .1 Only native species of wild provenance shall be installed. No cultivars are permitted.
  - .2 Trees and shrubs shall originate from the same geo-climatic zone as the project site. To the extent possible, the genetic origin shall be of similar or lower elevation and latitude.
- .2 Plant material: plants shall be generally true to type and structurally sound, well branched, healthy and vigorous, and free of disease, insect infestations, insect eggs, rodent damage, sunscald, frost cracks and mechanical wounds. They shall be densely foliated when in leaf and have a healthy, well-developed root system. Pruning cuts shall show vigorous bark on all edges and all parts shall be moist and show live, green cambium tissue when cut.
- .3 Root balls:
  - .1 Shall be of a diameter as specified in the CNLA Canadian Standards for Nursery Stock. Root ball sizes are a minimum and shall be adjusted according to the growth habit of plants.
  - .2 Root ball sizes shall be sufficiently large to contain at least 75% of the fibrous root depth.
  - .3 The root ball shall contain all the original soil in which the tree has grown and shall be free of all weeds and vegetation. It shall be firmly secured to prevent any soil from spilling or drying out.
  - .4 Any increase or decrease in tree size shall require a corresponding adjustment to the root ball size to conform to CNLA Canadian Standards for Nursery Stock.
- .4 Deciduous trees
  - .1 Deciduous trees shall have straight stems unless that would be uncharacteristic to the tree species.
  - .2 Minor adjustments of structural integrity may be attempted by structural pruning carried out by a Certified Arborist and will be subject to re-inspection.
  - .3 Clump or multi-stem trees shall have three (3) or more stems originating from a common base.
  - .4 Deciduous trees to show signs of good trunk taper and free of branches to a point not less than 60% or 1.5 m.
  - .5 All trunks shall be straight, clean and free from stubs and portions of decay, splits or other damage.
- .5 Coniferous trees:

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- .1 Coniferous trees shall be of normal shape and quality for the species. Trees with broken or missing leaders will not be accepted.
  - .2 Pine varieties shall have uniform branching which starts no higher than 600 mm from the root collar.
  - .3 Where 1- or 2-year seedlings are not used, root balls for coniferous trees to be:

Tree Height Range	Ball Diameter
1.8 – 2.4 m	86 cm
2.5 – 3.0 m	100 cm
3.1 – 3.5 m	122 cm
  - .4 Where 1- or 2-year seedlings are not used, pines to have oversized minimum root ball diameter (for trees 2.5m height) of 1150 mm.
  - .6 Collected stock: Any plants dug from native stands, woodlots, orchards or neglected nurseries and have not received proper cultural maintenance as advocated by the Canadian Nursery Landscape Association.
    - .1 The use of collected stock will not be permitted unless previously inspected and approved in writing by Departmental Representative.
    - .2 Trees collected from native stands or established plantings must be so designated and approved by the Owner prior to planting. Root balls shall be at least 10% larger in diameter than nursery grown stock.
  - .7 Shrubs shall have natural form typical of the species with a minimum of four (4) canes.
  - .8 Vines shall have at least four (4) runners, each of a minimum length of 300 mm.
  - .9 Ground covers shall have well developed tops, size proportionate to the developed roots typical of the species.
  - .10 Plants that have been top-worked, sheared or colour treated are not acceptable.

## 2.2 TOPSOIL

- .1 Topsoil shall be replaced where stripping occurred immediately following final grading of subsoil.
- .2 In locations of topsoil replacement, depth of topsoil shall be a minimum of 500 mm.
- .3 All topsoil shall originate from the project site; importing topsoil from off site locations shall not be permitted.
- .4 Soils shall be left rough and loose to provide an irregular and undulating surface.
- .5 Following topsoil replacement, vehicle and equipment traffic shall be prohibited to prevent soil compaction.

## 2.3 WATER

- .1 Free of impurities that would inhibit germination and growth.
- .2 Contractor to supply all related hoses, trucks, sprinklers as required at no cost to the Owner.

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<b>2.4</b>	<b>STAKES</b>
.1	T-bar, steel, 40 x 40 x 5 mm thick, 2100 mm in length (not including 1-year or 2-year old seedlings).
<b>2.5</b>	<b>WIRE TIGHTENER</b>
.1	Type 1: galvanized steel, stamped plate type rod, triangular shape (not including 1- or 2-year old seedlings).
<b>2.6</b>	<b>GUYING WIRE</b>
.1	Galvanized #12 guy wire or approved equal (not including 1-year or 2-year old seedlings).
<b>2.7</b>	<b>GUYING COLLAR</b>
.1	2 ply, reinforced, 12 mm black rubber hose, or approved equal (not including 1-year or 2-year old seedlings).
<b>2.8</b>	<b>TRUNK PROTECTION</b>
.1	As directed by Departmental Representative. <ul style="list-style-type: none"><li>.1 Wire mesh: galvanized, electrically welded 1.4 mm wire mesh with 25 x 25 mm mesh and fastener.</li><li>.2 Plastic: perforated spiralled strip.</li><li>.3 Burlap: clean 2.5 kg/m<sup>2</sup> minimum mass and 150 mm wide, and twine fastener.</li><li>.4 Tar impregnated crepe paper and twine fastener.</li></ul>
<b>2.9</b>	<b>FERTILIZER</b>
.1	Fertilizer shall not be used; it is not recommended for native species planting.
<b>2.10</b>	<b>AMENDMENT</b>
.1	Synthetic commercial type as recommended by soil test report. <ul style="list-style-type: none"><li>.1 Ensure new root growth is in contact with mycorrhiza.</li><li>.2 Use mycorrhiza as recommended by manufacturer's written recommendations.</li></ul>
<b>2.11</b>	<b>ANTI DESICCANT</b>
.1	Wax like emulsion.
<b>2.12</b>	<b>FLAGGING TAPE</b>
.1	Fluorescent orange colour.
<b>2.13</b>	<b>SOURCE QUALITY CONTROL</b>
.1	Obtain approval from Departmental Representative of plant material prior to planting. Previous approval of plant material shall not impair the right of Departmental Representative during construction to reject plants which have been damaged or which, in any way, do not conform to the Specifications.

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- .2 Imported plant material must be accompanied with necessary permits and import licences. Conform to Federal, Provincial or Territorial regulations.

### **Part 3 Execution**

#### **3.1 PLANTING SEASON**

- .1 Plant trees, shrubs and ground covers only during periods that is normal for such work. It is recommended that all coniferous material should be planted by mid August to allow for root establishment and energy storage prior to winter.

#### **3.2 EXAMINATION**

- .1 Verification of Conditions: verify conditions of substrate previously installed under other Sections are acceptable for planting 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.
  - .4 Commencement of planting operations implies acceptance of subgrade.

#### **3.3 PRE-PLANTING PREPARATION**

- .1 Proceed only after receipt of written acceptability of plant material from Departmental Representative.
- .2 Complete pre-planting site walkthrough with Departmental Representative to discuss planting layout and general restoration objectives prior to starting planting.
- .3 Remove damaged roots and branches from plant material.
- .4 Apply anti desiccant to conifers and deciduous trees in leaf in accordance with manufacturer's instructions.
- .5 Locate and protect utility lines. All trees shall be planted a minimum of 3m from any new or existing underground utilities.
- .6 Notify and acquire written acknowledgment from utility authorities before beginning excavation of planting pits for trees and shrubs.
- .7 Have all applicable planting areas ready for planting prior to having plant materials arrive on site to minimize storage duration of plant materials.

#### **3.4 EXCAVATION AND PREPARATION OF PLANTING BEDS AND PITS**

- .1 Establishment of sub-grade for planting beds in accordance with Division 31.
- .2 Preparation of planting beds in accordance with Division 32.
- .3 Stake out location and obtain approval from Departmental Representative prior to excavating.
- .4 Tree pits:

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- .1 Depth of planting hole to be 40 mm less than height of the root ball, such that following planting, the top of the rootball is 40mm above grade.
  - .2 Remove rocks, roots, debris and toxic material from excavated material that will be used as planting soil for trees and individual shrubs. Dispose of excess material off site as directed by Departmental Representative.
  - .3 Scarify sides of planting hole.
  - .4 Remove water which enters excavations prior to planting. Notify Departmental Representative if water source is ground water.

### 3.5 PLANTING

- .1 For bare root stock, place 50 mm backfill soil in bottom of hole.
  - .1 Plant trees and shrubs with roots placed straight out in hole.
- .2 For jute burlapped root balls, cut away top one third of wrapping and wire basket without damaging root ball.
  - .1 Do not pull burlap or rope from under root ball.
  - .2 If circling roots are found in the root ball, cut the root at the beginning of the circling.
- .3 For container stock or root balls in non-degradable wrapping, remove entire container or wrapping without damaging root ball.
  - .1 If circling roots are found in the root ball, gently loosen roots and cut container vertically with a sharp knife to allow root ball to become free.
- .4 Plant vertically in locations as indicated.
- .5 Orient plant material to give best appearance in relation to structure, roads and walks.
- .6 For trees and shrubs:
  - .1 Backfill soil in 150 mm lifts.
    - .1 Do not place soil while frozen or muddy.
    - .2 Tamp each lift to eliminate air pockets.
    - .3 When two thirds of depth of planting pit has been backfilled, fill remaining space with water.
    - .4 After water has penetrated into soil, backfill to finish grade.
- .7 For ground covers, backfill soil evenly to finish grade and tamp to eliminate air pockets.
- .8 Water plant material thoroughly.
- .9 After soil settlement has occurred, fill with soil to finish grade.
- .10 Install and maintain fence around tree and shrub planting areas during the 1 year establishment period to prevent damage by herbivory.

### 3.6 TRUNK PROTECTION

- .1 Install trunk protection on deciduous trees as directed by Departmental Representative.
- .2 Install trunk protection before installation of tree supports.

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### **3.7 TREE SUPPORTS**

- .1 Install tree supports for large trees, not including 1-year or 2-year old seedlings.
- .2 Support plants with stakes and guy wires immediately after installation.
- .3 Install guying collars above branch to prevent slipping at approximately 2/3 height for evergreens and 1/2 height for deciduous trees. Collar mounting height not to exceed 2.5 m above grade.
  - .1 Guying collars to be of sufficient length to encircle tree plus 50 mm space for trunk clearance.
- .4 Thread guy wire through collar encircling tree trunk and secure to lead wire by clamp or multi wraps; cut wire ends close to wrap. Spread lead wires equally proportioned about trunk.
- .5 Attach guy wire to stakes. Tension wire and secure by installing clamps.
- .6 Install wire tightener ensuring that guys are secure and leave room for slight movement of tree. All guy wires to be folded or bent in such a fashion so as to not be exposed outwardly.
- .7 After tree supports have been installed, remove broken branches with clean, sharp tools.

### **3.8 MAINTENANCE**

- .1 Conduct maintenance of trees, shrubs and groundcovers as required. Maintenance activities include watering, hand pulling weeds, and replacement of any staking or fencing installed to protect plants.
- .2 Water all trees and shrubs twice weekly between June 15 and September 15 during landscape maintenance period. Contractor may skip a watering period if it rains more than 10mm within two days of a scheduled watering period.
- .3 The landscape maintenance period shall be a period of two years from the issuance of substantial completion.

### **3.9 REPLACEMENTS**

- .1 All required replacements shall be of plants of the same size and species as specified on the Drawings and shall be supplied and planted in accordance with the Drawings and Specifications.
- .2 The Contractor is required to replace all planted tree and shrub material that dies during the maintenance and warranty period.

### **3.10 ACCEPTANCE**

- .1 Trees, shrubs and groundcovers will be accepted by Departmental Representative provided plant materials are in a vigorous, healthy condition, meet or exceed the sizes indicated on the Drawings, are structurally sound and of a shape and form typical of the species.

**END OF SECTION**

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**Part 1 General**

**1.1 DEFINITIONS**

- .1 This section refers to the supply and installation of a cathodic protection system for all buried ductile iron pipe and fittings, valves and hydrants.

**Part 2 Products**

**2.1 SACRIFICIAL ANODES - GENERAL**

- .1 The anode lead wire shall be a minimum of 3 metres in length and shall consist of #12 solid copper insulated wire type TW (blue for Mg anodes, white for zinc anodes). The lead wire shall be connected to the core with silver solder or approved equal. The connection shall be insulated by filling the recess and any voids in the lead wire core connection with an electrical potting compound.
- .2 The anode shall be packaged in a permeable cloth bag or cardboard tube containing a backfill mixture of the following composition:
- Ground Hydrated Gypsum 60% min.
  - Powdered Wyoming Bentonite 20%  $\pm$ 5%
  - Anhydrous Sodium Sulphate 5%  $\pm$ 2%
  - Quartz, Calcite, Dolomite Remainder
- .3 Backfill shall have a grain size so that 100% is capable of passing through a 20 mesh screen and 50% will be retained by a 100 mesh screen. The mixture shall be firmly packaged around the anode within the cloth bag or cardboard tube by means of adequate vibration. Backfill material shall be of sufficient quantity to cover all parts of the anode to a minimum thickness of 25 mm.
- .4 All anodes shall carry a label identifying the Manufacturer's name, type of anode, and the net weight of the anode. Anode packaged in cloth bags shall be shipped in a watertight plastic bag of sufficient mil thickness to permit normal handling without tearing. Cardboard tubes when used to package anodes shall have sufficient strength to permit normal shipping and handling without failure.
- .5 Manufacturers of sacrificial anodes shall have their anodes tested on a regular basis by an independent testing laboratory to ensure compliance to these Specifications. The Manufacturers shall furnish, when requested by the Engineer, an "Affidavit of Compliance" and test results prepared by an independent testing laboratory verifying compliance of these Specifications.

**2.2 MAGNESIUM ANODES**

- .1 Magnesium anodes shall be cast with a perforated galvanized steel core. The weight of the core shall not exceed 0.15 kg per metre. One end of the anode shall be recessed so that one end of the core is accessible for the lead wire connection. Magnesium anodes shall conform to the following composition:
- Al - 0.02% maximum
  - Mn - 0.80 to 1.50%
  - Fe - 0.03% maximum

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- Ni - 0.002% maximum
  - Cu - 0.003% maximum
  - Zinc - 0.02% maximum
  - Other - 0.02% maximum
  - Magnesium - Remainder

## 2.3 ZINC ANODES

- .1 Zinc anodes shall conform to ASTM B418-01 and shall have the following composition:

- Aluminium - 0.005% maximum
- Cadmium - 0.003% maximum
- Iron - 0.0014% maximum
- Lead - 0.003% maximum
- Copper - 0.002% maximum
- Zinc - Remainder

## Part 3 Execution

### 3.1 CATHODIC PROTECTION FOR A NON-METALLIC PIPE SYSTEM

- .1 Connect 2.3 kg zinc sacrificial anode (without a test point) to each valve, fitting and coupling.
- .2 Connect 5.0 kg zinc sacrificial anode (without a test point) to each hydrant.
- .3 The Contractor may at his option install and connect a single 5.0 kg zinc sacrificial anode to one valve and one adjacent metallic fitting.

### 3.2 CATCHODIC PROTECTION FOR AN EXISTING METALLIC PIPE SYSTEM

- .1 Whenever an existing metallic distribution system is exposed for the purpose of performing a tie-in, repair or service kill; the Contractor shall supply and install a 14.5 kg magnesium anode to protect the existing system.
- .2 If the tie-in requires the replacement of more than 5 m of existing uncoated pipe, then two 14.5 kg magnesium anodes shall be installed to protect the existing system.
- .3 If the tie-in is made to an existing coated pipe, then the size of the anodes may be reduced to 7.7 kg.
- .4 Electrical continuity shall be maintained in the existing system.
- .5 Test points are not required for these anode installations.

**END OF SECTION**

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**Part 1            General**

**1.1                REFERENCES**

- .1     American National Standards Institute/American Water Works Association (ANSI/AWWA)
  - .1        ANSI/AWWA C110/A21.10-98, Ductile Iron and Gray Iron Fittings, 3 inch through 48 inch for Water and Other Liquids.
  - .2        ANSI/AWWA C111/A21.11-00, Rubber Gasket Joints for Ductile-Iron and Gray-Iron Pressure Pipe and Fittings.
- .2     American Society for Testing and Materials International, (ASTM)
  - .1        ASTM A307-00, Specification for Carbon Steel Bolts and Studs, 60,000 psi Tensile Strength.
- .3     Manufacturer's Standardization Society of the Valve and Fittings Industry
  - .1        MSS-SP-70-1998, Cast Iron Gate Valves, Flanged and Threaded Ends.

**1.2                PRODUCT DATA**

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

**1.3                CLOSEOUT SUBMITTALS**

- .1     Provide maintenance data for incorporation into manual specified in Section 01 78 00 - Closeout Submittals.

**Part 2            Products**

**2.1                MATERIALS**

- .1     Water Service Pipe
  - .1        High Density Polyethylene Pipe (HDPE) Series 160 Municipal Tubing (Copper, Tubing Size), Conforming to AWWA C901-02.
  - .2        PEX Pipe (Cross-Linked Polyethylene), Minimum SDR9, to AWWA C-904, ASTM F876/877, CSA B137.5
- .2     Corporation Stops
  - .1        Corporation Stops: to ASTM B62-02, red brass.
  - .2        Inlet Thread: tapered to AWWA C800-05.
  - .3        Outlet: compression type ends.
  - .4        Ford pack joint, EMCO Successor, Mueller, Cambridge Brass, or equal.
- .3     Water Service Saddles
  - .1        Service Saddle: waterworks bronze saddle body tapped for AWWA tapered thread, T304 stainless steel straps, bolts and nuts, Buna S rubber gasket under saddle body.
  - .2        Use double strap saddles for taps larger than 25 mm in diameter.
  - .3        Robar 2706 or equal.
- .4     Curb Stop and Service Box

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- .1 Curb Stop: bronze ball type or O-ring plug type, without drain.
  - .2 Joints: Compression type ends.
  - .3 Ford Series B44, EMCO Century Ball Valve, Mueller-Oriseal, or equal.
  - .4 Service Box and Extension Spindles: epoxy coated with solid stainless steel rod as detailed in the drawings and in the Standard Specification of the City of Calgary Waterworks Construction.

## **Part 3 Execution**

### **3.1 PREPARATION**

- .1 Clean pipes and fittings of debris and water before installation. Inspect materials for defects before installing. Remove defective materials from site.

### **3.2 TRENCHING AND BACKFILLING**

- .1 Do trenching and backfill work in accordance with Section 31 23 33 - Excavating, Trenching and Backfilling.
- .2 Trench depth to provide minimum cover over water service pipe of:
  - .1 1.1 m from finished grade for water distribution lines,
  - .2 3.0 m from finished grade for well water supply line.
- .3 Install services at right angles to main, unless otherwise specified or shown.
- .4 Lay up to 50 mm water service in same trench as sanitary sewer where applicable. Excavate trench for minimum 1.0 m separation between water and sanitary pipes. Or minimum 300mm separation of pipes of the same type.
- .5 Shape bed true to grade to provide continuous uniform bearing surface for pipe exterior. Do not use blocks when bedding pipe.
- .6 Fill any excavation below level of bottom of specified bedding with crush stone and compact.
- .7 Bench trench when one service pipe is lower than the other. Support higher service pipe(s) with compacted backfill or granular backfill if benching not possible to prevent settlement or dislocation.
- .8 Lay sanitary sewer to left hand side of water pipe and storm sewer to right hand side of water pipe when viewed from the main to the property.
- .9 Do not backfill trenches until installed work has been checked by the Departmental Representative and hydrostatic and leakage test results are within limits specified.

### **3.3 WATER SERVICE PIPE INSTALLATION**

- .1 Drill and tap main under pressure with a tapping machine capable of inserting corporation stop into main or saddle.
- .2 Tap PVC pipe with one of the following core cutters and tap (do not use auger or twist bits):

.3 Footage Tools Main Line tap machine.

.4 Modified Mueller B, Mueller B100 or Hays B1.

.5 Tapping shall conform to the following requirements:

Pipe Diameter (mm)	Maximum Size Tap Without Saddle (mm)			Maximum Size Tap With Saddle (mm)
	CI & DI	AC	PVC	
100	25	20	Not Permitted	25
150	25	20	25	50
200	25	25	25	50
250	25	25	25	50
300	25	Not Permitted	25	50

.6 Tapping of PVC DR 25, Class 100 Pipe, without a Saddle is not permitted.

.7 Tap mains at 3:00 o'clock or 9:00 o'clock position and not closer than 0.6 m to a joint.

.8 Attach service pipe and form a goose neck horizontally from corporation stop.

.9 All copper services must be continuous from main to curb stop and from curb stop to end of service with no couplings joining short lengths of pipe.

.10 Set curb stop on treated 50 x 150 x 200 mm wooden block. Install and maintain service box in plumb position during backfilling.

.11 Open corporation stop, flush service line, check operation of curb stop and check all joints for leaks prior to backfilling.

.12 Set top service box to proper elevation.

.13 Provide a "pig tail" on the end of each water service as detailed on the drawings.

.14 All water service connections are to slope back to the main waterline to aid in gravity drainage of the system during fall shut down.

.15 The Contractor shall place the water service pipes in a manner which mitigates the potential for dips in pipe which will not support full drainage of the water pipe by gravity during fall shut down.

.16 Include tracer wire installation on water service connections. Leave 5m of coiled tracer wire on the surface at water service termination points.

**END OF SECTION**

**Part 1            General**

**1.1            REFERENCE STANDARDS**

- .1 American National Standards Institute/American Water Works Association (ANSI/AWWA)
  - .1 ANSI/AWWA B301, Standard for Liquid Chlorine.
  - .2 ANSI/AWWA C651, Standard for Disinfecting Water Mains.
  - .3 ANSI/AWWA C901, Polyethylene (PE) Pressure Pipe and Tubing, ½ in (13mm) Through 3 In. (76mm), for Water Service.
  - .4 ANSI/AWWA B300, Hypochlorites.
- .2 ASTM International
  - .1 ASTM C117, Standard Test Methods for Material Finer Than 0.075 mm (No. 200) Sieve in Mineral Aggregates by Washing.
  - .2 200) Sieve in Mineral Aggregates by Washing.
  - .3 ASTM C136, Standard Method for Sieve Analysis of Fine and Coarse Aggregates.
  - .4 ASTM F2164, Standard Practice for Field Leak Testing of Polyethylene (PE) and Crosslinked Polyethylene (PEX) Pressure Piping Systems Using Hydrostatic Pressure.
- .3 Canadian General Standards Board (CGSB)
  - .1 CAN/CGSB-8.2, Sieves, Testing, Woven Wire, Metric.
- .4 CSA International
  - .1 CAN/CSA-B137 Series-13, Thermoplastic Pressure Piping Compendium. (Consists of B137.0, B137.1, B137.2, B137.3, B137.4, B137.4.1, B137.5, B137.6, B137.8, B137.9, B137.10, B137.11 and B137.12).
    - .1 CAN/CSA-B137.1-13, Polyethylene Pipe, Tubing, and Fittings for Cold-Water Pressure Services.

**1.2            SUBMITTALS**

- .1 Refer to Section 01 33 00 – Submittal Procedures.
  - .2 Submit a work procedure plan and indicate proposed method of installation (including fusing HDPE pipe, flushing, testing and disinfection), schedule and expected interruptions to existing utilities.
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- .3 Inform Departmental Representative of proposed source of bedding materials and provide access for sampling at least four (4) weeks prior to commencing work.
  - .4 Submit manufactures' test data, certification that pipe materials meet requirements of this Section, information data sheets and installation instructions at least four (4) weeks prior to beginning Work.
  - .5 Pipe certification to be marked on pipe.
  - .6 Submit certificates of the technician that will be fusing on-site for review by the Departmental Representative.
  - .7 Submit all fusion data reports for review by the Departmental Representative prior to final acceptance.
  - .8 Submit shop drawing of the manholes for review by the Departmental Representative.
  - .9 Submit digital copies of the quality control test results of all testing to the Departmental Representative for review.

### **1.3 CLOSEOUT SUBMITTALS**

- .1 Contractor to provide as-built information for all water piping installed on the project.

### **1.4 DELIVERY, STORAGE AND HANDLING**

- .1 Deliver, store and handle materials in accordance with manufacturer's written instructions.
- .2 Delivery and Acceptance Requirements: deliver materials to site in original factory packaging, labelled with manufacturer's name and address.
- .3 Storage and Handling Requirements:
  - .1 Store materials off ground and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.
  - .2 Store and protect water distribution piping from nicks, scratches, and blemishes.
  - .3 Replace defective or damaged materials with new.
  - .4 Pipe shall be unloaded and handled by the Contractor with care to prevent damage.
  - .5 Lift pipe with fabric slings or manually.
  - .6 Do not use hooks in pipe ends.

### **1.5 SCHEDULING OF WORK**

- .1 Schedule Work to minimize interruptions to existing services.
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- .2 Submit schedule of expected interruptions at least 1 week prior for approval, and adhere to interruption schedule as approved by Departmental Representative.
- .3 Notify Departmental Representative minimum of 24 hours in advance of interruption in service.

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## **Part 2 Products**

### **2.1 PIPE, JOINTS AND FITTINGS**

- .1 Polyethylene pressure pipe:
  - .1 50 mm: to ASTM F714, type PE 3708/4710 DR 11.
  - .2 Polyethylene fittings: to CAN/CSA-B137.1, for pipe sizes 100 mm and less.
  - .3 Pipe joints: to be butt welded joints.

### **2.2 VALVES AND VALVE BOXES**

- .1 Valves to open counter clockwise.
- .2 Gate valves: to ANSI/AWWA C509, ductile iron resilient wedge gate valve with poly stubs.
- .3 Service valves: Cambridge brass valve or approved equal.
- .4 Cathodic protection: 2.3 kg zinc anode c/w cadweld or mechanical connection to valve.
- .5 All valves are to include factory manufactured pipe welding end connection points. Valves are not to be connected to waterlines using mechanical connections.

### **2.3 BUILDING SERVICE CONNECTIONS**

- .1 Polyethylene pressure pipe:
  - .1 To ASTM F714, Type PE 3708/4710, series DR 11.
- .2 Polyethylene pipe joints: thermal butt fusion welded.
- .3 Polyethylene tapping tees or multi-saddle tees: for Polyethylene pipe. Tees to be socket fused to pipe.
- .4 Building service connections are to be installed inside of PVC sleeving extending to 3m outside of the building foundation and 25mm above the finished floor slab.

### **2.4 PIPE BEDDING AND SURROUND MATERIAL**

- .1 Refer to Section 31 23 33.01 for pipe bedding and surround material.
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## **2.5 PIPE DISINFECTION**

- .1 Liquid chlorine to ANSI/AWWA B300 to disinfect water mains.
- .2 Disinfect water mains in accordance with ANSI/AWWA C651.

## **2.6 CORROSION PROTECTION**

- .1 In addition to anode protection, all buried nuts, bolts and rods to be coated with Denso Mastic and Denso Tape.
- .2 Other corrosion protection method to be approved by the Departmental Representative.

## **2.7 FROST PROTECTION**

- .1 Contractor shall use CEMATRIX insulation with a density of 400 kg/m<sup>3</sup>.
- .2 Contractor shall submit the CEMATRIX mix design before use on site.

# **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 water utility distribution installation in accordance with manufacturer's written instructions.
  - .1 Visually inspect substrate.
  - .2 Inform Departmental Representative of unacceptable conditions immediately upon discovery.
  - .3 Proceed with installation only after unacceptable conditions have been remedied and after receipt of written approval to proceed from Departmental Representative.

## **3.2 PREPARATION**

- .1 Clean pipes, fittings, valves, and appurtenances of accumulated debris and water before installation.
  - .1 Inspect materials for defects to approval of Departmental Representative.
  - .2 Remove defective materials from site as directed by Departmental Representative.

## **3.3 TRENCHING**

- .1 Do trenching work in accordance with Section 31 23 33.01 - Excavating, Trenching and Backfilling.
-

- .2 Shallow bury refers to water main buried a minimum of 1.1 meter below finished grade and deep bury refers to water main buried a minimum of 3.0 meters below finished grade.

### 3.4 GRANULAR BEDDING

- .1 Place 150 mm of granular bedding material before placing pipe.
- .2 Place granular bedding material in uniform layers not exceeding 150 mm compacted thickness to 300 mm above top of pipe.
- .3 Do not place material in frozen condition.
- .4 Shape bed true to grade to provide continuous uniform bearing surface for pipe.
- .5 Compact each layer full width of bed to 95% corrected maximum dry density.
- .6 Fill authorized or unauthorized over excavations to the bottom of specified bedding using fill material specified in Section 31 23 33.01 - Excavating, Trenching and Backfilling.

### 3.5 PIPE INSTALLATION

- .1 Terminate building water service at outside building wall.
- .2 Lay pipes to manufacturer's standard instructions and specifications.
  - .1 Do not use blocks except as specified.
- .3 Position and join pipes with equipment and methods approved by Departmental Representative.
- .4 HDPE pipe will be fused by a qualified fusion technician holding current qualification credentials for the pipe size being fused, as documented by the pipe supplier.
- .5 Each fusion joint shall be recorded and logged by an approved electronic monitoring device (data logger) connected to the fusion machine, which utilizes a current version of the pipe supplier's recommended and compatible software.
- .6 Handle pipe by methods recommended by pipe manufacturer.
- .7 Lay pipes on prepared bed, true to line and grade.
  - .1 Ensure barrel of each pipe is in contact with shaped bed throughout its full length.
  - .2 Take up and replace defective pipe.
- .8 Keep jointing materials and installed pipe free of dirt and water and other foreign materials.
  - .1 Whenever work is stopped, install a removable watertight bulkhead at open end of last pipe laid to prevent entry of foreign materials.
- .9 Cut pipes in approved manner as recommended by pipe manufacturer, without damaging pipe and to leave smooth end at right angles to axis of pipe.
- .10 Align pipes before jointing.

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- .11 Do not lay pipe on frozen bedding.
  - .12 Do hydrostatic and leakage test and have results approved by Departmental Representative before surrounding and covering joints and fittings with granular material.
  - .13 Backfill remainder of trench.
  - .14 Install tracer wire on all waterlines. Tracer wire is to be fastened to waterline every 2m or less to ensure tracer wire accurately follows waterline.
  - .15 Install all waterlines true to profile design, and without dips or sags which will result in ponding water inside of the pipe. Entirety of the pipe must be installed to allow for gravity draining of the waterlines to the low point in the system to allow for annual winterization without the use of forced air if necessary.

### **3.6 VALVE INSTALLATION**

- .1 Install valves to manufacturer's recommendations at locations as indicated.
- .2 Support valves located in manholes by means of drain rock. Valves not to be supported by pipe. Bedding same as adjacent pipe.
- .3 Valve caps are to be finished flush with the finished ground surface.

### **3.7 SERVICE CONNECTIONS**

- .1 Construct service connections at right angles to water main unless otherwise directed.

### **3.8 THRUST BLOCKS**

- .1 For thrust blocks: concrete shall be sulphate resistant, 20 MPa at 28 day strength. Max slump to be 75 mm.
- .2 Place concrete thrust blocks between valves, tees, bends, reducers, and fittings and undisturbed ground.
- .3 Minimum thrust block size is 150 mm x 150 mm.
- .4 Keep pipe joints and couplings free of concrete.
- .5 Do not backfill over concrete within 24 hours after placing.

### **3.9 HYDROSTATIC AND LEAKAGE ACCEPTANCE TESTING**

- .1 Do tests in accordance with ASTM F2164.
  - .2 Provide labour, equipment, materials temporary connections, and potable required to perform hydrostatic and leakage tests hereinafter described.
  - .3 Notify Departmental Representative at least 48 hours in advance of proposed tests.
    - .1 Perform tests in presence of Departmental Representative.
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- .4 Where section of system is provided with concrete thrust blocks, conduct tests at least five (5) days after placing concrete or two (2) days if high early strength concrete is used.
  - .5 Upon completion of pipe laying and after Departmental Representative has inspected Work in place, surround and cover pipes between joints with approved granular material placed as directed by Departmental Representative.
  - .6 Leave valves, pipe joints and fittings exposed.
  - .7 When testing is done during freezing weather, protect valves, joints and fittings from freezing.
  - .8 Strut and brace caps, bends, tees, and valves, to prevent movement when test pressure is applied.
  - .9 Open valves.
  - .10 Expel air from main by slowly filling main with potable water.
    - .1 Install corporation stops at high points in main where no air-vacuum release valves are installed.
    - .2 Remove stops after satisfactory completion of test and seal holes with plugs.
  - .11 Thoroughly examine exposed parts and correct for leakage as necessary.
  - .12 Apply hydrostatic test pressure of 150% of the normal working pressure at the lowest elevation and not less than 125% of the normal working pressure. The test pressure shall not exceed the Manufacturer's recommended maximum test pressure. The test pressure shall be maintained for one (1) hour. The test pressure can drop within 5% of the test phase pressure.
  - .13 Normal working pressure is 482.6 kPa.
  - .14 Examine exposed pipe, joints, fittings and appurtenances while system is under pressure.
  - .15 Remove joints, fittings and appurtenances found defective and replace with new sound material and make watertight.
  - .16 Repeat hydrostatic test until defects have been corrected.

### **3.10 PIPE SURROUND**

- .1 Upon completion of pipe laying and after Departmental Representative has inspected Work in place, surround and cover pipes as indicated.
  - .2 Hand place surround material in uniform layers not exceeding 150 mm compacted thickness as indicated.
    - .1 Do not dump material within 2 m of pipe.
  - .3 Place layers uniformly and simultaneously on each side of pipe.
  - .4 Do not place material in frozen condition.
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- .5 Place granular material up to 300 mm above the top of pipe.
- .6 Compact each layer from pipe invert to top of pipe to at least 95% corrected maximum dry density.

### **3.11 BACKFILL**

- .1 Place backfill material, above pipe surround, in uniform layers not exceeding 150 mm compacted thickness up to grades as indicated.
- .2 Approved native backfill can be used for backfill above the pipe surround.
- .3 Compact trench backfill to 98% corrected maximum dry density.
- .4 Do not place backfill in frozen condition.

### **3.12 FLUSHING AND DISINFECTING**

- .1 Flushing and disinfecting operations: carried out by specialist contractor witnessed by Departmental Representative.
  - .1 Notify Departmental Representative at least four (4) days in advance of proposed date when disinfecting operations will begin.
- .2 Flush water mains through available outlets with a sufficient flow of potable water to produce velocity of 1.5 m/s, within pipe for minimum 10 minutes, or until foreign materials have been removed and flushed water is clear.
- .3 Provide connections and pumps for flushing as required.
- .4 Open and close valves and service connections to ensure thorough flushing.
- .5 When flushing has been completed to Departmental Representative approval, introduce strong solution of chlorine as approved by Departmental Representative into water main and ensure that it is distributed throughout entire system.
- .6 Disinfect water mains.
- .7 Rate of chlorine application to be proportional to rate of water entering pipe.
- .8 Chlorine application to be close to point of filling water main and to occur at same time.
- .9 Operate valves and appurtenances while water main contains chlorine solution.
- .10 Take water samples at service connections, in suitable sequence, to test for chlorine residual.
- .11 Measure chlorine residuals at extreme end of pipe-line being tested.
- .12 After adequate chlorine residual not less than 50 ppm has been obtained leave system charged with chlorine solution for 24 hours.
  - .1 After 24 hours, take further samples to ensure that there is still not less than 10 ppm of chlorine residual remaining throughout system.

- .13 Flush line to remove chlorine solution after 24 hours.
- .14 Perform bacteriological tests on water main, after chlorine solution has been flushed out.
  - .1 Take samples daily for minimum of two (2) days.
  - .2 Should contamination remain or recur during this period, repeat disinfecting procedure.
  - .3 Specialist contractor to submit certified copy of test results.

### **3.13 SURFACE RESTORATION**

- .1 After installing and backfilling over water mains, restore surface to original condition in existing area and according to design drawings.

### **3.14 CLEANING**

- .1 Progress Cleaning:
  - .1 Leave Work area clean at end of each day.
- .2 Final Cleaning: upon completion of water installation, remove surplus materials, rubbish, tools and equipment.

**END OF SECTION**

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**Part 1            General**

**1.1            REFERENCES**

- .1 American National Standards Institute/American Water Works Association (ANSI/AWWA)
  - .1 ANSI/AWWA C111/A21.11-00, Rubber-Gasket Joints for Ductile-Iron Pressure Pipe and Fittings.
- .2 American Society for Testing and Materials International, (ASTM)
  - .1 ASTM C14M-99, Standard Specification for Concrete Sewer, Storm Drain and Culvert Pipe (Metric).
  - .2 ASTM C76M-02, Standard Specification for Reinforced Concrete Culvert, Storm Drain and Sewer Pipe (Metric).
  - .3 ASTM C117-95, Standard Test Method for Material Finer Than 75 MU m (No. 200) Sieve in Mineral Aggregates by Washing.
  - .4 ASTM C136-01, Standard Test Method for Sieve Analysis of Fine and Coarse Aggregates.
  - .5 ASTM C443M-02, Standard Specification for Joints for Concrete Pipe and Manholes, Using Rubber Gaskets (Metric).
  - .6 ASTM D698-00a, Standard Test Method for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft4-lbf/ft3 (600 kN-m/m3)).
  - .7 ASTM D2680-01, Standard Specification for Acrylonitrile-Butadiene-Styrene (ABS) and Poly-Vinyl Chloride) (PVC) Composite Sewer Piping.
  - .8 ASTM D3034-00, Standard Specification for Type PSM Poly (Vinyl Chloride) (PVC) Sewer Pipe and Fittings.
  - .9 ASTM D3350-02, Standard Specification for Polyethylene Plastics Pipe and Fittings Materials.
- .3 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.
- .4 Canadian Standards Association (CSA International)
  - .1 CAN/CSA-A3000-98 (April 2001), Cementitious Materials Compendium (Consists of A5-98, A8-98, A23.5-98, A362-98, A363-98, A456.1-98, A456.2-98, A456.3-98).
    - .1 CAN/CSA-A5-F98, Portland Cement.
  - .2 CAN/CSA-A257 Series-M92 (R1998, Standards for Concrete Pipe.
  - .3 CSA-B70-02, Cast Iron Soil Pipe, Fittings, and Means of Joining.
  - .4 CSA B1800-02, Plastic Non-pressure Pipe Compendium - B1800 Series (Consists of B181.1, B181.2, B181.3, B181.5, B182.1, B182.2, B182.4, B182.6, B182.7, B182.8 and B182.11).
    - .1 CSA B182.1-02, Plastic Drain and Sewer Pipe and Pipe Fittings.
    - .2 CSA B182.2-02, PVC Sewer Pipe and Fittings (PSM Type).
    - .3 CSA B182.6-02, Profile Polyethylene Sewer Pipe and Fittings for Leak-Proof Sewer Applications.

- .4 CSA B182.11-02, Recommended Practice for the Installation of Thermoplastic Drain, Storm, and Sewer Pipe and Fittings.

- .5 Department of Justice Canada (Jus)

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

- .6 Transport Canada (TC)

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

## **1.2 DEFINITIONS**

- .1 Pipe section is defined as length of pipe between successive manholes and/or between manhole and any other structure which is part of sewer system.

## **1.3 SUBMITTALS**

- .1 Submit shop drawings in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Submit complete shop drawings and construction schedule, including methods of installation.
- .3 Inform the Departmental Representative at least 4 weeks prior to beginning Work, of proposed source of bedding materials and provide access for sampling.
- .4 Submit manufacturer's test data and certification at least 2 weeks prior to beginning Work.
- .5 Ensure certification is marked on pipe.
- .6 Submit manufacturers information data sheets and instructions in accordance with Section 01 33 00 - Submittal Procedures.

## **1.4 CLOSEOUT SUBMITTALS**

- .1 Provide data to produce record drawings, including directions for operating valves, list of equipment required to operate valves, details of pipe material, location of air and vacuum release valves, hydrant details, maintenance and operating instructions in accordance with Section 01 78 00 - Closeout Submittals.
  - .1 Include top of pipe, horizontal location of fittings and type, valves, valve boxes, valve chambers.

## **1.5 DELIVERY, STORAGE AND HANDLING**

- .1 Deliver, store and handle materials in accordance with Section 01 61 00 - Common Product Requirements.

## **1.6 WASTE MANAGEMENT AND DISPOSAL**

- .1 Separate waste materials for reuse and recycling.
- .2 Collect and separate for disposal packaging material for recycling in accordance with Waste Management Plan.

- .3 Handle and dispose of hazardous materials in accordance with the CEPA, TDGA, Regional and Municipal regulations.

## **1.7 SCHEDULING**

- .1 Schedule Work to minimize interruptions to existing services and maintain existing sewage flows during construction.
- .2 Submit schedule of expected interruptions for approval and adhere to approved schedule.
- .3 Notify the Departmental Representative 96 hours minimum in advance of any interruption in service.

## **Part 2 Products**

### **2.1 PLASTIC PIPE**

- .1 Type PSM Polyvinyl Chloride (PVC): to CSA-B182.2 and ASTM D3034.
  - .1 Standard Dimensional Ratio (SDR): 35.
  - .2 Locked in gasket and integral bell system.
  - .3 Pipe joints to be third party tested to withstand a 345 kPa hydrostatic pressure.
  - .4 Nominal lengths: 4 m or 6 m.
- .2 Polyethylene (PE) pressure pipes: to CSA-B137.1, CGSB 41-GP-25M:
  - .1 NPS 1/2 to NPS 6: to CSA B137.1 type PE 3406, series 160 ASTM F714, type PE 3408, series DR 11.
  - .2 90 mm to 1600 mm: to CGSB 41-GP-25M, type PE 1404, series 250.
  - .3 Polyethylene to polyethylene joints: to be thermal butt fusion joined, to ASTM D2657 or flanged with steel aluminum ductile iron backing flanges.
  - .4 Cast iron fittings with flanged ends: to ANSI/AWWA C110/A21.10 for pipe size above NPS 4, Cement mortar lined to ANSI/AWWA C104/A21.4.
  - .5 Polyethylene fittings: to CSA B137.1, for pipe sizes NPS 4 and less.
  - .6 Size as indicated on drawings.
- .3 Fittings:
  - .1 To be flanged to AWWA C207.
  - .2 Fittings shall match pipe supplied and shall be supplied by the manufacturer of the pipe or by suppliers approved by the manufacturer.
  - .3 All fittings to be compatible in materials and dimensions with the pipe.

### **2.2 SERVICE CONNECTIONS**

- .1 Type PSM Poly (Vinyl) Chloride: to CSA-B182.2.
  - .1 Standard Dimensional Ratio (SDR): 28.
  - .2 Locked in gasket and integral bell system.
  - .3 Nominal lengths: 4 m or 6 m.

- .2 Multi-Fitting gasketted "strap-on" Tee (or Wye) saddle with two stainless steel clamps for PVC mains.

## 2.3 CEMENT MORTAR

- .1 Portland cement: to CAN/CSA-A5, normal type 10.
- .2 Mix mortar one part by volume of cement to two parts of clean, sharp sand mixed dry.
  - .1 Add only sufficient water after mixing to give optimum consistency for placement.
  - .2 Do not use additives.

## 2.4 PIPE BEDDING AND SURROUND MATERIALS

- .1 Granular material to Section 31 05 16 - Aggregate Materials and following requirements:
  - .1 Crushed or screened stone or gravel consisting of hard, durable particles.
  - .2 Gradations within limits specified when tested to ASTM C136 and ASTM C117. Sieve sizes to CAN/CGSB-8.2.
- .2 Table

Sieve Designation	% Passing by Mass	
	Stone/Gravel	Gravel/Sand
200 mm	-	-
75 mm	-	-
50 mm	-	-
38.1 mm	-	-
25 mm	100	-
19 mm	-	-
12.5 mm	65-90	100
9.5 mm	-	-
4.75 mm	35-55	80-100
2.00 mm	-	50- 90
0.425 mm	10-25	10- 50
0.180 mm	-	-
0.075 mm	0- 8	0- 10

- .3 Concrete mixes and materials required for bedding cradles, encasement, supports, thrust blocks and plugs: to Section 03 30 00 - Cast-in-Place Concrete.

## 2.5 BACKFILL MATERIAL

- .1 Type 2, in accordance with Section 31 23 33 - Excavating, Trenching and Backfilling.

## Part 3 Execution

### 3.1 PREPARATION

- .1 Clean pipes, fittings, valves, and appurtenances of accumulated debris and water before installation.
- .2 Inspect materials for defects to approval of the Departmental Representative.

- .3 Remove defective materials from site as directed by the Departmental Representative.

### **3.2 TRENCHING**

- .1 Do trenching Work in accordance with Section 31 23 33 - Excavating, Trenching and Backfilling.
- .2 Do not allow contents of any sewer or sewer connection to flow into trench.
- .3 Trench alignment and depth require approval of the Departmental Representative prior to placing bedding material and pipe.
- .4 Do not backfill trenches until pipe grade and alignment have been checked and accepted and test results are within limits specified.

### **3.3 CONCRETE PLUGS**

- .1 If required, do concrete work for drainage plugs in accordance with Section 03 30 00 - Cast-in-Place Concrete.
  - .1 Place concrete to details as indicated or directed by the Departmental Representative.
- .2 Pipe may be positioned on concrete blocks to facilitate placing of concrete. When necessary, rigidly anchor or weight pipe to prevent flotation when concrete is placed.
- .3 Do not backfill over concrete within 24 hours after placing.

### **3.4 GRANULAR BEDDING**

- .1 Place selected bedding materials to details indicated on the contract drawings or as directed. Do not place material in frozen condition.
- .2 Place granular bedding material in uniform layers not exceeding 150 mm compacted thickness to depth as indicated.
- .3 Fill authorized or unauthorized excavation below design elevation of bottom of specified bedding in accordance with Section 31 23 33 - Excavating Trenching and Backfilling with compacted bedding material.
- .4 Shape bed true to grade and to provide continuous, uniform bearing surface for pipe.
  - .1 Do not use blocks when bedding pipe.
- .5 Shape transverse depressions as required to suit joints.
- .6 Compact each layer full width of bed to at least 98% corrected maximum dry density.

### **3.5 INSTALLATION - PVC**

- .1 Lay and join pipes in accordance with manufacturer's recommendations and to approval of the Departmental Representative
- .2 Handle pipe using methods approved by the Departmental Representative.

- .1 Do not use chains or cables passed through rigid pipe bore so that weight of pipe bears upon pipe ends.
- .3 Lay pipes on prepared bed, true to line and grade, with pipe invert smooth and free of sags or high points.
  - .1 Ensure barrel of each pipe is in contact with shaped bed throughout its full length.
- .4 Begin laying at outlet and proceed in upstream direction with socket ends of pipe facing upgrade.
- .5 Do not exceed maximum joint deflection recommended by pipe manufacturer.
- .6 Do not allow water to flow through pipe during construction, except as may be permitted by the Departmental Representative.
- .7 Whenever Work is suspended, install removable watertight bulkhead at open end of last pipe laid to prevent entry of foreign materials.
- .8 Install plastic pipe and fittings in accordance with CSA B182.11.
- .9 Pipe jointing:
  - .1 Install gaskets in accordance with manufacturer's recommendations.
  - .2 Support pipes with hand slings or crane as required to minimize lateral pressure on gasket and maintain concentricity until gasket is properly positioned.
  - .3 Align pipes before joining.
  - .4 Maintain pipe joints free from mud, silt, gravel and other foreign material.
  - .5 Avoid displacing gasket or contaminating with dirt or other foreign material. Gaskets so disturbed shall be removed, cleaned and lubricated and replaced before joining is attempted.
  - .6 Complete each joint before laying next length of pipe.
  - .7 Minimize joint deflection after joint has been made to avoid joint damage.
  - .8 At rigid structures, install pipe joints not more than 1.2 m from side of structure.
  - .9 Apply sufficient pressure in making joints to ensure that joint is complete as outlined in manufacturer's recommendations.
- .10 When stoppage of Work occurs, block pipes as directed by the Departmental Representative to prevent creep during down time.
- .11 Plug lifting holes with pre-fabricated plugs approved by the Departmental Representative set in shrinkage compensating grout.
- .12 Cut pipes as required for special inserts, fittings or closure pieces as recommended by pipe manufacturer, without damaging pipe or its coating and to leave smooth end at right angles to axis of pipe.
- .13 Make watertight connections to manholes and storage tanks.
  - .1 Use shrinkage compensating grout when suitable gaskets are not available.
- .14 Use prefabricated saddles or field connections approved by Engineer Consultant, for connecting pipes to existing sewer pipes.

- .1 Joints to be structurally sound and watertight.

### **3.6 INSTALLATION - HDPE**

- .1 Polyethylene (PE):
  - .1 Install polyethylene pipe in strict conformance with manufacturer's recommendation for the specific pipe being installed.
  - .2 Just prior to placement in the trench, check the pipe to ensure the surface is free of debris, stones, nails, loose concrete or other material that may ultimately damage the pipe. Any gouges or cuts that are deeper than 10% of the wall thickness shall result in rejection of that section of pipe. Other defects such as kinking and ovality shall not be cause for rejection provided the sections involved are satisfactorily repaired and meet limits outlined by the pipe manufacturer.
  - .3 Any spillage of petroleum products on any polyethylene pipe material shall result in rejection of that section.
  - .4 Stainless steel bolts for fittings, to the class shown on the drawings shall be used in conjunction with insulating bolt sleeves and washers to install all fittings.
  - .5 The pipe shall be lifted and placed into the trench, not rolled.
  - .6 Make all allowances for expansion and contraction of pipe due to temperature changes, especially when tying into rigid structures and existing lines.
  - .7 Backfilling shall follow a minimum of 20 m behind the point where the pipe passes over the top of the trench. Backfilling equipment shall maintain a minimum of 1 m vertical separation above the pipe.

### **3.7 PIPE SURROUND**

- .1 Place surround material in unfrozen condition.
- .2 Upon completion of pipe laying, and after the Departmental Representative has inspected pipe joints, surround and cover pipes as indicated. Leave joints and fittings exposed until field testing is completed.
- .3 Hand place surround material in uniform layers simultaneously on each side of pipe not exceeding 150 mm compacted thickness as indicated.
- .4 Compact each layer from pipe invert to mid height of pipe to at least 95% corrected maximum dry density.
- .5 Compact each layer from mid height of pipe to underside of backfill to at least 95% corrected maximum dry density.
- .6 When field test results are acceptable to Departmental Representative, place surround material at pipe joints.

### **3.8 BACKFILL**

- .1 Place backfill material in unfrozen condition.
- .2 Place backfill material, above pipe surround in uniform layers not exceeding 150 mm compacted thickness up to grades as indicated.

- .3 Compact backfill to at least 95 % corrected maximum dry density.

### **3.9 SEWER SERVICE PIPE INSTALLATION**

- .1 Connect 100 mm service lines to main by means of:
  - .1 A saddle installed over a machined tapped (cored) hole of sizes suitable for saddle utilized.
- .2 Connect service line to main by cutting opening in main without cracking the main. Remove cuttings from main. Install saddle. Do not project spigot into main. Make joint between saddle and main watertight.
- .3 Install bends, if required, only at the following locations:
  - .1 A 45 degree bend with wye connection or 11-¼ degree bend at tee connection.
  - .2 A 22-½ degree bend at top of riser.
  - .3 An 11-¼ degree bend at property line.
- .4 Maintain grade for 100 mm sewer at 1 vertical to 50 horizontal (2%) unless otherwise directed.
- .5 Place and compact granular backfill around connection to adequately support the main, saddle and service.
- .6 Provide a "pig tail" on the end of each sewer service as detailed on the drawings.
- .7 Install service pipe to connect to building service if existing. Remove abandoned service pipe.
- .8 Install marker at ends of unconnected service lines. Each marker shall consist of 50 x 100 mm stake extending from pipe invert level to 0.6 m above grade.

### **3.10 ABANDONMENT**

- .1 If existing pipe must be abandoned, abandonment shall be in accordance with City of Calgary standards or as directed by the Department Representative.

### **3.11 TESTING**

- .2 The following shall be the minimum acceptable standard for Testing Services and Reports.
  - .1 Tests are taken within 24 hours of the backfill being placed in the trench or cut. Reports indicate date when the backfill was placed and testing completed.
  - .2 Soil density and moisture content tests are taken on each 150mm of trench depth for a maximum of 75 meters of trench length or as directed by the Departmental Representative.
  - .3 Tests shall be so distributed that they are representative of the entire area of the backfill operations.
- .3 Trenches shall be tested from pipe zone to finished sub-grade.

- .4 Such tests are taken adjacent to all manholes and valves from pipe zone to finished sub-grade.

### **3.12 FIELD TESTING GRAVITY MAINS**

- .1 Repair or replace pipe, pipe joint or bedding found defective.
- .2 When directed by the Departmental Representative draw tapered wooden plug with diameter of 50 mm less than nominal pipe diameter through sewer to ensure that pipe is free of obstruction.
- .3 Remove foreign material from sewers and related appurtenances by flushing with water.
- .4 Perform infiltration and exfiltration testing as soon as practicable after jointing and bedding are complete, and service connections have been installed.
- .5 Do infiltration and exfiltration test to ASTM C828.
- .6 Do infiltration and exfiltration testing as specified herein and as directed by the Departmental Representative.
  - .1 Perform tests in presence of the Departmental Representative.
  - .2 Notify the Departmental Representative 96 hours in advance of proposed tests.
- .7 Carry out tests on each section of sewer between successive manholes including service connections.
- .8 Install watertight bulkheads in suitable manner to isolate test section from rest of pipeline.
- .9 Exfiltration test:
  - .1 Fill test section with water to displace air in line. Maintain under nominal head for 24 hours to ensure absorption in pipe wall is complete before test measurements are begun.
  - .2 Immediately prior to test period add water to pipeline until there is head of 1 m over interior crown of pipe measured at highest point of test section or water in manhole is 1m above static ground water level, whichever is greater.
  - .3 Duration of exfiltration test: 2 hours.
  - .4 Water loss at end of test period: not to exceed maximum allowable exfiltration over any section of pipe between manholes.
- .10 Infiltration test:
  - .1 Conduct infiltration test in lieu of exfiltration test where static ground water level is 750mm or more above top of pipe measured at highest point in line to be used.
  - .2 Do not interpolate a head greater than 750 mm to obtain an increase in allowable infiltration rate.
  - .3 Install watertight plug at upstream end of pipeline test section.
  - .4 Discontinue pumping operations for at least 3 days before test measurements are to begin and during this time, keep thoroughly wet at least one third of pipe invert perimeter.
  - .5 Prevent damage to pipe and bedding material due to flotation and erosion.

- .6 Measure rate of flow over minimum of 1 hour, with recorded flows for each 5 min interval.
- .11 Leakage: not to exceed following limits in litres per hour per mm of diameter per 100m of sewer including service connections:
  - .1 Exfiltration, based on 600 mm head: 0.175 L.
  - .2 Infiltration: 0.150 L.
- .12 Repair and retest sewer line as required, until test results are within limits specified.
- .13 Repair visible leaks regardless of test results.
- .14 Television and photographic inspections:
  - .1 Carry out inspection of installed sewers by television camera, photographic camera or by other related means.
  - .2 Provide means of access to permit the Departmental Representative to do inspections.

### **3.13 SURFACE RESTORATION**

- .1 After installing and backfilling over sanitary mains, restore surface to original condition as directed by the Departmental Representative.

**END OF SECTION**

## **Part 1            General**

### **1.1            REFERENCE**

- .1 American National Standards Institute/American Water Works Association (ANSI/AWWA)
  - .1 ANSI/AWWA C207-18, Standard for Steel Pipe Flanges for Waterworks Service, Sizes 4 Inch Through 144 Inch (100 mm Through 3,600 mm).
  - .2 ANSI/AWWA C900-16, Standard for Polyvinyl Chloride (PVC) Pressure Pipe and Fabricated Fittings, 4 Inch Through-12 Inch (100 mm-300 mm), for Water Transmission and Distribution.
- .2 ASTM International (ASTM)
  - .1 ASTM C136-19, Standard Test Method for Sieve Analysis of Fine and Coarse Aggregates.
  - .2 ASTM C117-17, Standard Test Method for Material Finer Than 0.075 mm (No. 200) Sieve in Mineral Aggregates by Washing.
  - .3 ASTM D698-12, Standard Test Method for Laboratory Compaction Characteristics of Soil Using Standard Effort ((12,400 ft-lbf/ft<sup>3</sup>) (600kN-m/m<sup>3</sup>)).
  - .4 ASTM D2241-20, Standard Specification for Poly(Vinyl Chloride) (PVC) Pressure-Rated Pipe (SDR Series).
  - .5 ASTM D3034-21, Standard Specification for Type PSM Poly(Vinyl Chloride) (PVC) Sewer Pipe and Fittings.
- .3 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 CGSB 41-GP-25M, Pipe, Polyethylene, for the Transport of Liquids.
- .4 CSA Group (CSA)
  - .1 CAN/CSA-B70:19, Cast Iron Soil Pipe, Fittings, and Means of Joining.
  - .2 CSA B137 Series:20, Thermoplastic Pressure Piping Compendium.
- .5 Department of Justice Canada (Jus)
  - .1 Canadian Environmental Protection Act, 1999 (CEPA)

### **1.2            SCHEDULING**

- .1 Schedule Work to minimize interruptions to existing services.
- .2 Submit schedule of expected interruptions for approval and adhere to approved schedule.
- .3 Notify Departmental Representative a minimum of 24 hours in advance of interruption in service.

### **1.3            SUBMITTALS**

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

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- .2 Product Data:
    - .1 Submit manufacturer's instructions, printed product literature and data sheets for for pipes and backfill and include product characteristics, performance criteria, physical size, finish and limitations.
  - .3 Shop Drawings:
    - .1 Submit shop drawings showing proposed method of installation for sewage force main in undercrossing.
  - .4 Samples:
    - .1 Submit samples in accordance with Section 01 33 00 – Submittal Procedures.
  - .5 Certification to be marked on pipe.
  - .6 Test and Evaluation Reports: submit manufacturer's test data and certification at least 2 weeks prior to beginning Work in accordance with Section 01 33 00 – Submittal Procedures.
  - .7 Manufacturer's Instructions: submit to Departmental Representative copy of manufacturer's installation instructions.
  - .8 Provide As-built drawings on project completion. Give directions and list equipment required for opening and closing of valves, details of pipe materials, location of cleanouts, locations of vacuum and air release valves, maintenance and operating instructions.

#### **1.4 DELIVERY, STORAGE AND HANDLING**

- .1 Deliver, store and handle materials in accordance with Section 01 61 00 - Common Product Requirements.

### **Part 2 Products**

#### **2.1 MATERIALS**

- .1 Polyethylene (PE) pressure pipes: to CSA B137, CGSB 41-GP-25M :
  - .1 To be type called for as shown in the contract documents and meet the requirements noted in subsequent clauses of this section.
  - .2 Joints: to ANSI/AWWA C207, thermal butt fusion.
  - .3 Polyethylene fittings: to CSA B137, for pipe sizes 4 and less.

#### **2.2 PIPE BEDDING AND SURROUND MATERIALS**

- .1 Granular material to Section 31 05 16 - Aggregate Materials and following requirements:
  - .1 Crushed or screened stone, gravel or sand.
  - .2 Gradations within limits specified when tested to ASTM C117 and ASTM C136. Sieve sizes to CAN/CGSB-8.2and CAN/CGSB-8.1.
- .2 Table:

Sieve Designation	% Passing	
Stone/Gravel	Gravel/Sand	
200 mm	-	-

75 mm	-	-
50 mm	-	-
38.1 mm	-	-
25 mm	100	-
19 mm	-	-
12.5 mm	65-90	100
9.5 mm	-	-
4.75 mm	35-55	80-100
2.00 mm	-	50 - 90
0.425 mm	10-25	10 - 50
0.180 mm	-	-
0.075 mm	0 - 8	0 – 10

- .3 Concrete mixes and materials for cradles for undercrossing, thrust blocks, encasement, supports and plugs to Section 03 30 00 - Cast-in-Place Concrete.

## 2.3 BACKFILL MATERIAL

- .1 As indicated.
- .2 Type 3, in accordance with Section 31 23 33.01 - Excavating, Trenching and Backfilling.
- .3 Unshrinkable fill in accordance with Section 31 23 33.01 - Excavating, Trenching and Backfilling.

## Part 3 Execution

### 3.1 EXAMINATION

- .1 Verification of Conditions: verify conditions of substrate previously installed under other Sections or Contracts are acceptable for pipe 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 PREPARATION

- .1 Temporary Erosion and Sedimentation Control:
  - .1 Provide temporary erosion and sedimentation control measures to prevent soil erosion and discharge of soil-bearing water runoff or airborne dust to adjacent properties and walkways, according to EPP.
  - .2 Inspect, repair, and maintain erosion and sedimentation control measures during construction until permanent vegetation has been established.
  - .3 Remove erosion and sedimentation controls and restore and stabilize areas disturbed during removal.
- .2 Pipes and fittings to be clean and dry.

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- .3 Prior to installation, obtain Departmental Representative's approval of pipes and fittings.
  - .4 Prior to beginning with pipe installation, the Contractor shall demonstrate to the Departmental Representative their intended pipe installation method to prevent dips and sags in the force main pipe.

### **3.3 TRENCHING**

- .1 Do trenching Work, in accordance with Section 31 23 33.01 - Excavating, Trenching and Backfilling.
- .2 Trench alignment and depth require approval from Departmental Representative prior to placing bedding material or pipe.

### **3.4 GRANULAR BEDDING**

- .1 Place granular bedding in unfrozen condition.
- .2 Place granular bedding material in uniform layers not exceeding 150 mm compacted thickness to depth as indicated..
- .3 Shape bed true to grade and to provide continuous, uniform bearing surface for pipe.
- .4 Shape transverse depressions as required to suit joints.
- .5 Compact each layer full width of bed to at least 98 % corrected maximum dry density.
- .6 Fill excavation below design elevation of bottom of specified bedding with common backfill.

### **3.5 INSTALLATION**

- .1 Lay pipes in accordance with manufacturer's recommendations.
- .2 Join pipes in accordance with manufacturer's recommendations. All pipes to be joined using pipe welding.
- .3 Avoid damage to machined ends of pipes in handling and moving pipe.
- .4 Maintain grade and alignment of pipes.
- .5 Align pipes carefully before jointing.
- .6 Joint deflection permitted within limits in accordance with pipe manufacturer's written recommendations.
- .7 Support pipe firmly over entire length, except for clearance necessary at couplings.
  - .1 Do not use blocks to support pipe.
- .8 Keep pipe and pipe joints free from foreign material.
- .9 Avoid bumping gasket and knocking it out of position, or contaminating with dirt or other foreign material. Remove disturbed gaskets clean, lubricate and replace before jointing is attempted.
- .10 Support pipes using hand slings or crane as required to minimize lateral pressure on gasket and maintain concentricity until gasket is properly positioned.
- .11 Apply sufficient pressure in making joint to ensure that joint is complete to manufacturer's recommendations.

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- .12 Apply restraint to pipe to ensure that joints when completed are held in place, by tamping fill material under and alongside pipe, or otherwise as approved by Departmental Representative.
  - .13 When stoppage of Work occurs, block pipe as directed by Departmental Representative to prevent creep during downtime.
  - .14 Install tracer wire on all sanitary forcemain lines. Tracer wire is to be fastened to sanitary line every 2m or less to ensure tracer wire accurately follows pipe.
  - .15 Install all sanitary forcemain lines true to profile design, and without dips or sags which will result in ponding wastewater inside of the pipe. Entirety of the pipe must be installed to allow for gravity draining of the lines to the low point in the system to allow for annual winterization without the use of forced air if necessary.

### **3.6 THRUST BLOCKS**

- .1 Restrain bends, tees and fittings using concrete thrust blocks [as indicated].
- .2 Keep pipe couplings free of concrete.
- .3 Bearing area of thrust blocks to be as indicated.

### **3.7 PIPE SURROUND**

- .1 Place surround material in unfrozen condition.
- .2 Upon completion of pipe laying, and after Departmental Representative inspected pipe joints, surround and cover pipes as indicated. Leave joints and fittings exposed until field testing is completed.
- .3 Hand place surround material in uniform layers simultaneously on each side of pipe not exceeding 150 mm compacted thickness as indicated.
- .4 Compact each layer from pipe invert to mid height of pipe to at least 95 % corrected maximum dry density.
- .5 Compact each layer from mid height of pipe to underside of backfill to at least 95 % corrected maximum dry density.
- .6 When field test results are acceptable to Departmental Representative, place surround material at pipe joints.

### **3.8 BACKFILL**

- .1 Place backfill material in unfrozen condition.
- .2 Place backfill material, above pipe surround in uniform layers not exceeding 150 mm compacted thickness up to grades as indicated.
- .3 Under paving and walks, compact backfill to at least 95 % corrected maximum dry density. In other areas, compact to at least 98 % corrected maximum dry density.
- .4 Place unshrinkable fill in accordance with Section 31 23 33.01 - Excavating, Trenching and Backfilling.

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### **3.9 UNDERCROSSING**

- .1 Excavate working pit to minimum of 0.5 m below lowest invert of encasing pipe.
- .2 Dewater excavation.
- .3 Dewater area of undercrossing.
- .4 Install heavy timber or steel frame backstop.
- .5 Provide shop drawings showing proposed method of installation for sewage force main in undercrossing.

### **3.10 FIELD TESTING OF FORCE MAIN**

- .1 Testing of force main to be carried out in presence of the Departmental Representative.
- .2 Strut and brace caps, bends and tees, to prevent movement when test pressure is applied.
- .3 Expel air from force main, by slowly filling main with water.
  - .1 Drill and tap high points and install suitable cocks to vent air and to be shut when pressure is applied.
  - .2 Remove cocks after satisfactory completion of test and seal holes with tight fitting plugs.
- .4 Apply hydrostatic test pressure of 1.5 times working pressure based on elevation of lowest point in line and corrected to elevation of test gauge for hydrostatic test and design working pressure for leakage test.
- .5 Apply pressure for 1 hour for pressure test and 2 hours for leakage test.
- .6 Examine exposed pipe, joints and fittings while system is under pressure.
- .7 Remove defective joints, pipe and fittings and replace with new sound material.
- .8 Define leakage as amount of water supplied from meter or water storage tank in order to maintain test pressure for 2 hours.
- .9 Do not exceed allowable leakage as defined in ANSI/AWWA C600.
- .10 Locate and repair defects if leakage is greater than amount specified.
- .11 Repeat test until leakage is within specified allowance for full length of force main.
- .12 Complete backfill.
- .13 Repeat test after completing backfill. Locate and repair defects and backfill. Repeat tests, repairs and backfills as needed until leakage is less than amount specified.

### **3.11 CLEANING**

- .1 Progress Cleaning: clean in accordance with Section 01 74 00 - Cleaning.
  - .1 Leave Work area clean at end of each day.
- .2 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment in accordance with Section 01 74 00 - Cleaning.
- .3 Waste Management: separate waste materials for reuse and recycling.

- 
- .1 Remove recycling containers and bins from site and dispose of materials at appropriate facility.

**END OF SECTION**

## **PART 1        GENERAL**

### **1.1            REFERENCES**

- .1 American Society for Testing and Materials International, (ASTM)
  - .1 ASTM C117, Standard Test Method for Material Finer Than 0.075 mm (No. 200) Sieve in Mineral Aggregates by Washing.
  - .2 ASTM C136, Standard Method for Sieve Analysis of Fine and Coarse Aggregates.
  - .3 ASTM D698, Standard Test Method for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft<sup>3</sup> (600 kN-m/m<sup>3</sup>)).
- .2 Canadian General Standards Board (CGSB)
  - .1 CAN/CGSB-8.2, Sieves, Testing, Woven Wire, Metric.
- .3 Canadian Standards Association, (CSA International)
  - .1 CAN/CSA-A23.1/A23.2- (June 2001), Concrete Materials and Methods of Concrete Construction/Methods of Test for Concrete.
  - .2 CAN/CSA-A23.4/A251-September 2000, Precast Concrete-Materials and Construction/Qualification Code for Architectural and Structural Precast Concrete Products.
  - .3 CAN/CSA-B66, Prefabricated Septic Tanks and Sewage Holding Tanks.

### **1.2            DESIGN REQUIREMENTS**

- .1 Design precast concrete sewage holding tank in accordance with CAN/CSA-B66.

### **1.3            SUBMITTALS**

- .1 Submit shop drawings in accordance with Section 01 33 00 - Submittal Procedures and in accordance with CAN/CSA-A23.4/A251.
- .2 Shop drawings to indicate:
  - .1 Design calculations for items designed by manufacturer.
  - .2 Tables and bending diagrams of reinforcing steel.
  - .3 Camber, including all tank fittings and attachments.
  - .4 Formwork.
  - .5 Finishing schedules.
  - .6 Methods of handling and erection.
  - .7 Storage facilities.
  - .8 Openings, sleeves, inserts and related reinforcement.
- .3 Each drawing submission shall bear stamp and signature of qualified professional engineer registered or licensed in Province of Alberta, Canada.

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#### **1.4 QUALIFICATIONS**

- .1 Manufacturers of precast concrete elements shall be certified by CSA as meeting requirements of CAN/CSA-A23.4/A251, for Category SC and SP products.

#### **1.5 WASTE MANAGEMENT AND DISPOSAL**

- .1 Separate waste materials for reuse and recycling.
- .2 Collect and separate for disposal packaging material for recycling in accordance with Waste Management Plan.

### **PART 2 PRODUCTS**

#### **2.1 SEPTIC TANK**

- .1 Septic tank is to be custom built or modified tank product to meet all functional requirements as per the contract drawings. Tank is to be CSA approved fibreglass product of sufficient size and dimensions to provide necessary storage and solids settling as per Provincial standards. Requires 8.0m<sup>3</sup> solids compartment working volume and 6.0m<sup>3</sup> effluent compartment working volume.
- .2 Product to be:
  - .1 FRP Mocoat B3500S with necessary modifications to meet project requirements.
  - .2 Or approved equivalent.

#### **2.2 CONCRETE MIXES AND MATERIALS**

- .1 Concrete mixes and materials: to CAN/CSA-B66 and CAN/CSA-A23.1/A23.2.
- .2 Use type 50 cement.

#### **2.3 MANUFACTURE**

- .1 Manufacture units in accordance with CAN/CSA-A23.4/A251, except where specified otherwise.

#### **2.4 FINISHES**

- .1 Finish tanks to commercial grade to CAN/CSA-A23.4/A251.

#### **2.5 ACCESS**

- .1 Provide access holes to surface to facilitate cleaning inspection.

#### **2.6 TANK BEDDING**

- .1 Type 2, in accordance with Section 31 23 33 - Excavating, Trenching and Backfilling.

#### **2.7 TANK SURROUND MATERIAL**

- .1 Type 2, in accordance with Section 31 23 33 - Excavating, Trenching and Backfilling

**2.8 BACKFILL MATERIAL**

- .1 Type 2, in accordance with Section 31 23 33 - Excavating, Trenching and Backfilling.

**PART 3 EXECUTION**

**3.1 INSTALLATION**

- .1 Place bedding and surround material in unfrozen condition.
- .2 Do excavation in accordance with Section 31 23 33 - Excavating, Trenching and Backfilling.
- .3 Place tank bedding material in accordance with details as indicated. Compact to 98% corrected maximum dry density.
- .4 Make inlet joints of tank watertight.
- .5 Conduct 24 hour leakage test on tank in presence of the Departmental Representative after backfilling. Fill tank and allow to stand for 24 hours prior to starting 24 hour test. Allowable leakage is zero.
- .6 Do backfilling in accordance with Section 31 23 33 - Excavating, Trenching and Backfilling and design drawings.
  - .1 Compact to 98% corrected maximum dry density.
- .7 Prior to substantial completion, completely clean and dry both tank compartments to hand over tank to the Owner in brand new and clean condition.

**END OF SECTION**